What's the Answer?

If You Have a Question That You Would Like to Have Someone Answer, Or If You Can Answer Any of the Questions Shown Below, Please Write to the Editor.

Reducing Unnecessary Train Stops

"What progress has been made on your road in the matter of eliminating, or reducing the number of, unnecessary train stops at non-permissive signals?"

Train Movements at Sidings

R. D. Moore
Signal Engineer, Southern Pacific, San Francisco, Cal.

Certain progress has been made on the Southern Pacific in eliminating, or reducing the number of, unnecessary train stops at non-permissive signals. For years we have eliminated train stops under certain conditions as provided for under our rules, in part as follows:

When a block signal indicates "Stop," a train may, without stopping, proceed with caution, not exceeding 12 m.p.h., under the following conditions:

(a) To enter a siding where the switch is not more than 1,000 ft. beyond the signal, and it can be seen that no opposing train has passed the next home signal governing such opposing train; or that an opposing or preceding train has stopped, or is moving prepared to stop, clear of the route to be used.

(b) To enter a yard when the switch is set for the receiving track and the route is clear to the fouling point of the switch.

(c) To continue on the main track when meeting or passing a train when the view of track is clear to the point where fouled by the train which is taking siding, or when the engineman is informed by a member of the crew of the train to be met or passed that the "stop" position of the signal is caused by the train to be met or passed being partly in the siding and not clear of the main track.

Under all other conditions, the train, after stopping, may proceed according to the rules. In addition, we are giving consideration to the use of the grade signal as recommended by the American Railway Association.

In Train Control Territory

Leroy Wyant
Signal Engineer, Chicago, Rock Island & Pacific, Chicago

The only purpose of requiring a complete stop at certain types of automatic block signals is to insure observance of the signal and proper control of the train operating through the block. I have always contended that these two conditions could be enforced without penalizing operation by requiring trains to come to a complete stop. With present-day locomotives, a train can attain excessive speed before the rear of the train is by the signal. A stop does not, of itself, insure proper speed through the block. Proper rules, properly enforced, do. If a stop can be enforced, a reduced speed at and through the block can also be enforced.

Several years ago when we installed automatic train control on the Illinois Division on our double track we eliminated the stop at an automatic block signal with train control in service. I am quoting the rule—

"On two or more tracks, when a train encounters a stop and proceed signal at stop, Rule 501a, it may proceed without stopping, at restricted speed if the engine is equipped with train control device which is in service and operating properly."

This practice has proved entirely satisfactory and certainly has resulted in large savings, although they would be hard to detail. Personally, I would go further than we do at present and eliminate the stop at double-track automatic block signals, irrespective of whether automatic train control is used.

In 1926 we modified our rules with respect to observance of headblock signals under certain conditions. I am quoting our rules covering this condition—

"At meeting point, when stop and proceed signal, Rule 501a, at entrance of siding indicates 'stop,' train having right to main track may proceed without stopping, but at a speed not exceeding eight miles per hour, to clearance point of switch used by opposing train, if opposing train can be seen entering siding.

To Be Answered in an Early Issue

(1) Is there any difference on your road in the flagging rule, as applied in automatic block territory, as compared with that in non-automatic block territory?

(2) When installing a spring switch at an end of double track, how close to the switch should the signal for the facing-point train movements be located, and why?

(3) Where dual-control power switch machines are used in a remote-control installation, should the circuits be designed so that it is impossible for any signal to clear while the dual-selector lever is out of its normal position?

(4) Has any system of cab control been tried out that enables the engineman to operate a junction switch or passing-track switch from his seat in the cab of the locomotive as the train approaches the switch? What is your opinion as to the practicability of such a system?

(5) What precautions do you take to guard against the possibility of your a-c. floating storage batteries being charged continuously at too high a rate?

"The train taking siding may pass stop and proceed signal, Rule 501a, at entrance of siding, while indicating stop, without stopping, but at a speed not exceeding eight miles per hour entering siding, if the opposing train can be seen clear of the route to be used."

