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RAILWAY GAUGES.

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The author regrets that indisposition and unavoidable absence from Sydney has prevented him from presenting his paper in such a complete form as he would have desired, but he trusts, nevertheless, that the few remarks that he intends to make will be productive of a valuable discussion. The question of economical railway construction is one which has at all times agitated the public mind, but, perhaps, at no time has it been regarded with more importance that at present, when financial considerations enter so largely into railway undertakings. In all parts of the world unproductive railways will probably be found, but in most of the countries of Europe, and even in India, the basis on which railways should be constructed have now been definitely settled; while in the Australian Colonies the question of cheap railways still continues to be discussed without any practical solution having been arrived at. Experience of other countries has apparently had no effect in guiding the deliberations of those responsible for the railway construction in the Colonies, and hundreds of thousands of pounds continue to be expended on new railways where there is no adequate traffic to support them.

It is a singular fact that while in every other industry everything is made in proportion to the natural requirements, exception should be made in the building of railways.

In the erection of an hotel, in determining the number of rooms, one has in view the number of guests to be accommodated; a manufacturer will not erect a 500 horse-power engine when he knows that a 50 horse-power will be sufficient; but when we build a railway such considerations are not weighed, and, especially in the case of branch railways, they are always constructed in excess of the absolute requirements. It may well be asked why this exception should be made.

Of course, it is quite understood that railways have not to meet the requirements of the present only, and that the development of the traffic must always be kept in view in determining the gauge, weight of the rail and rolling stock; but with the experience before us, this is by no means a difficult matter to arrive at.

The question is, why an exception should be made in the case of railways. The reason is the great prejudice that exists still in the minds of Railway Engineers against the break of gauge; they regard it in the light of an insurmountable difficulty, and thereby sacrifice the best interests of the country to the absurd idea that all Government Railways should be on the one gauge.

Nature has offered illustrations in the growth of a tree, and in the formation of the waterways, of how railways should be constructed. In the former we have the stem representing the main trunk, and in the outstretched branches of smaller size, the offshoots form the principal artery, and in the second case the rivers represent the main lines, and the creeks the branches; and all those stems, branches, rivers and creeks are of a size in proportion of the quantity of sap or water they have to carry; and so it must be with railways if they are rationally constructed—their size must be in proportion to the traffic to be carried.

Some Engineers maintain that this object can be achieved by keeping to the one gauge. We have, for instance, the Railway Committee in the neighbouring colony of Victoria, who recommend the construction of half-finished railways, which

should be completed as time goes on and the traffic develops. But it seems to be well-proved to-day that for "a given gauge" there is only one proper and efficient way of constructing a railway.

The cost may be cheapened, but generally at the expense of an increase in the working expenses.

If, in order to avoid deep cuttings, steep gradients are introduced, it will cost more coal, more oil, more wear and tear, etc., etc. If the ballast is reduced to below the necessary quantity, the permanent way will have to be raised at intervals, at considerable expense. If the road is not properly drained the life of the sleepers will be of short duration, and so on.

These, however, are the conditions upon which it is recommended to construct cheap railways for Victoria.

There is only one rational way of reducing the cost of a railway, and that is by reducing the gauge.

Nearly everywhere, with but few exceptions, the gauge of main railways is of 4 ft. 8½ in. This has been chosen instinctively, so to say, by the first railway constructors; but, later on, when railway construction had so far progressed as to make an alteration of the gauge practically an impossibility, the question was being discussed as to whether a more practicable gauge could not be adopted. Congress of Engineers have agreed that Stephenson had acted rightly in maintaining his 4 ft. 8½ in. gauge.

Actually, the standard gauge, as it is called to-day, leaves all the desirable latitude for the increase of the power of the rolling stock without interfering with its stability. We know that the standard gauge is suitable for the use of 60-ton locomotives and carriages 75 feet in length, and a man has no trouble in working the points of a suitable size for this gauge. One does not see, consequently, that any real advantage would result from the adoption of a wider gauge. But, in view of the economical and regular working of a standard gauge line, there are certain con-

ditions which must be observed as closely as possible in its construction. If it is anticipated the traffic will at some future time be heavy, it is not advisable that the gradients should be much greater than 1 in 100, and that the curves should not be of less than 1000 ft. radius. The construction of bridges, culverts, &c., should be designed in view of a pressure which may attain 18 ton per axle. The general installation of the railroad should be such as to ensure the security of the traveller and everything must be provided in the way of signals, semaphores, &c., &c., to meet this object.

The rolling-stock also must possess all those qualities which experience has proved are a necessity, and which represents, in proportion to the number of travellers, a dead weight which goes on increasing every day.

On all these items there is very little saving to be made in the construction of a railway as long as the one guage is adhered to.

