

7. Would you give to the Committee an idea of the cost of tunnels somewhat similar to the Otira Tunnel—tunnels in the Alps and other parts of the world—as compared with the Otira Tunnel?—The contract rate for the Otira Tunnel is £61 per running yard, the length being five miles and a quarter. The cost of the Mossoni Tunnel, seven miles and a half, was £213 per running yard, and the St. Gothard, nine miles, £142 per running yard. I have not got the particulars of the cost of the Loetschberg Tunnel, and I do not know that anybody has.

8. *Hon. Mr. R. McKenzie.*] Can you give us the quantity of excavation, lining, and timbering per lineal yard in those tunnels?—Yes, there were 72 yards of excavation per lineal yard. In the Otira Tunnel there are 34 yards. The Mont Cenis and St. Gothard tunnels are very old, the Mont Cenis being constructed in 1875 and the St. Gothard in 1881. I have no information as to when the Arlberg was built, but it was considerably later.

9. Have you details of the lining per lineal yard in those two?—No, I have not exactly. It varied in places, but in those two tunnels I think it was about 16 yards.

10. And how much in Arthur's Pass Tunnel?—5·7.

11. Can you give us an idea of the quantity of timber used for lining those tunnels?—No. The later tunnels that have been built in the Austrian Alps are the Woocheim Tunnel, 3·9 miles in length, at a cost of £115 per running yard; the Karawhankan, 4·9 miles, £170 per running yard; the Tauern, 5·3 miles, £140 per running yard. The next tunnel is the Bosruck, 3 miles long, and costing about £73 per running yard. This was a single-track tunnel, but the others were all double-track tunnels, and the last four are all in the Austrian Alps, being built between the years 1901 and 1910. There are two other Alpine tunnels, the Reckon and the Albula, and that covers the lot which at all resemble the Otira Tunnel. There is one in the United States, the Hoosac Tunnel, 4·7 miles long, and costing £239 per running yard. The Lyttelton Tunnel is given by my authority as costing £68 per running yard, and the length is 1·6 miles. Now, those tunnels not being of the same area as the Otira Tunnel, I made a reduction to bring them to about the same thing. I made a calculation of the bottom heading and the top heading, and then the amount after you have driven the two headings—

12. Would not the St. Gothard be driven with a double-bottom heading?—I could not say for certain about the Mont Cenis and St. Gothard. I think the greater part of the St. Gothard was driven with a top heading. The later practice has been simply with the bottom heading and the top heading following it. The result I arrived at was that I could take the cost of excavation per running yard as being directly proportional to the area, plus 25 per cent., when reducing the 72-yard tunnel to the size of the Otira 34-yard. That came out at £275 for the Mont Cenis Tunnel, and for the St. Gothard £152. I omitted to say that I also made a calculation in regard to wages. The price for ordinary labour in the Mont Cenis Tunnel was 2s. a day, and the St. Gothard Tunnel came midway between the Mont Cenis and the other tunnels, and I put it at 2s. 6d. In the case of the Loetschberg it was 3s. 4d. per day. These are not for skilled labour.

13. *The Chairman.*] You have made all the necessary adjustments for the purpose of comparison?—Yes. That gave the Mont Cenis £275 per running yard, the St. Gothard £152, and the Arlberg £80. The Alberg is noted as the cheapest of all those tunnels.

14. *Hon. Mr. Fraser.*] I do not understand your calculation: what is the £275 as against the £152?—That means the price per running yard of the length of the tunnel. You measure the length of the tunnel, and one yard length of this tunnel would be £275 and the other £152.

15. Have you any evidence as to the rate of wages paid in those tunnels in the Austrian Alps?—No, I have not precisely, but the price would be very much the same as in the Loetschberg Tunnel, and the wage there was 3s. 4d. per day.

16. *Mr. Reed.*] Was that the actual cost for the Bosruck Tunnel?—No, that was making an estimate on parallel lines to the Otira.

17. Was the Bosruck Tunnel the same size?—No, a little bigger; and I made a very small reduction there of 5 per cent.

18. Can you tell us the gauge of the line that runs through it?—I think, 4·8½ ft.

19. You said that you added 25 per cent.: did you include wages in that?—No.

20. Well, what were you covering?—I was simply covering the extra cost of dealing with a similar quantity of material. A certain amount of the work that you do is only preparation, and then the more work you have to do and the more stuff you have to shift for that expenditure in proportion the cheaper it comes out.

21. *Hon. Mr. Fraser.*] Were those tunnels worked from both ends?—Yes.

22. And what grades were they?—Low grades. There is only one tunnel of which I know the grade the Hauenstein, and that is 1 in 23.

23. Were these tunnels driven equally from both ends?—Approximately from both ends.

24. *Mr. Seddon.*] In regard to wages, you say that 3s. 4d. per day was the wage paid: does that apply to all the tunnels you mentioned or only to the particular one?—To several of them. On the older tunnels it was 2s., on the intermediate tunnels 2s. 6d., and on the last five 3s. 4d. per day.

25. That is just rough labouring-work?—Yes, you can reckon that the lowest rate paid.

26. You were talking of the Midland Railway tunnels of which you had charge, and you say they were cheaply driven. Was that on account of the material?—Yes, the nature of the ground made it easy.

27. It is quite different country to that of the Otira country?—Yes, there is a good deal of very hard rock in the Otira.

28. What was the tunnel in the United States that you were connected with?—The Flower Pass Tunnel, in Nevada.