Great Northern Practice

C. A. Dunham
Superintendent of Signals, Great Northern, St. Paul, Minn.

On the Great Northern we have very largely reduced unnecessary train stops. All of our main lines from St. Paul to Seattle, as well as the north and south lines on Puget Sound are equipped with the automatic block signal system. These results have been secured by good signal construction and maintenance; also by a thoroughly practical application of the interlocking and block signaling rules as printed on page 87 to 118 of our 1929 Transportation Rules. It is to be understood that all of our interlocking signals are positive, and when displaying the "stop" indication trains must stop and stay. Practically all of our automatic block signals are permissive and when displaying the "stop" indication trains are required to stop, but may at once proceed under rule 509-b, which reads as follows:

"When a train is stopped by a STOP and PROCEED signal, it may proceed at once at a speed not to exceed 8 miles per hour, expecting to find a train in the block, broken rail, obstruction, or switch not properly set. When it is not positively known that another train is in block, all switches should be examined before passing over them."

We make a limited use, on heavy ascending grades, of a permissive marker, which is simply a piece of metal 15 in. square, painted yellow, and displayed on the signal mast, and where such marker is in use rule 509 applies, which rule reads as follows:

"A square yellow PERMISSIVE marker on a signal mast is authority for a train to proceed without stopping when the signal is displaying a stop indication, at a speed not to exceed 8 miles per hour to the next signal, expecting to find a train in the block, broken rail, obstruction or switch not properly set."

As stated, practically all of our automatic block signals are permissive; however, at a very few places these signals are positive "stop" signals and at such points rule 509-a applies. This rule reads as follows:

"When a train is stopped by a STOP-SIGNAL it must stay until authorized to proceed, or in case of failure of means of communication it may proceed when preceded by a flagman to the next signal displaying a proceed indication, expecting to find a train in the block, broken rail, obstruction or switch not properly set."

Under these rules trains may proceed with a maximum of safety and a minimum of delay.

Equipment and Maintenance

R. B. Elsworth
Assistant Signal Engineer, New York Central, Albany, N. Y.

The question as to what progress has been made in eliminating train stops at signals giving the "Stop and Proceed" indication is a broad one, and might be made to cover the entire automatic signal and train control field. Such stops are made principally on account of the signal system failing to work as intended and the signal giving a more restrictive indication than the track and switch conditions permit or the spacing of trains requires; in other words, because of a signal failure.

The word unnecessary which is frequently used in referring to train stops made at a "Stop and Proceed" signal is not a proper one. Train stops which are required by the Standard Code or by the rules, to provide desirable safety in operation, may not properly be called unnecessary. The enforcement of the requirement that trains make a full stop before passing a signal giving the "Stop and Proceed" indication is of value in protecting against a train or obstruction ahead by being sure that the following train is under control at the signal location at least, and is of still greater value as providing an incentive to the railroad personnel from the management to the maintainer to so install and maintain the signal system that these train stops be reduced to a minimum; in other words, the penalty for stopping the train is such as to cause special effort to be made to keep the signals working.

On the New York Central, Buffalo and East, the percentage of improper indications of the nature in question has been reduced 85 per cent during the last 25 years; that is, six out of every seven that formerly occurred have been eliminated. This improvement was largely a gradual accomplishment due to steady and careful research and attention to minor details. One of the practices that has been most helpful is the policy of listing each failure separately, and investigating the causes and possible remedies with equal thoroughness whether there may be few or many failures of a given type. This gives better results than classifying failures by groups with the unconscious tendency to devote major energy to the large groups. Three major means in providing for improvement in signal performance are: 1. Improved material. 2. Improved construction methods, and 3. Improved maintenance methods.

