9 JUNE, 1899.

“The most Expeditious Method of Relaying the Railways of this Country, involving the least Interruption of Traffic, having regard to Safety and Economy.”¹

By HARRY FOOTNER, M. Inst. C.E.

In introducing this question, no detailed description of any system of relaying can be given within the prescribed limits. The Author therefore confines himself to classifying the methods of relaying, and to suggesting what appear to him to be the principal objects to be attained, and the circumstances that should be borne in mind in determining which method is most suitable under given conditions. His remarks will refer only to suburban and to main trunk lines.

In the compilation of a train service, when all other demands have been satisfied, an average allowance of time must necessarily be made for the interruptions and delays arising from the repairs and renewals of the permanent way and works; and even a further margin must be provided for contingencies. The regularly recurring operations so anticipated will comprise—signalling work, bridge and station reconstruction, mining subsidences, renewal of junctions and points and crossings, lifting and relaying the permanent way, &c. Although relaying does not cause one-half or even one-fourth of the total “train slackenings” due to these numerous works, it is nevertheless extensive enough to call for any amelioration that can be suggested. It is therefore obvious that such a division of repair and renewal work as will spread all these slackenings uniformly over the months of normal traffic, and will reduce them to a minimum when traffic is abnormally heavy, will conduce materially to the maintenance of a regular train service, and will be best for all concerned.

When putting in hand a long length of relaying, the question arises, what should be the maximum length of line to be taken up at one time? A little consideration will show that no more definite rule can be laid down than this: that the operation should not require any important train to run at slackened speed for so long a space as to render it impossible for it to arrive in time at the next stopping-place where it has some connection to make.

¹ *The Engineer*, vol. lxxxvii. p. 612; *Engineering*, vol. lxvii. pp. 799 and 826.

All relaying requires:—

(1) A period of train “slackening,” while preparing the old line for removal.

(2) An interval of “absolute block,” while throwing out the old line and laying down the new.

(3) A further period of “slackening,” while lifting, levelling, and straightening the new line, until consolidated.

These periods will be in different proportion, according to the method of relaying adopted; but the length of the “absolute block” interval (2), whatever it may be, must be so determined as never actually to *stop* an important train, and seldom to stop any other train whatever. In the interests of the traffic the engineer has to consider how he can reduce the “slackening” periods (1) and (3). Sometimes a line may with safety be denuded of a portion of its ballast, and of some of its keys and fish-plate bolts, while trains are running at their customary speed; but with an old and weakened road it is not prudent to permit the relaying foreman to trench upon the margin of safety to an extent which cannot be exactly defined beforehand, and which even in most careful hands may some day be carried too far, and result in disaster. All trains should therefore be slackened at the commencement of period (1), that is, as soon as the work of preparation begins; and should be similarly slackened all through period (3), that is, until it is seen that all sleepers are uniformly and solidly bedded, and the rails true in line and level.

The methods of relaying may be classified as follows:—

A. Gradually replacing old with new materials: such as turning the old rails out and the new rails into the old chairs; then withdrawing the old chairs with the old sleepers one by one, and replacing them with new chairs and sleepers.

B. Putting together all the new materials in one of the two following ways before removing the old line:—either (1) putting the new line together wholly outside of and parallel to the old line; or (2) interlacing the new line with the old, each of the new rails being 9 inches to 12 inches from the corresponding old rail. Finally slueing the new permanent-way into position, as fast as the old can be removed.

C. Clearing away entirely the old line, and preparing the sleeper-bed before putting the new materials together.

Period 2.—When the working intervals between trains are too short and infrequent to permit of the replacement at the desired rate of progress, single-line working must be adopted; or if the trains are too numerous night and day during the week for

working single line satisfactorily, and no other diversion of the trains can be made, Sunday work must be adopted. Working single line for the whole or part of Sunday generally presents no traffic difficulty; and the length of new line that can be put in (bearing in mind the rules as to slackening) is limited only by the available number of platelayers, and by the amount of ballast that can be brought to the place when new ballast is required.

The cost of labour in relaying depends upon the following conditions, amongst other things:—

- (1) The weight of the materials to be handled.
- (2) The level at which it is considered necessary or desirable to place the new line.
- (3) The relative quantity of old ballast to be thrown out and used again, and the quantity to be sent away and replaced by new.
- (4) Whether day, night, or Sunday work.
- (5) The extent to which the regular traffic interferes with the attending ballast trains.
- (6) The relative number of skilled and unskilled men available.
- (7) The degree of thoroughness of the work done at the time: good work is amply repaid later on by the lessened attention required in repairs.

The cost of relaying, however important in itself, is subservient to the necessity for executing the work in a manner that shall offer the least interruption to the regular train service. Even with the same method of relaying, the foregoing conditions vary to an extent that may cause one piece of relaying under unfavourable conditions to cost twice and even three times as much as an equal length where everything is favourable. On this account therefore it would be difficult to make any useful comparison of the cost of different methods without a large number of instances of each. The Author is of opinion that method A is more expensive in the long run than either of the others. Method B (2) may present the greatest advantages when the chairs have to be attached to the sleepers on the ground; and method B (1) is an expeditious way of executing the work during the "absolute block interval" (2), provided the embankments and cuttings are wide enough and sufficiently free from obstruction to allow of laying out the new material parallel to the old line. But he ventures to express the opinion that method C is best calculated to result in a good running road, and on this account is preferable for general adoption.