

fact which made me decide on and put my trust in the magnetic brake, because where you have gradients it is necessary that the man who is to operate the cars should be able to utilise his brake on the down grade for coasting and for ordinary or emergency stops. Another feature is that with heavy down grades the motorman cannot hold his car at rest with the magnetic brake, unless he applies the hand-brake. The reason of that is, of course, that the magnetic brake is energized by the current generated by the motors, which current cannot be generated unless the motors are rotating. We also find that with the grades in Adelaide we do not get the excessive speed due to gravity on down grades. If a car has stopped on a down gradient, you must attain the speed of two miles an hour, which is a critical speed, before the motors will excite and give the necessary current to energize the magnetic brake. Under those conditions it is inadvisable to adopt a brake that you cannot depend on to hold the cars stationary on a down grade. If travelling at a speed higher than fifteen miles per hour, my instructions to my men are to slow down the car to that speed by the hand-brake, after which the motorman can apply the magnetic brake. The reason of that limit being made is because the brake is designed to act under normal conditions, and not at very high speeds, and you cannot provide for the brake acting readily under abnormal conditions, and at the same time work properly under normal conditions. In other words, we should have to have a brake which had more resistance and a greater series of brake-notches, which would only be used occasionally, as they would be of no use when working under normal conditions. Another reason for limiting the application of the magnetic brake to speeds of fifteen miles an hour is that I find it advisable to save the stress put on the motors. I particularly designed the motors with 10 per cent. greater capacity than was necessary for traction purposes, so as to meet the stress put on those motors by the brake; but even with that precaution, I find it necessary to fix the limit of speed. I want you to bear in mind that if I were redesigning the trams in Adelaide I would still use the magnetic brake, as our conditions are entirely different from Auckland. We have practically a level country. Our speeds are entirely dependent on the motors, whereas in Auckland you have the gradients, and the gravity would enable you to get up a far greater speed than the horse-power of the motors would on level country. In designing rolling-stock you have to carefully consider the conditions, and that is most essential in deciding what type of brake should be adopted. I should say from what I know of Auckland—and my knowledge is fairly extensive—it should be imperative that the cars should be equipped with a mechanically operated track brake, and if the cars are provided with that apparatus, then it is practically an impossibility to apply the magnetic brake. I should say that if you have the cars thoroughly fitted with the hand-operated track brake, and the hand-operated wheel brake, you have done everything in reason, because as well as these two brakes you also have two emergency brakes, by making use of the motors themselves either by reversing the motors, or making them work against each other. So that, as far as Auckland is concerned, they have the hand-brake, the mechanically operated track brake, the reversal of the motors, and the third emergency, which is the letting of one motor work as generator and the other as a motor, working against each other. I think the present system is effective with regard to the facilities of the men handling the car. Of course, you must admit that they had a fair amount of work to do in applying the hand-brake and the mechanically operated track brake. The installation of the air brake would, of course, enable the motorman to do his work much more easily and quickly, and you would relieve the motorman of the necessity of operating the hand wheel brake. It would, of course, be necessary for them to still apply the hand-operated track brake, which should be imperative, and irrespective of whatever type of brake is decided upon, to put it in in addition to the track brake. The track brake should be imperative, and always used on down grades. I have been over the whole system of the Auckland tramways, and I went to the Ponsonby depot this morning and inspected the various types of rolling-stock, also cars 75 and 48. It would be possible to install the magnetic brake on the single-track cars, but you would have to sacrifice the mechanically operated track brake. On the double-bogie cars it would be impossible to install the magnetic brake unless you had new trucks throughout, and trucks specially designed to provide the necessary room for the magnetic brake. You would also require new controllers, and, in my opinion, it would be imperative to put in new motors. I do not think, from what I have seen, and the close inspection I have made this morning of the apparatus, that the motors at present in use would hold up the work of the magnetic brake, and you would have to sacrifice that very necessary provision, the hand-operated track brake. That applies to both types of cars. I have calculated it would cost to install the magnetic brake about £60,000, and to fit the cars with the air brake about £12,000. I do not think that expenditure is warranted, having regard to the Auckland conditions. I think the provision made by the company is all that is reasonable. It should be remembered that the company have to carry the risk and have to pay for any trouble, and I think they have entered into this question very carefully indeed, and I doubt whether the British Board of Trade in England would allow the cars such as we have in Adelaide, without insisting on the provisions of the mechanically operated track brake. I want to lay great stress on this point, and I do not wish to be misunderstood: On a very steep gradient, where a man stops his car and then applies the magnetic brake he has got at the same time to go through the work of applying the hand wheel brake, to hold this car. I maintain that this is not desirable, as a man should be able to handle his car by the application of one lever; he should be able to stop and hold the car at any one point. If you tell him he has to pull one lever to slow the car down, and then operate another lever to stop it, you are bringing in a risk which it is not desirable to bring in. I understand the company in Auckland have agreed to install all its cars with the air brake, and retain the track brake, and I think they are doing really more than they should do—in other words, they are going out of their way, spending a lot of money, in order to provide the men with extra facilities. At the same time an extra brake is an extra safeguard. If you apply the air brake to the cars, you have five means of stopping the car. I do not think the company could