The question of design and quality of signal material is one to which the signal engineer must devote special attention. There is enough profitable work to keep the signal engineer busy studying this subject. This is well illustrated in the case of two minor developments. The standard A.R.A. ¼-in. brass binding post is just strong enough for the purpose intended with practically no margin of safety. Not very often, but occasionally, one of these posts breaks, due to stresses set up by repeated tightening of the nut over a period of years. Such checking of the tightness of the nuts is required of the maintenance force to avoid the possibility of loose connections. If the breaking of a binding post opens a circuit, causing a stop indication to be displayed to a tonnage freight train or to cause a tie up at a busy terminal during the rush period, the results are expensive as well as embarrassing to the signal engineer. By giving this detail careful consideration and paying a fraction of a cent more for each post, a material with a minimum specified strength may be obtained which will provide the desirable additional margin for reliable operation.

Another item is the selection of a satisfactory type of lightning arrester. In addition to providing lightning protection the arrester should be such as will not be the cause of signal failures, and will permit of ready test of wires for crosses or grounds. A lightning arrester with proper connections and grounds that has given adequate protection on a large railroad for the past 30 years is perhaps the least expensive of any signal lightning arrester on the market, and has had no adverse effect on signal performance. In this instance the most suitable material is not the most expensive.

Methods of installation require the same careful attention to assure that not only the most economical first cost is secured but that a system is provided which is subject, as far as possible, to a ready inspection of all of its parts, and which requires, over a period of years, minimum renewals. The installation of wires and cables so that the physical condition of the covering may be readily inspected is also of great importance. Maintenance methods should be subject to the same careful research and supervision.

A marked improvement has been obtained by giving the men in the field printed instructions covering as many details of the work as practicable. By this the workman, who wishes to know, can refer to the instructions instead of depending upon information given by one who may or may not be correctly informed. The men know they will be held responsible for complying with these instructions, and take pride in obeying them. Engineering tests requiring the maintainer to take and report meter readings and measurements are most helpful, as the work is benefited to a greater extent by such tests than by the men casually walking or riding over their sections waiting for something to turn up.

As in many other things the general maintenance condition is improved by an occasional inspection or "audit" by men not directly responsible for the maintenance condition. The men in charge of the maintenance know that certain things ought to be done when they can get to it, but a definite report from a general inspector is very helpful in deciding on repairs that must be made before trouble is caused.

The signal system itself may also be designed and signals located to reduce unnecessary stops with delay incidental to picking up a flagman. This may be accomplished by providing adequate approach indications permitting a train closing in on a junction or a train ahead to reduce speed and avoid in many cases the application of the automatic train brake on a freight train. This may provide time for obstruction ahead to clear up without the approaching train coming to a full stop. These conditions may be covered by the two, three, and even in some cases, the four-block system of indications.

B. & O. Permits Trains to Pass Under Certain Circumstances

G. H. Dryden
Signal Engineer, Baltimore & Ohio, Baltimore, Md.

Strict obedience to signal indications must be enforced and standard rules observed, consequently the only safe method of reducing train stops at non-permissive signals is by discontinuing the use of such signals.

Where tracks are signaled in one direction only, automatic block signals operate in three positions, giving: "Stop and Proceed," "Approach," and "Clear" indications, which indications are obeyed to the letter. On ascending grades of 0.4 per cent or greater, the letter "P" is applied to the signal mast, and freight trains hauling 80 per cent or more of their rated tonnage are permitted to pass the "Stop and Proceed" signal without stopping.

On level track and on descending grades, semi-automatic signals are provided with "Stop and Proceed" indications that are made effective when the block is occupied, by an operator restoring the signal lever to the normal position and again reversing same, and under these conditions the same rules apply in entering a block protected by a semi-automatic signal as are applicable in entering a block protected by an automatic block signal.

On ascending grades, semi-automatic signals are provided with both "Stop and Proceed" and "Restricting" indications. The "Restricting" indication is given to freight trains hauling 80 per cent or more of their rated tonnage, and a "Stop and Proceed" indication to other trains to enter an occupied block.

