Editorial Comment

Signaling for Higher Train Speeds

The introduction of light-weight streamlined diesel-propelled trains by several roads, and the speeding up of steam-operated trains to speeds of 80 to 90 miles per hour, brings to attention the correction of the spacing of automatic signals and the replacing of antiquated types with modern signals.

Recent tests made by the Burlington, described in detail at a recent meeting of the Western Railway Club, demonstrated the fact that the new light-weight trains are equipped with braking facilities that will bring these trains to a stop, from speeds of 100 m.p.h., in a distance as short as the more common brakes will stop an ordinary steam passenger train from a speed of 65 to 70 m.p.h. This would seem to obviate the necessity for changes in signaling as might be occasioned by the operation of these light-weight high-speed trains. However, the Burlington has made numerous changes in its signaling as will be explained later.

The introduction of high-speed six and seven-car trains drawn by steam locomotives would appear to introduce more problems with reference to braking distance than are brought about by the diesel-propelled trains, and has resulted in concurrent changes in signaling systems, thereby indicating that this matter is of importance. For example, after April 28, the Chicago & North Western's "400" will be scheduled to traverse the 85 miles between Chicago and Milwaukee in 75 minutes, which means that speeds of more than 80 m.p.h. must be made on portions of the line. When making test runs preparatory to instituting faster schedules, the Milwaukee ran a train from Chicago to Milwaukee in 67½ minutes, one section of 5 miles being traversed at a speed of 103 m.p.h. It cannot be assumed that the braking distances for these six-car steam trains, moving at these speeds, is the same as that for passenger trains with more cars operated at slower speeds, unless changes are made in the braking system.

The speed of these trains on the line has, of course, been increased greatly, but an important factor in such marked reductions in overall time between termini is the reduction in the number of station stops, as well as delays caused by meets with other trains.

Although the respacing of signals has been brought more forcibly to attention by the introduction of these new trains, the problem of inadequate braking distance has been becoming more acute for several years on numerous roads by reason of the gradual increase in the speeds of passenger as well as freight trains. The problem is perhaps more serious with freight trains, consisting primarily of loaded cars, for the operation of such trains at 50 to 60 m.p.h. is not uncommon and the braking distance is further complicated by the increased length and tonnage of these trains. Thus the necessity for the respacing and rehabilitating of the signaling to meet train operating conditions is not confined to the few roads which are instituting spectacular high-speed trains, but is likewise the problem of many other roads as well. Several train accidents within the past year have resulted from enginemen overrunning signals. For example, on the Florida East Coast a passenger train ran into an open draw recently; a factor contributing to this accident was the location of the distant signal only 2,628 ft. from the home signal.

Proper braking distance can be provided by changing the signaling in several ways. As a part of the electrification program on its line between New York and Washington, the Pennsylvania installed practically an entirely new system of automatic signaling, using blocks averaging 8,000 ft. with three-aspect, two-block signaling for train speeds of 90 miles per hour. Also, on the double-track territory of this road between Ft. Wayne, Ind., and Hobart (Chicago) the automatic blocks have been rearranged and lengthened from about 5,000 ft. to 8,500 ft.

On the Milwaukee, which will soon introduce high-speed steam-operated passenger service between Chicago and Minneapolis, the signaling on 78 miles of road between Milwaukee, Wis., and Mayfair, Ill., has been rearranged to extend the blocks from an average of 5,100 ft. to approximately 7,600 ft., a total of 55 signals being eliminated. On the 32-mile section from Rondout to Chicago, where the number of trains is greater because of suburban service, it is planned to provide four-aspect signaling, at a later date, with blocks somewhat less than a mile in length. On the line between Milwaukee and St. Paul, the signals are now spaced about two miles apart, except at interlocking plants, yards and some other points. It will be necessary to remove 28 signals and to relocate 24 others in that territory, in order to provide adequate braking distances.

On the line of the Burlington between Chicago and St. Paul, over which the three-car Zephyr trains are to operate, several changes have been made. On the multiple-track main line between Chicago and Aurora, braking distance has been extended by changing the signal controls to present a yellow aspect on two signals approaching a stop signal. On the single and double-track territory between Aurora and Miner, Wis., where two-position semaphore home and distant signals are used, 138 distant signals were moved to provide longer braking distance, while on the double-track section from Miner to St. Paul, where modern color-light signals are used, only four signals had to be moved.

The Chicago & North Western placed its fast passenger train, the "400," in service between Chicago and St. Paul in January, on a schedule which, after April 28, will be reduced to 390 minutes for the 408 miles, an average of 68 m.p.h. between Chicago and Milwaukee, 85 miles, and of 63 m.p.h. between Milwaukee and St. Paul, 325 miles. The signaling on certain sections of this route had previously been modernized as to braking distances over a period of several years. At the present time, the enclosed-disk automatic block signaling between Milwaukee and Wilmette, Ill., 70 miles, is being replaced with modern color-light, three-aspect signaling, using blocks averaging about 6,000 ft. Between Highland Park and Wilmette, 9 miles, the semaphore signaling is being installed to co-ordinate the operation of through trains with suburban trains, block lengths being adjusted to facilitate train movements and provide adequate braking distances, this part of the program leading to the use of three-block, four-aspect signaling with blocks about 3,000 ft. long in this territory. On the 154-mile section between Milwaukee and Wyeville, Wis., the three-position semaphore signaling is comparatively modern, changes having been made in recent years to adjust the braking distances to modern requirements so that it was necessary at this time to relocate or remove only a few of the signals to lengthen blocks for trains closing up on the station layouts. On the remainder of the line, between Wyeville and St. Paul, signals have been moved where necessary to provide adequate braking distances. All of these railroads have, of course, lengthened the controls for highway crossing signals to provide at least 20 seconds warning before the arrival of the fastest train at a crossing.

