EDITORIAL COMMENT

Adapting Signaling to Requirements

In years gone by, automatic block signaling installations were laid out to meet entirely different conditions of train operation than, in many instances, are in effect today. Furthermore, as viewed now, it would seem that in certain instances rule of thumb procedure, rather than an analysis of train operation, might have been used as a basis for locating the signals as they were located in those earlier years.

For example, in single-track signaling, the practice formerly followed in many installations was to locate an approach signal about 3,000 ft. in the approach to each station-entering head-block signal, and to provide one set of staggered intermediate signals or one or more double intermediate locations with the result that, where passing tracks were a comparatively short distance apart, the automatic blocks were very short. Such an arrangement provided safety and maximum track capacity and was well adapted to the traffic at that time, i.e., many more trains, shorter trains, and slower train speeds.

However, methods of train operation have changed materially during the last 20 years. Larger locomotives pull longer and heavier trains, especially freight trains. Improved service to the public demands that all trains, both passenger and freight, be operated at higher speeds. Although the volume of traffic is at a low ebb at present, thus reducing the number of trains, signaling should be planned to handle traffic during peak periods, as well as to be prepared for the gradual return of traffic to normal volume.

Although the short blocks gave maximum capacity for light trains moving at low speeds, these same short blocks would not afford adequate braking distances for heavy trains operating at high speeds. Furthermore, on territories where new signaling is being proposed today, the average number of trains is comparatively few, and the problem is to increase the average train speed and improve safety. Both of these results are accomplished by automatic signals which give the enginemen confidence that main-line switches are in the proper position and that the track ahead is not occupied, the latter being of special benefit by eliminating "slow downs" in permissive manual block territory, particularly where sighting distance is short on account of curves or during storms.

Keeping these facts in mind and also considering that track capacity is not the major problem because trains are fewer and speeds higher, thus in effect reducing block lengths in train time, it would seem logical that block lengths be increased, which, of course, solves the problem of adequate braking distance, except where the volume of traffic necessitates closer spacing of trains, especially in the territories approaching interlockings.

Not only can block lengths be increased to a minimum of braking distance, but where traffic volume permits, certain block lengths can be extended up to a maximum of two or three miles, which might previously have been considered faulty signaling. An example of such a procedure is presented on the Missouri Pacific between McCracken, Kan., and Sugar City, Colo., as explained on page 458 of the July, 1937, issue of *Railway Signaling,* and a second example on the Rock Island as described on page 506 of the September, 1937, issue. The Rock Island is also following this practice on a 467-mile installation now practically completed between Herington, Kan., and Tucumcari, N.M. A special arrangement of signaling to meet operating conditions encountered on a heavy grade on the Northern Pacific is described elsewhere in this issue.

A point of importance is that the lengthening of certain blocks results in the use of fewer signals, thus reducing the cost of signaling per mile to a figure readily justified. As a result, extended mileages, as on the Missouri Pacific and the Rock Island, are readily authorized on the basis of improved safety and faster average train speeds, even with a comparatively light volume of total traffic. These points are important, in view of the fact that an estimated 5,000 miles of lines not now signaled should be so equipped within the next five years as a means of effecting faster schedules to meet competition. Furthermore, an even greater mileage of existing antiquated automatic signals should be modernized, using light signals spaced properly to meet requirements for braking distances.

An Example of Modernization

New apparatus and systems of interlocking and signaling have been brought out so frequently and applied so extensively during the last 25 years, that it is difficult to visualize progress as a whole for this period unless installations presenting decided contrasts are set side by side.

For example, in 1899, the Denver & Rio Grande Western installed a mechanical interlocking at Pueblo, Colo., in which the derails and switches were operated by pipe line connections and the signals by wire line connections. Mechanical selectors were used, by means of which one signal lever controlled two and in some cases three signals governing train movements over a switch, depending on the selection set up by the position of the switch. In other words, this plant represented practically the ultimate development in the ingenious use of mechanical devices in the interlocking field prior to the introduction of electric circuits and apparatus.