In single track territory—or where any track is signaled in both directions—all signals, both automatic and semi-automatic, are arranged to give "Stop," "Stop and Proceed," "Approach" and "Clear" indications. The "Stop" indication is displayed on all signals opposing, to and including the next meeting point. Trains following receive "Stop and Proceed," "Approach" or "Clear" indications at either head-block or intermediate signal. The circuits provide that the "Stop and Proceed" indication cannot be given unless the block is occupied by a train which entered in the same direction, and trains observe such signals ("Stop and Proceed"), the same as in double track territory, Rule 509 being modified to cover.

Briefly, we do not install absolute signals excepting at important tunnels, or locations where it is imperative that an absolute block be maintained. Generally, we favor the enforcement of the rule requiring trains to stop before entering an occupied block.

Special Indication Used

C. A. Taylor
Superintendent Telegraph & Signals, Chesapeake & Ohio

It is the practice on the Chesapeake & Ohio, in a great many instances, to provide the so-called "Call-on" feature on interlocking signals so as to furnish a means to pass trains through interlocking plants at restricted speed if, for any reason, a more favorable indication cannot be given. In a great many instances this eliminates the necessity of holding a train at a signal until the block is clear.

We also eliminate the necessity of stopping our freight trains, having 50 per cent or more of their rated tonnage, at permissive automatic signals indicating "Stop Then Proceed," where such signals are located on ascending grades, by the use of a grade signal. The grade signal consists of the letter "G" painted on a yellow disc which is attached to the signal mast directly above the number plate.

In some instances where the automatic block system is extended through yard territory we have equipped our automatic block signals with an additional yellow light so that the signals will display red over yellow (permissive indication) when the block is occupied. The permissive indication allows the train to proceed at restricted speed without stopping, but it must proceed prepared to stop short of a train, obstruction, or anything that may require the speed of the train to be reduced. We also use this indication to some extent to eliminate the necessity of trains having to stop when heading into passing tracks where the automatic signal is located immediately in approach of the switch. We do not, however, provide any special indication which would allow trains to pass the head-block signals in A.P.B. territory unless the block is clear.

Santa Fe Practice

T. S. Stevens
Signal Engineer System, Atchison, Topeka and Santa Fe, Topeka, Kan.

We have endeavored on the Santa Fe to design our signal system so that unnecessary train stops need not be made when trains are making meets or entering yards.

We do not use A.P.B. and, therefore, the same action is necessary for the signal at "stop" whether an opposing or following move is undertaken. This may be considered an oversight because a slightly better situation is possible with A. P. B.

On the Santa Fe, a train taking a siding is given a restricted speed indication, and when a train is taking siding at the opposite end of the siding, a caution indication is displayed allowing the train to move to the signal at the fouling point of the main line at the other end.

As a signal department, we would like to see the stop eliminated from the requirements necessary for the observance of indications of automatic signals but do not believe that a rule is the proper way to accomplish the result. If our executives felt that the stop had become undesirable, we would recommend using restricted speed and proceed indications. So far they have not felt that the elimination of the stop is desirable.

We have a very small mileage where the adverse ascending grade is in excess of 1.5 per cent, where we do not display stop signals for an occupied block.

▼ ▼ ▼

Adjusting A-C. Track Circuits

"What practical test can be made by one man working alone at the transformer end of an a-c. track circuit feeding a two-element relay, to insure that the impedance unit is properly set to give the best phase relation between the track and local windings of the relay?"

Ballast Conditions Govern

H. A. Hudson
Signal Supervisor, Southern, Asheville, N. C.

A practical method by which one man working alone at the transformer end of an a-c. track circuit can be reasonably certain that the impedance unit is properly set to insure a satisfactory phase relation at the relay, is to adjust the impedance unit so the rail voltage, opposite the transformer, will be approximately one-third or less of the track transformer secondary voltage. This is a general rule and will work out on most a-c. track circuits. However, there are many things to take into consideration when adjusting the circuit. The length of the circuit is most important. It is more difficult to balance the phase relation on an extremely short circuit than on a long one. Also, the ballast resistance and the weather must be considered. The phase relation might be perfect at a track relay in wet or damp weather, and then when the track dries out the relay may fail due to an unbalanced phase relation. On real short circuits, about one thousand feet or less, it is sometimes necessary to shunt a fixed resistance of about one ohm across the relay end of the circuit in order to load up the impedance unit so the phase relation at the relay will be satisfactory in dry weather or when the ballast is frozen.