This in brief outlines the changes in signaling that a few railroads have authorized as a part of their programs for high speed train operation. The point to emphasize is that on these roads, as well as on many others, the signals may not have been properly spaced for years, for train speeds have been increasing gradually during the past decade. Every signal engineer who has not already done so should make a careful check of his signaling with reference to his train speeds and braking distances and recommend at once those changes which should be made. The so-called "lazy method" of using a caution aspect on two signals in the approach to a signal indicating "stop" should be adopted only as a temporary measure, for if enginemen reduce speed in conformance with the Standard Code caution rule through two blocks, schedules will be disrupted. Furthermore, the incorrect use of the caution aspect leads enginemen to form a new conception of its meaning and results in confusion that may contribute to an accident when they encounter only one caution aspect in approaching a "stop" signal. Where shorter blocks are necessary to handle the traffic, the introduction of four-aspect signaling is the satisfactory solution.

Checking Rail Ends on Drawbridges

The problem of checking the normal position of rail ends, which overlap from a movable bridge span to the adjacent fixed spans, received renewed attention during the recent convention of the Signal Section. The Committee on Interlocking presented the recommendation that "Rail-locking devices on interlocked drawbridges shall control and indicate when rails are within ¼ in. of being surfaced, and shall control and indicate when rails are fully unlocked." The chairman stated further that the Signal Section had referred this problem to the American Railway Engineering Association, which had sent a questionnaire to its members, requesting data as to permissible tolerances in the position of the rail ends. A recapitulation of the replies received showed that the gap between the ends of the rails on the movable span and on the fixed span should not be more than ½ in. where no carry-over rail is provided, and not more than 2 in. where such a device is used. These figures refer only to longitudinal or end gap between the rail ends, whereas the recommendation of the Committee on Interlocking, given above, has to do with the checking of the vertical position. In discussing the report, a member of the Signal Section expressed the opinion that the rail chairs or centering devices used on some bridges permit more than ¼-in. variation in the lateral or side movement of the rail end, and suggested that the lateral position should also be checked.

During the past two years, articles have been published in *Railway Signaling* dealing with interlockings on seven modern movable bridges and two other articles appear elsewhere in this issue.* Therefore, it might be well to review briefly practices employed for checking the rail ends on these installations. On seven of them, only the vertical position of the rail end is checked. On one bridge a 1¼-in. plunger is inserted through the rail chairs and through the web of the rail, thus checking the position of the rail vertically and longitudinally. A toggle arrangement prevents the plunger from being pushed "home" unless the rail is down. The use of such an arrangement necessitates practically perfect alinement and this, of course, requires the use of switch points in the rail to compensate for expansion and contraction, as well as to allow for the "running" of the rail where it cannot be held by anti-creepers.

Practically all bridges of modern construction are equipped with chairs or centering devices to bring the rail ends into the correct lateral position so that there should be no need for a special device to check this position, and none of the installations referred to made any such provision.

The longitudinal movement of the rail ends can or should be held within reasonable limits by the use of anti-creepers, or split points should be inserted to compensate for the "running" of the rails so that the rail ends can be held in place. The A.R.E.A. report indicates that longitudinal movement up to two inches is not objectionable where a device is used to carry the wheels over the gap. Thus, the longitudinal position of the rail ends can and should be taken care of satisfactorily by the engineering forces, and it would seem that there is no great need for a special signaling device to check the longitudinal opening or gap between the rail ends. Of course, if the rail ends lap over so that one end "hangs up," this constitutes a hazardous condition, but in such an instance the check on the vertical position would disclose this condition.

Therefore, in so far as bridges of modern construction are concerned, the problem simmers down to a check of the vertical position of the rail ends, which is adequately provided for in the recommendation of the Committee on Interlocking quoted above. The important point is that, where mechanical checking devices are used, a toggle or locking arrangement should be provided such that the lock lever cannot be placed in normal position if the rail does not return to its normal position. The descriptions of the installations on the New Haven, the Louisville & Nashville, and the Southern Pacific explain how this can be done, while the Atlantic Coast Line also has a device

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*

Boston & Maine	August, 1932	page 236
Chicago, Rock Island & Pacific	August, 1933	page 219
Louisville & Nashville	September, 1933	page 245
Maine Central	October, 1933	page 273
Missouri-Kansas-Texas	November, 1933	page 291
New York, New Haven & Hartford	January, 1934	page 33
Elgin, Joliet & Eastern	June, 1934	page 291
Southern Pacific	April, 1935	page 197
Texas & Pacific	April, 1935	page 191