EDITORIAL COMMENT

Intermediate Signals and Approach Aspects

Two sections of the rules, standards and instructions prescribed by the Interstate Commerce Commission, as quoted below, have a bearing not only on the locations of intermediate signals on single track but also on the proposition of arranging for an Approach aspect to be displayed in each instance in approach to a signal displaying a Stop or a Stop-and-Proceed aspect.

204. Signals shall be spaced at least stopping distance apart, or, where not so spaced, an equivalent stopping distance shall be provided by two or more signals arranged to display restrictive indications approaching signals where such indications are required.

207. On track signaled for movements in both directions, signals shall be so arranged and controlled that proper restrictive indications will be provided to protect both following and opposing movements.

The significance of Sec. 204 lies in the fact that the sighting distance, i.e., the distance which an engineman when approaching a signal can see the aspect being displayed, cannot be considered as a part of the train stopping distance. To comply with this section, three-aspect signals should be so spaced that an engineman who takes action to obey an Approach aspect at that signal location will have adequate distance in which to stop before passing the stop signal. Under this arrangement, sighting distance would provide an additional margin of safety and it would not be necessary to rely for safety of operation upon such sighting distance which is a variable factor depending upon obstructions to view, permanent or temporary, and changing weather conditions. This requirement is in accord with the views expressed in certain accident investigation reports of the Director of the Bureau of Safety, in which the spacing of approach and home signals did not provide adequate stopping distances for trains at the speeds operated.

In numerous instances where signals are not spaced braking distance under modern train operation conditions, the direct track circuit control of certain signals have been extended as overlaps beyond the next signals ahead. This practice insures adequate safety in that a following train is always spaced full braking distance from a train ahead. Nevertheless, it might be contended that the use of overlaps as explained above leaves the signals as they were, less than braking distance apart, and, therefore, that the practice does not conform with the opening statement in Sec. 204. On the other hand, while a train is occupying an overlap section two signals to the rear are displaying the Stop or the Stop-and-Proceed aspect. A question arises whether this fact meets with the exceptions stated in Sec. 204, following the word "or."

Sec. 207, applying to single-track signaling, in combination with Sec. 204, leads to a consideration concerning intermediate signals and Approach aspects for these signals. A considerable number of single-track signaling installations are so arranged that two opposing trains might conceivably pass station-leaving head-block signals or overlap points simultaneously under proceed signal indications, and, later, both trains would encounter their respective intermediate signals displaying Stop-and-Proceed aspects without either train having previously encountered a signal displaying the Approach aspect. This condition would not arise unless the two opposing trains when departing from adjacent station layouts on single track disregard timetable requirements or unless train orders were improperly issued or overlooked. Granting, however, that such errors occur, although rarely, and also conceding that in some such instances the trains might possibly pass opposing points simultaneously, the next consideration is whether compliance with the two sections quoted necessitates changes in signaling practices.

On some installations, when only one set is used between stations, the practice has been to place the intermediate signals opposite each other. Some roads stagger the intermediate signals at least train stopping distance, the basis of this practice being that it would be an extremely remote contingency that the two opposing trains which enter the station-to-station block or overlap limits simultaneously would likewise simultaneously closely approach the intermediate signals displaying the Stop-and-Proceed aspects, and in that event they would utilize the sighting distance as a major part of the braking distance, thereby stopping the trains before they collided. This practice is not in accordance with the theory that enginemen may not, under certain weather conditions, see a signal until closely approaching it. Another practice is to stagger the intermediate signals twice braking distance apart. Braking distance, in these instances, is based on the service brake applications.

A new situation has been brought about not only by the sections of the rules quoted previously, but also by the fact that the lengths and speeds of trains have been increased decidedly in recent years. Roughly, the length of the stopping distance required increases in proportion to the square of the speed. Braking distances vary with the speed, weight and length of trains as well as on grades and curves, but in general it may be said that where trains of freight cars loaded to three times their empty weight are handled at speeds of approximately 50 m.p.h., at least 7500 ft. should be allowed, on the basis of level tangent track, to provide adequate stopping distance. Moving staggered intermediate signals to 15,000 ft. spacing would involve considerable expense. Either this expedient or the extension of direct track circuit controlled overlaps would result in establishing both long and short blocks which would prevent uniform time-distance spacing of following trains and thus reduce track capacity. An alternative might be to provide overlaps for 90°

control which would be effective for opposing but not for following moves, although where only one or two signal location layouts are used between sidings, the overlaps would extend within station limits which might introduce certain complications and possible train delays.

