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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which accomplishes this purpose adequately. Where electrical checking devices are used, they are usually so arranged that the rail must be in the normal position before a release is secured. The controller should be so mounted, preferably on the fixed span, so that if the rail end "hangs up" there will be a difference between the relative position of the controller and the rail end.

It might be said that the committee, in making its recommendation, ignored the fact that many of the older bridges are not equipped with rail-centering devices to bring the ends into line laterally and that there is little or no provision to prevent the running of the rails. One answer to this is that where a dangerous condition exists, it should be corrected, or else the signal engineer will have to provide some special means of checking the lateral and longitudinal movement of the rail ends.

Letters to the Editor

Crossing Protection Situation

St. Paul, Minn.

To the Editor:

Judging from the amount of discussion following the presentation of report of Committee XII, Signal Section, A.A.R., at the March convention, the question of highway crossing protection is, apparently, satisfactorily settled.

I am of the opinion, however, that a great many questions will bob up to be answered by the Signal Section of the A.A.R., as the interested members of those organizations which have so readily adopted their so-called standards for highway crossing signals begin to learn something about the specific problem involved.

There is nothing very strange or even complimentary in the fact that the National Conference on Street and Highway Safety, the American Association of State Highway Officials, and others, adopted whole-heartedly the standards of the Signal Section. They have never been greatly concerned about protection at railroad grade crossings up to this time, but undoubtedly some of their members will eventually show an interest in this phase of highway traffic.

The Institute of Traffic Engineers may also become interested. They have been told by one writer in referring to highway crossing protection in general use, that "most of the crossing signs, signals, and practices were developed before the Institute of Traffic Engineers was organized and before the highway officials had gotten the farmer out of the mud." They have also been told that "in the future the motor transport industry should be represented by highway and traffic engineers who will know what can be done to safeguard and expedite traffic." These are without doubt good things to start on. What this writer did not tell them is that it is one thing to know what can be done to safeguard and expedite traffic, but an entirely different thing to safeguard a traffic which only wants to be expedited. Nevertheless, some of them are bound to become interested, and when they do, questions will arise. These questions should be considered and answered out of the experience and knowledge of the railway signal engineers without waiting for the traffic and safety organizations to learn of their importance, and then present them as something new.

The protection for highway-railway grade crossings has always been, and should remain, a signaling problem, although it should not remain entirely a railway obligation. It must be continually kept in mind that a crossing is more dangerous after automatic signal protection has been installed than before. Drivers of highway vehicles let down in the use of their senses of sight and hearing, their greatest safety devices, and depend on signal indications for protection.

Highway crossing protection has long since ceased to be a question of prevention of damage to life and property of the users of the highway. The nature of highway traffic has become such that there is more danger to rail traffic than to highway traffic, and the possible costs of damage to railway property and railway employees and passengers, so greatly exceeds the possible damage to highway traffic that there is no comparison. We need only to recall a few of the destructive derailments which have resulted from collisions between heavy, high-speed passenger or freight trains, and relatively valueless automobiles, to make this understandable.

The construction of the steadily increasing number of automobiles and trucks on the highways is such that the very lightest car possesses many parts which may easily derail the heaviest locomotive. One such derailment makes the cost of the very highest degree of protection obtainable at a crossing appear extremely small.

When considered from the standpoint that the highway crossing signal primarily protects the train rather than the highway traffic, can any railroad afford to approve of the use of a device not founded on the fundamental principles of railway signaling?

Why should a loss of power, due to a blown fuse, an open circuit breaker, an exhausted storage or primary battery, a broken wire, a high-resistance relay contact, a burned-out relay coil, a broken contact ribbon, faulty terminals, open-circuit flashers, or any one of many other possible causes, be required to result in a "stop" indication of a railway signal, and, in direct contrast, a "proceed" indication of a highway crossing signal? Why should a burned-out electric light be required to result in a "stop" indication of a railway signal and a "proceed" indication of a highway crossing signal? Why require two sources of power for a highway crossing signal consisting of lamps, without emergency standbys for the lamps themselves?

Why decide that the crossbuck "Railroad Crossing" sign should only be illuminated or reflectorized at crossings where no automatic train approach signals are in use? Is not the crossbuck "Railroad Crossing" sign the very foundation of highway crossing protection, the most universally used and best understood indication everywhere? If this "Railroad Crossing" sign is not needed at night, why use it in the daytime when conditions are entirely more favorable for omitting it? Is it not a fact that a very high degree of protection for a railway-highway crossing is obtained by plainly indicating the existence of that crossing both day and night? I am of the opinion that had it been practicable to illuminate or reflectorize the crossbuck "Railroad Crossing" sign in the beginning so that it plainly marked the existence of a grade crossing, the requirement of train approach signals may never have developed. The obligation of a railway should be completely fulfilled when the presence of a crossing is clearly shown at all times.

Why reflectorize the sign indicating the number of tracks and place it high above the range of an automobile headlight and the driver's line of vision, so that it will not be seen by a driver standing facing a "stop" indication? Is this not the condition under which its effectiveness is most beneficial? Is this sign of any im-