It is evident that the gauge of the trunk lines has been rightly chosen by those engineers who have had the responsibility of constructing the first railways in New South Wales and if the break of gauge at Albury is to be deplored, it is the Victorian engineers that have to bear the responsibility of this unfortunate occurrence, as there is no justification for the adoption in that colony for anything wider than the standard gauge.

But if the gauge for the great trunk lines has been rightly chosen, so much cannot be said about a large number of branch railways which are only acting as feeders to the main lines, and which as stated before are sufficient for a considerably greater traffic. However, no one is to blame in this matter, as at the time most of them were constructed, the same error was being committed all over the world.

But laying down railways of the standard gauge at the present time—railways similar to the one from Nyngan to

Cobar, and many others—is an error for which there is no longer any excuse.

On the continent of Europe, and especially in France, the practice of making broad gauge railways in places where there is but little traffic has been abandoned, and the Government of that country is now sanctioning the construction of railways on the following gauges, viz. :—1st, the standard gauge; 2nd, the 3ft. 4in. gauge; and 3rd, the 2ft. gauge. It is only lately, however, that the 2ft. gauge has been officially sanctioned,—that is to say, since the late Paris Exhibition, where Messrs. Decauville erected their two-foot railway, and in six months carried over 6,000,000 passengers without a single accident.

It is necessary to further demonstrate the adaptability of the narrow gauge lines for all places where the traffic is moderate.

Have we not the example of the celebrated Festinag railway in Wales built on the 2ft. gauge, and which carries annually 150,000 passengers and 120,000 tons of goods ?

Another example of a more recently constructed railway is the line from Illigori to Darjeeling, in India. This railway, which is partly laid down on the public road, has gradients reaching sometimes 1 in 29, and curves of 70ft. radius. The weight of the rail is 40lbs. per yard. The rolling stock is composed of 12 locomotives, 41 carriages, and 110 trucks. The cost of the railway has been a little below £5,000 a mile; but a line on the standard gauge would have cost four times as much, and have answered all the requirements of the traffic.

Those who have never seen a railway on the 2ft. gauge may be prejudiced against it, and think that it is dangerous that it offers no comfort to the travelling public, etc., etc., but, you know that the security is as absolute as on standard gauge railways, carriages offering similar comfort are now being constructed, and there is no difficulty in transporting the most bulky goods. Visitors to the late Paris Exhibition may have witnessed the transport of a 48-ton cannon on the Decauville

line of 2ft. gauge, with steel rails weighing 19lbs. per yard. Special trucks are built for the carriage of live stock as well, and, in one word, there is no kind of traffic that cannot be worked on a 2ft. gauge as well as on any broader gauge railway.

The author has already stated the only rational way of reducing the cost of a railway is by reducing its guage, for the following reasons :—

If the 2 ft. guage be taken as an example, which is certainly the most economical; owing to its narrowness it can, when required, be laid on the public roads and no expenditure need be incurred in the resumption of land.

The proportion of ballast for the permanent way is reduced to about one-sixth of the quantity required in a standard gauge.

Tunnels, heavy cuttings, and earth works can, in most cases, be dispensed with, owing to the sharp curves of which such gauge is susceptible, and which permits of the railway being laid round the hills and valleys, or inexpensive side cuttings.

If wooden sleepers are required, it is evident that the cost will be lessened on account of their much smaller size.

The small diameter of the wheels do away with the necessity for platforms at stations.

The narrow gauge permits the use of a much lighter and less expensive rolling stock, more in proportion to the real requirements of the traffic.

Another and very great advantage is the facility it affords to private individuals to connect their factories, farms, saw mills, wood yards, etc., etc., with the railway, and, by means of a few portable sections, to enable them to load their goods on the railway trucks on the spot of production, and thus avoid transport to the railway stations, and expenses of unloading and loading.

Before concluding, the author must refer to the consequence of a break of gauge, in case of a narrow gauge railway serving as a feeder to a main line.

To the passenger traffic alone it it is a matter of secondary importance for the change of carriage can be effected without cost.

As far as the handling of goods is concerned it is a little different, it entails some expense, which, however, with proper installations can be reduced to a minimum, and these expenses will in all cases be nothing compared with the enormous losses which represent the interest on borrowed money which would be required for the construction and maintenance of standard gauge railways. The question therefore resolves itself into this: whether it is preferable to have a break of gauge with a railway that will answer all requirements, or have no railway at all, or a railway which compromises the finance of the State.

The author thinks it would be beneficial and perhaps advisable if the Engineering Association would carefully discuss, and, if possible, express an opinion on this most important question, and should they agree to the views that he has expressed, it would, he thinks, have an important bearing upon the future railway policy of the country.