Another expedient might be to devise a control arrangement by means of which certain signals would display the Approach aspect normally, and change to the Clear aspect on an approach control scheme, thus eliminating the necessity for extended overlaps. Another solution, which has been proposed for an installation on one road, is to introduce an additional fourth aspect, yellow over yellow as Advance Approach, with overlaps which are effective for opposing moves but not for following moves. With this arrangement, the intermediate signals can be placed opposite rather than staggered, and following train movements can be made on a time-distance basis.

The situation under discussion has been brought about not only by the sections of the rules quoted above, but also by the fact that where train speeds have been increased, the required braking distances also have increased decidedly. Nevertheless, a question arises as to whether this situation justifies any considerable expense for changes and, if so, what changes can be made that will not interfere with train operation. The subject should be discussed thoroughly before further action is taken. Those interested are invited to consider the question on page 615, and send their comments to the editor for publication in *Railway Signaling*.

Interconnection of Train Signals and Crossing Protection

THE inclusion in highway-railroad crossing protection projects of an arrangement of wayside signals which do not display aspects for trains to proceed unless the crossing protection is in operation, represents a practice which is adaptable in solving some serious problems on slow-speed switching tracks, but is highly impracticable as well as undesirable on tracks handling high-speed trains.

The idea of using wayside signals to control switching movements at slow speeds is not only adaptable but also serves to solve certain complexing problems where approach track circuits long enough to secure proper timing control for the crossing protection cannot be used. Such an arrangement, including wayside signals, were installed in 1928 on the Manufacturer's Railway, a switching line in St. Louis, Mo., as described in an article in the February, 1929, issue of *Railway Signaling*. Here, a special push-button control, operating in conjunction with wayside signals, was used on one of the track sections where cars were sometimes spotted.

During 1935, the Michigan Central made a similar installation on a double-track industrial switching line in Detroit, Mich., involving 17 street crossings, as described in the February, 1936, issue of *Railway Signaling*. At some of these crossings involving street car lines, automatically-controlled flashing-light signals direct motor vehicle traffic, color-light type signals direct street car movements as well as vehicle traffic, and color-light wayside signals direct train movements. Time cut-outs and key controllers, operated by standard switch padlock keys, are used to effect special controls. In 1938, the Chicago, Milwaukee, St. Paul & Pacific made an installation at Narragansett avenue in Chicago, involving a crossing with two passenger main tracks, four freight main tracks and six yard tracks. Here the flashing-light signals and crossing gates are controlled automatically by track circuits on the passenger main tracks and on two of the freight main tracks, while manual control is effective for movements on these tracks as well as on the two remaining freight tracks and the yard tracks. Color-light dwarf signals, controlled in conjunction with the crossing protection, direct train movements on the four freight tracks. This installation was described in the July, 1938, issue of *Railway Signaling*.

A further development of this idea of using wayside signals to direct switching movements in connection with crossing protection has been made on the Pullman Railroad, a switching line in Chicago. Eleven tracks are involved in this project and the types of control vary. Where approach control sections of the proper time distance cannot be arranged, very short sections are used. When a movement is to be made, the locomotive or first car is stopped on this clearing section, which causes the crossing protection to be set in operation, but the wayside signal does not clear until after a 20-sec. time interval has elapsed. On one track, cars are spotted up to the street line, thus occupying the clearing section, and the control is set in operation when a derail is reversed.

In some of the European countries, where gates are in service at highway-railroad crossings, wayside railroad signals are so controlled that these signals display Stop aspects normally, and display the Proceed aspect only when the crossing gates are in position to obstruct highway traffic. At least one railroad in the United States, handling slow-speed freight traffic only, made a considerable number of flashing-light crossing protection installations including wayside signals so arranged that Clear aspects would not be displayed to authorize trains to proceed unless the crossing signals were in operation.

Such an arrangement is, of course, impracticable on tracks where trains are operated at high speeds, because train stopping distances are too long. For train speeds of 90 m.p.h. for passenger trains and 50 m.p.h. for freight trains, with a train stopping distance of 7,500 ft., the wayside signal would have to be placed this distance in approach to the crossing. A track section located in approach to the wayside signal would have to be long enough to set the crossing protection in operation, and to afford time for the aspect of the wayside signal to change, as well as to permit time for the engineman to view the signal; thus this section would have to be 2,000 ft. or more in length. The crossing protection, therefore, would be set in operation 93 sec. before a passenger train would arrive at the crossing, and 129 sec. before a freight train arrived. If crossing gates are used and are to be checked in the down position, requiring at least 16 sec. more time-distance in the preliminary section, the time of operation before the arrival of trains would be extended still further. Thus the crossing protection would have to be in operation for a very long period in excess of the standard 20 sec. The conclusion is that, with reference to tracks on which trains are operated at speeds above 40 m.ph. no such provision of wayside signals to check the operation of crossing protection is feasible, because the crossing protection would operate for too long a period.