All of the above details, with many others, must be taken into consideration by the one man working alone at the transformer end of the circuit or else he might adjust the impedance unit so that the phase relation at the relay would be perfect, and then, within a few hours, the relay might fail due to a rain or due to the track drying out.

Fixed Impedance and Voltage Adjustment

B. E. O'Hagan
Engineering Department, Union Switch & Signal Company, Swissvale, Pa.

The question as worded seems to imply that the adjustment of the impedance (reactor or resistor) at the transformer end of the track-circuit is all important in obtaining proper phase relations between the track and local elements of a two element a-c. track relay. This is not strictly true. The phase shift between the local and track elements is due very largely to the rail impedance drop between the relay and the transformer ends of the track circuit in combination with the effect of the ballast leakage current in causing a drop in voltage through the track circuit.

If a certain set of conditions is arbitrarily established by the length of the track circuit, the weight of rails and their bonding, the probable minimum ballast leakage resistance and the frequency of the a-c. power, the relay is then designed with characteristics which will permit the use of a resistor or a reactor between the transformer and the track and provide good phase relations. The type of limiting impedance having thus been determined, there is little that can be done in service by adjustment to affect the phase relations of the relay without affecting also other characteristics of the track circuit.

In addition to providing some phase displacement, the limiting impedance serves also to prevent short-circuiting of the transformer when the track circuit is occupied. If the impedance is set too high, the track circuit will require excessive power normally and will be sensitive to changes in the ballast leakage resistance. If the impedance is set too low, the occupied current flow from the transformer secondary will be excessive and the shunting sensitivity will be lowered. An adjustment of the limiting impedance which has been shown by experience to meet most conditions satisfactorily is that which will, in wet weather, give a ratio of two to one between transformer secondary voltage and the voltage on the rails at the transformer end of the track circuit. This adjustment has been found by calculation and test to provide adequate shunting sensitivity and good phase relations for the relay. After the impedance has been adjusted to give the two to one ratio, the transformer secondary voltage must be adjusted to provide the proper energization of the relay. It is evidently impossible for a man working entirely at the transformer end of a track circuit to know whether or not the relay is properly energized.

Wet and Dry Weather

The discussion so far has been concerned with the adjustment of the impedance to give the two to one ratio of transformer volts to rail volts in wet weather. Since track circuit adjustments may be made in dry weather, it should be borne in mind that a track circuit adjusted to have the two to one ratio in wet weather will have a smaller ratio than two to one in dry weather. Or, conversely, if the adjustment is made in dry weather, the ratio must be smaller than two to one. The dry weather ratio is affected by the length of the track circuit and the minimum ballast resistance existing in wet weather. For example, a 2,500-ft. track circuit adjusted for the two to one ratio with 3 ohm per thousand feet ballast leakage will have a ratio of about 1.75 to 1 when the ballast leakage is 20 ohms per thousand feet. A 5,000-ft. track circuit adjusted to have a 2 to 1 ratio at 3 ohm ballast will have approximately 1.5 to 1 ratio at 20 ohm ballast.

Since improper adjustment of the limiting impedance may result in loss of shunting sensitivity, if it is adjusted to too low a value, or in failure of the track relay to pick up in wet weather if too much impedance is used, a number of railroads are now using impedances of fixed value and making all track circuit adjustments by changing the transformer voltage.

When such an arrangement is used the value of the impedance is selected so that approximately a 2 to 1 voltage ratio will be obtained in wet weather for an average length track circuit. The track transformers have