Editorial Comment

What Is the Capacity of a Single-Track Line?

An official of a railroad of a foreign country is on his way to America to study railroad practices and, in particular, to gather information concerning methods employed to develop the maximum capacity of a single-track main line where modern signaling and centralized traffic control are in service. He will find instances were as many as 60 trains a day have been operated over such a line, and he may receive so many general statements that will leave him in a haze, with the conclusion that his question is similar to that of "How long is a piece of string?" On the other hand, we can develop from available records and methods of calculation information that will be valuable not only to our visitor from abroad, but to the railroads of America as well.

In determining the capacity of a single-track line, consideration must, of course, be given to the characteristics of the line as to grade, curvature and number and location of sidings, as well as to the rating and speed of locomotives, and the number of passenger, manifest and drag freight trains, as well as their spacing throughout the 24 hr. By using outlines presented by Committee I of the Signal Section, time-distance charts can be prepared for any specific conditions which will show how the existing traffic as well as the expected increase can be handled over the line being studied.

Furthermore, data available on such roads as the Pennsylvania, the New York Central, the Wabash, the Southern Pacific, the Missouri Pacific and the Baltimore & Ohio, where sections of centralized traffic control have been in service for several years, can be used to prove that such facilities not only permit on-time performance of passenger trains on faster schedules, but also reduce the road time of through freight trains about two minutes per mile, as for example, increase the average speed from about 15 m.p.h. to 30 m.p.h.

With these facts in hand, our visitor might reasonably question why the railroads of America are not using these facilities more extensively. Of course, it might be explained that some roads have reverted from double to single track, and by means of power-operated or spring switches and signaling have been able to handle trains efficiently. The Milwaukee has followed this procedure on approximately 200 miles of line and another road is now considering the abandonment of one track of 30 miles of double track, the remaining track to be equipped with centralized traffic control.

The Chesapeake & Ohio has developed a comprehensive method for increasing the capacity of an existing single-track division by relocating the passing tracks on a time-distance basis and providing centralized traffic control for the direction of trains by signal indication. Likewise, two other large railroads have made studies which prove that it would be practicable to revert from double track to single track on extensive sections of important divisions. In certain of these cases, the deciding factor is the utilization of the life of the existing rail now in the track. In other words, the time for changing to single-track operation is coincident with the end of the life of the rail in one of the tracks. In this respect, the Milwaukee solved its rail problem by operating on one of the tracks until the rail was worn out and then gradually switching over to the remaining track, at which time the second track was abandoned.

As a whole, it might be said that we have as yet comparatively few examples to show our foreign visitor. Therefore, such data as he may accumulate regarding the capacity of a single-track line will be of equal interest to the railroads of America, because, faced with the necessity for reducing operating expenses, it is logical to expect that the railroads of this continent will give serious consideration in the near future to more extensive joint operation of sections of line, thereby permitting the abandonment of other portions of track. Furthermore, present and anticipated traffic on some double-track lines can now be handled efficiently on a single-track line equipped with modern signaling. Therefore, our visitor from across the water is bringing to us a question which the railroads of America must soon prepare to answer for themselves.

Slide Detector Fences

The use of the line control circuits of automatic block signals to detect rock slides that might foul the tracks has been followed in various forms for years. Such roads as the Northern Pacific and the Great Northern have used such forms of protection very effectively in the mountainous regions of the Northwest. Likewise, the Norfolk & Western has installed detector fences on its lines through the Allegheny mountains, and more recently the Pennsylvania has made sixteen installations, while the Baltimore & Ohio, the Southern, the New York Central and other roads have made investigations and estimates for proposed installations.

The use of detector fences provides many advantages over and above the economies effected by the replacement of watchmen. The protection is effective in giving instantaneous notice of rock or ice slides 24 hr. every day, whereas it is impracticable to employ enough watchmen to provide effective patrol over entire slide areas at all times and have the men in position to stop trains quickly in the event of hazard. Therefore, some roads consider the improvement in protection afforded by the fences to be the deciding factor, providing the proposed saving in operating expense will offset the carrying charges and maintenance.

Since March, 1928, the Norfolk & Western has installed 71,531 lin. ft. of slide detector fences at 55 locations, at a total cost of $75,047, the unit cost varying from $0.53 to $3.15 per lineal foot, or an average of $1.14 per foot. The costs vary with the height of the fence required and the difficulties encountered in construction, while the savings depend on local conditions. As an example, the installation of seven fences on one division resulted in the elimination of a monthly operating expense of $1,150 for part-time watchman service, at which rate the fences paid for themselves in approximately one year.

The most serious disadvantage of slide detector fences is the fact that the detector device sometimes sets the automatic signal at "stop" when rocks, which would not foul the track, encounter the fence, delaying trains unnecessarily until the device is reset. On some of the earlier types of fences, including seven installations totaling 12,000 ft. on one division, there were 16 train stops between January 1 and April 3, 1932, including the season of thawing and freezing when rock falls are most frequent. None of these 16 rock falls resulted in hazardous damage to the track, but it is a matter of conjecture how many of them might have been dangerous if the fences had not intercepted the rocks.