Contrast Between Old and New

In decided contrast, this old all-mechanical interlocking was recently replaced by a modern all-relay interlocking using a machine with miniature levers, the locking being effected electrically by interconnection of circuits rather than by mechanical locking between levers, and selections effected by circuits rather than with mechanical selectors. Switches are operated by electric machines rather than by pipe lines actuated by manually-operated levers; electric locking controlled by track circuits replaces detector bars; and searchlight type signals displaying three aspects in one unit, all operated electrically, replace the old semaphore signals which were operated by wire line connections.

In certain respects, this replacement is typical of many that should be made at numerous locations as a means of improving safety, expediting train movements and reducing operating expenses. Especially is this true where two or more interlockings can be consolidated into one control arrangement.

The Relation of Signaling to Train Operation

WITHIN recent years, signaling apparatus has been applied in several new ways which have brought about changes in the methods of directing train movements. As a result, those who plan signaling installations, as well as those who construct and maintain these systems, should be informed of terms used in train operation as applied to signaling, so that a clear understanding may be had of the exact meaning of manual block, permissive manual block, time-interval block, operation by time table and train orders with or without automatic signals, remote control, and centralized traffic control in which train movements are directed by signal indication without train orders or rights of trains by time table direction or class.

An Analysis of Problems

With the thought that many of the readers of *Railway Signaling* would be interested in an extended study of the background through which signaling and train operation have been built up, a series of questions and answers has been prepared and is to be published in installments monthly in the What's the Answer department. This series has been prepared to present both the background of signaling and an analysis of signaling systems. Special attention has been given to the orderly arrangement of the material. The general field of railway signaling will be described, an attempt being made to clarify its interconnection with railroad operation. As the subject matter is developed, the various sub-divisions of signaling will be discussed and analyzed in detail. It is to be understood that all answers are to be considered as "general" in nature, since practices vary on railroads.

Accident Involving Rule 93

(Continued from page 345)

signal the engineman called the indication of signal 306-2. It was still displaying a proceed indication when the head brakeman last observed it, at which time his engine was a short distance beyond the yard office or about 10 or 12 car lengths from the signal. He estimated the speed of his train to have been about 20 m.p.h. at that time and it was then increased to about 25 m.p.h. He saw the southbound train which appeared to be clear on the southward track and he called attention to this train, referring to it by number. He did not see either signal 305-4 or the switch lights, nor did he see anyone giving stop signals, and he did not realize that a collision was imminent until his engine entered the crossover, at which time he thought he heard an application of the air brakes. The signal lights in that vicinity are bright and can be seen for a considerable distance. The engine cab is equipped with storm windows and there is nothing in the cab to interfere with the view through these windows. No one in the cab called the indication of signal 305-4, and he was unable to explain his failure to see that signal.

Using as a basis for calculation the time consumed in opening the crossover switches during a test conducted after the accident, it appears that signal 305-2 would have displayed an approach indication and signal 305-4 a stop-and-proceed indication approximately 2½ min. before the accident occurred. A train traveling at a speed of 25 m.p.h. would consume 2 min. 10 sec. traversing the distance between signal 306-2 and the point of accident, and this would indicate that the signal displayed an approach indication before engine 1384 passed it. Twenty-five m.p.h. was the lowest estimate of the speed of Extra 1384 in the vicinity of signal 306-2.

There is conclusive evidence that signal 305-4 displayed a stop-and-proceed indication and that the crossover switch displayed a red indication; in addition, the brakeman of Extra 1391 gave a stop signal when the train was approximately 30 car lengths south of the block signal. Apparently none of these warning signals were seen by any of the employes on engine 1384. The engineman and fireman of Extra 1391 were killed in the accident.

Tests conducted after the accident showed that the signals functioned as intended, and that switch indications adverse to the movement of Extra 1384 were displayed in time for that train to have been brought to a stop before passing the clearance point of the switches. Regardless of block-signal indications, weather conditions, or the effect of the headlight of the southbound engine upon visibility, this accident would have been averted had Extra 1384 been operated within the yard limits in compliance with the requirements of rule 93.

This accident was caused by the failure of the crew of Extra 1384 properly to observe and obey signal indications and to comply with the requirements of rule 93.