

mences, the elevation to run off $\frac{1}{2}$ in. to each 25 ft.

On very sharp reverse curves perhaps this might not be enough if the distance between curves would permit more, & where this distance is not long enough the speed should be reduced.

We are not in favor of elevating any curve more than 6 ins., where trains do not attain a maximum speed of 35 miles per hour.

For a rate of 35 miles an hour we would elevate the curve 1 in. for each degree up to 3 degrees. For 4 degrees add $\frac{3}{4}$ in. & $\frac{1}{2}$ in. for each additional degree above 4 degrees.

We consider no rule can be laid down that will meet all cases, & the elevation may have to be varied according to circumstances. For a rate of 50 miles an hour elevate the curve $1\frac{1}{4}$ in. to the degree up to 3 degrees. For 4 degrees add 1 in. & for each additional degree add $\frac{3}{4}$ in.

On all curves raise the outer rail rather than depress the inner.

The adoption of the report having been moved, it was discussed.

MR. DRINKWATER.—I do not wish to be too inquisitive, but there are a few portions of the report that I do not understand very well. I can raise no objection to the substance of it, but the 1st paragraph is not very plain to me. I do not thoroughly understand it, nor the following: "Elevation to run off $\frac{1}{2}$ an inch to every 25 ft." On very sharp curves, or reverse curves perhaps this would not be enough. I believe in curve easement at the tangents, & that elevation should commence to run off at the same point on the curve that easement commences.

MR. R. SHANKS.—That is, your elevation would start to decrease at the point where your curve starts to ease off?

MR. DRINKWATER.—Yes. I think this report meets my views fairly well, judging from my small experience of curves, for I have been fortunate enough to have a road so straight that I can see from one end of it to the other. It is true that no rule can be laid down that will meet all cases. Any of us who have had any experience—we have all had some I suppose—know that this is the case. On a curve on a 1% grade, or whatever grade it may be, a train going down grade, whether freight or passenger, will run 45 or 50 miles an hour, & going in the other direction will run maybe 15. In other cases trains run from 45 to 65 miles an hour in both directions. There are many instances of this kind in 150 miles of road that only close attention & practical experience can deal with properly. This has been my experience, & I think that one clause in the report covers that point.

MR. MORIN.—I am waiting for some of the older heads to say something on curves. I think there is a good deal of judgment to be used in ascertaining correct elevation. It depends a good deal on where the curve is located. It is on a down grade it would, of course, require more elevation than on the top of grade where the speed would not be so

great. I believe the elevation mentioned is not too much for sharp curves, where the outside rail gets worn. I believe that in a case of that kind the curve should be well elevated & well braced on inside & outside. I would like to hear from some of the old hands who have been at the business a long time.

MR. KEEFE.—From what experience I have had of curves, & we have some pretty bad ones on the other side of the river, I would say that I have been accustomed to give from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch to a degree, & found that sufficient. In many cases I have had to take elevation out of curves on a grade down to $\frac{1}{2}$ an inch, sometimes less. The fast trains would require more elevation, but the slow trains dragged over the top of the inside rail. In regard to running out elevation on curves, I have struck places where we have had to run out at the rate of an inch to the rail, but I presume you do not get that on the C.P.R. or some other lines, & in fact on the new line which we are building here the curves are very light. I have always found that wherever track was elevated from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch that we had to take the elevation out on account of tipping the inside rail. As Mr. Drinkwater says, it is necessary to use a good deal of judgment on account of the different speeds of trains.

MR. R. SHANKS.—Have you had no trouble with the outer rail cutting on grades of which you speak, with $\frac{1}{2}$ to $\frac{3}{4}$ inch elevation?

MR. KEEFE.—Yes. Also with the inch elevation; with the inner rail.

MR. JELLY.—Would it not be better to tip the inside rail, instead of having the rail cut?

MR. KEEFE.—It does not make any particular difference.

MR. LESLIE.—There are some very considerable curves in our line. I find that to elevate for 50 or 60 miles an hour for 8 degrees is as near as we can come at it. We have curves between Depot Harbor & Eganville 8 degrees, & between Eganville and here the sharpest curves are four degrees. I elevated them for 60 miles an hour & found it sufficient. The inner rail is now showing slight signs of wear on heavy grades. I elevated for 45 miles an hour & found it too much for heavy freights crawling up grade at a slow rate. I think this question is a pretty hard one to decide on, & it depends, of course, on the circumstances what elevation must be given. Passenger trains running at 60 miles an hour & freights crawling along at 15 to 20 miles require different treatment, & it is hard to provide for both. We feel like giving more elevation when trains are running fast.

THE PRESIDENT.—On what speed is the report based?

MR. R. SHANKS.—On a speed of 35 to 50 miles an hour.

MR. DRINKWATER.—What do you take for a basis in starting easement of curves?

MR. R. SHANKS.—The only way that you can work it successfully is that you can hold your curves in. Of course the proper way to get easement is to put it in in constructing the

road. If you do not ease your curve in you will certainly sharpen your curve.

THE PRESIDENT.—How you are going to ease a curve without changing the whole curve I do not understand.

MR. DRINKWATER.—Would it not be simply taking work away from the engineer that he had left undone at construction to do that.

MR. R. SHANKS.—We are not disputing that the work should have been done by the engineer.

MR. DRINKWATER.—If you take a 3 degree curve it is easier than a 4 or 5 degree, but the points are the same as the centre. If you ease the curve you make the points of curve easier than you make the centre; you can ease it in either way. If you line the whole curve in you make another curve; you do not change that one at all, you make another one. I do not take the position that the curve is not easier, but you do not make the points any easier than the rest of it. If you put in easement you do not leave the same curvature at the points as in the centre, & leave the centre where it was. That is exactly what the engineer would have done if he had made that style of curve when the road was under construction.

MR. R. SHANKS.—We do not recommend the changing of all curves, but the easement of curves.

MR. JELLY.—The curve could be lined all the way around, & then easement could be made on the end, & curvature made the same as formerly, & have an easement on the end as well. But of course if you ease portions you certainly make the balance of it sharper.

THE PRESIDENT.—If the easement is put in when the road is constructed then you have something that is worth something. Then you commence to slacken elevation where easement commences, so that your train will pass on to curves without getting that knock which it is so customary to get when striking curves. First your car comes over on a straight line where it should not come over, & there is no question in my mind, but that if we had roads laid out with easement they would ride much better, but I fail to see how you can get this & have curve ride well unless the whole curve is eased. That is my opinion in connection with easements. So far as elevation is concerned I find that I cannot get good results at 50 miles an hour with less than an inch to a degree up to at least 4 degrees. If you get beyond 4 degrees I would not be in favor of putting an inch to a degree. I am of the same opinion as one of the road masters (I forget his name) of the New England Roadmasters' Association, that is that after you get a certain elevation, I think it is 7 inches, that I would not elevate over that. Where it is necessary to elevate over 6 or 7 inches, you must reduce speed.

The report having been adopted, the meeting adjourned till the following day.

RAIL JOINTS.

The committee, J. Drinkwater & W. Shanks, reported as follows: In connection with our

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