That the fences are effective as a safety measure is shown by the record of one of them near Glen Union, Pa., on the Williamsport division of the Pennsylvania. Here, within the period from December 1, 1933, to December 31, 1934, there were 64 fence operations. On two occasions in April, six tons and two tons, respectively, of ice, rock and mud fouled both main tracks, operating the fence and stopping trains. On six other occasions during the year when trains were stopped, the fence caught and retained ice or rock weighing from 200 to 2,000 lb., which would otherwise have fouled the tracks. Within this period, there were 56 other instances of fence operation caused by small slides or rock falls which, in all probability, would not have fouled the tracks. The delay to trains on these occasions has been deemed justifiable in view of the positive 24-hr. protection given to train operation, and the savings made in patrolling the tracks.

In many cases, the sensitiveness of the fences has been reduced by adjustment of the circuit controllers, so that only falls and slides of a magnitude which might possibly cause unsafe operating conditions are reflected in danger signal indications. The location of the fences and the clearance between the ground and the bottom of the fence to allow small rocks to roll under are also important factors in reducing the number of unnecessary operations. During the last two years the cost of complete installations has been reduced and the protection improved by adopting the practice of providing one high fence at the base of a slope close to the track rather than building several lower panelled fences at successive locations down the face of a slope. Of course, local conditions govern the arrangements needed to intercept rocks falling from hillside slopes or bluffs.

Some roads, such as the Pennsylvania, provide a special marker "SP" on the mast of the automatic signal governed by the slide detectors so that an engineman stopped by such a signal indicating danger knows that, when proceeding with caution, he should watch carefully for rocks or other obstructions on the track.

Circuit Breaker Devices

In some of the more simple types of slide protection, the signal line control wire has been extended on short stakes across the danger zone, on the theory that a large stone or slide would break the wire, thus opening the circuit and placing the signal at "stop." With the development of fences to cover the area more thoroughly, plug-type connectors, actuated by a movement of the fence, have been utilized to break the circuit. In some instances, these plugs have become corroded and, because they were liable to stick when called upon to function, they have been discarded in favor of a trigger arrangement for actuating a circuit controller. This trigger can be adjusted so that it will not kick off when small rocks strike the fence, while an indicator can be provided to assist a man on the track in determining which controller has been operated.

In some of the earlier installations, the line control circuits were extended through the circuit breakers on the fences. However, this method involved the possibility of improper operation in case a slide smashed the cable and "shorted" the wires. To obviate this possibility, as well as to eliminate chances for grounds on the signal line circuit, some roads provided separate fence detector relays fed from a battery located at the fence and controlled through the detector device, the relay being located in a housing near the pole line at a point beyond the slide zone, and the line control circuits being taken through contacts of this special relay. In other instances, where there is a likelihood of the line or cable wires being crossed by slides, one road has used an arrangement of two stick relays, picked up by operating a push button and so connected that a broken wire or a short circuit will cause the relays to release, thus opening the line control circuit.

From the above, it is to be noted that during the last few years numerous improvements have been made in the type of fences and in the location of panels to afford better protection. Furthermore, advances have been made in circuit controllers and circuits. Therefore, the entire question of the field for slide detector fences is again opened up for serious consideration. From an economic standpoint alone, the installation of these fences can be justified at the majority of the locations where hazardous conditions exist; in addition to the savings effected in operating expenses, the fences provide full 24-hr. protection throughout the year.

Preserving Anchor Bolts

Honolulu, Hawaii.

To the Editor:

Replying to E. G. Stradling's letter on page 213 of the April issue, regarding rust on anchor bolts:

The Oahu Railway of Honolulu had a similar condition, although a 1-in. galvanized bolt was used on the original installation, which was completed in 1916. This island is surrounded by salt air and the trade winds, which blow during eight months of the year, help drive the salt air into the iron.

In 1925, we found that the anchor bolts were badly rusted above the concrete. As there was no portable air compressor available to sand-blast the bolts, the rust was chipped off by hand, leaving about ¾ in. of the bolt diameter. "No-Oxide, grade A special" was first applied with a small brush, after which the entire hole in the signal base was filled up with a compound of such grade that would not be melted by the heat of the sun. A great many of these bolts were inspected during 1933, and in no instance was there any change, other than the original corroded condition.

Our worst case of corrosion involved the two-piece galvanized retaining rings used with roundels, which were embedded in lamp wicking. After being in service about eight years, approximately 50 roundels cracked within four months. The corrosion was next to the wicking and not apparent during an outside inspection. Copper retaining rings were used on all replacements.

W. D. Cleveland,
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