

THE
INSTITUTION OF LOCOMOTIVE
ENGINEERS, LONDON.

President :
A. J. HILL, M.Inst.C.E.

Presidential Address.

QUESTIONS AFFECTING THE COST OF
REPAIRS AND RENEWALS OF
ROLLING STOCK.

TWENTY-THIRD PAPER
(OF TRANSACTIONS).

SESSION 1914.

*Read on Monday, January 12th, 1914,
at Caxton Hall, Westminster.*

LONDON :
Published by the Institution.
1914.
Price One Shilling Net.



ALFRED J. HILL, M.INST.C.E.,
PRESIDENT, 1914.

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PAPER No. 23.

Questions Affecting the Cost of Repairs and Renewals of Rolling Stock.

BY

A. J. HILL, M.Inst.C.E.

When I was approached by Mr. Suffield as to whether I would allow myself to be nominated as your President, one of the greatest difficulties which presented itself to me was the preparation of an address, owing to the limited time at my disposal for work of this nature. I have had the privilege of reading the admirable address given you last year by Mr. Fowler, and after doing so I decided that I also would to some extent take for my subject the question of Repairs and Renewals of Rolling Stock, dealing with the subject, however, more from a financial point of view than that taken by Mr. Fowler. In doing so, I would like to point out that all locomotive engineers have opportunities of influencing the working costs, and no detail is too small to be unworthy of consideration in this connection.

The works manager and shop foreman have not only to watch that the engines are built to drawings and that the necessary repairs are carried out satisfactorily and in such a way that no trouble is likely to ensue on the road or in the shed, but naturally to see also that the work is done as economically as is consistent with obtaining the above results. The draughtsman, in designing details, has not only to consider efficiency, but also simplicity of design, so that the first cost may be kept down and repairs effected without difficulty. In my experience this is a point sometimes lost sight of, due probably to a want of complete shop and shed training of the draughtsman, and sometimes to

insufficient communication between the various sections of the department.

The shed foreman and running department inspectors, etc., have not only to see that the engines are properly kept and manned, but also by careful diagramming to ensure that as many miles are got out of the engines as is possible, and that the engines are used on trains most suitable for them. As an illustration of what should not be done in this matter, I might mention a fact in my own experience. Soon after Mr. James Holden came to the Great Eastern Railway as Locomotive Superintendent he found it was the custom for the bulk of the shunting work to be done by tender engines which were not in good enough state of repair for train work and were almost due for shops. By putting suitable shunting tank engines to do the work it was done both more efficiently and much more economically.

Just a few words now on the unit which is used to compare working expenses ; of course I mean the "Train Mile." Without for a moment agreeing that it is necessarily fair to compare expenses in this way, I am not at all sure that if the "Ton Mile" were adopted it would be much better, and certainly as far as I can see, the expense of arriving at this figure at all accurately would not be justified. Just recently I have been asked to give some information as to the tractive power of the locomotives on the Great Eastern Railway, with the object of comparing the costs of English railways in units of tractive power of their engines. For two reasons at least I fail to see how any information of value could be obtained in this way. First of all, if I may use a somewhat different term, the "*Tractive Value*" of an engine depends to a very great extent upon the boiler capacity, which is entirely left out of the calculation ; and secondly, you must know not only what an engine is capable of doing, but also what work it is actually performing, before you can express any opinion as to the results obtained.

In the year 1895 I wrote a paper for the Institution of Civil Engineers on this subject, dealing particularly with the Expenses for Repairs and Renewals of Rolling Stock (Engines, Carriages and Wagons) for the five years ending June, 1892. I propose in my address to you this evening to quote some of these figures and to compare them with similar figures for the five years ending June, 1912. You will note that there is an interval of twenty years between the two periods I have mentioned, and I will endeavour to point out some conclusions I have arrived at in comparing these figures.

So that there shall be no misunderstanding, I think I ought to point out that the whole of the figures I have used with regard to the various railway companies, excluding the Great Eastern Railway, figures as to boiler mileage, etc., are based upon those shown in the half-yearly reports issued to the shareholders and, although they are drawn upon similar lines, from the year 1913 there are many modifications in connection with the figures which must be presented in the way prescribed in the Railway Accounts Act of 1911. It is thought that by this means the shareholders will be better able to compare the expenses of the various companies. Theoretically, of course, this is true; but I am afraid the conclusions which will be drawn may not always be correct, and the form of the accounts in the future will be much more complicated. However, this is perhaps a matter rather outside my subject.

In 1892 I dealt with almost the whole of the railways in the United Kingdom; but I am to-night going to refer only to the following English companies:—

Great Eastern, Great Northern, Great Western, Lancashire and Yorkshire, London and North Western, London and South Western, London, Brighton and South Coast, Midland, and North Eastern.

I have left out the South Eastern and Chatham because the amalgamation of the two companies has taken place since the year 1892, and the Great Central because in that year this company existed only as the Manchester, Sheffield and Lincolnshire Railway, the main line to London not having been made. In referring to these nine companies I do not propose to try to explain or discuss the differences between the expenses on the individual lines, as to do this would entail entering into so many questions with regard to the class of traffic dealt with, etc. I have, however, thought it desirable to take a group of companies rather than the Great Eastern only, in order to show more conclusively how the average expenses have varied in the two periods under review. I have prepared tables showing the cost to the above-mentioned companies, for the two periods under review, of (miles per engine, etc., not referred to; gross miles, 1892):—

1. Repairs and Renewals of Locomotives per Train Mile;
2. Locomotive Running Expenses per Train Mile;

3. Repairs and Renewals of Carriages per Passenger Train Mile ;
4. Ditto per Vehicle ;
5. Repairs and Renewals of Wagons per Goods Train Mile ;
6. Ditto per Vehicle ;

and I will now proceed to discuss them. In doing so, I shall group 1 and 2 together, 3 and 4 together, and 5 and 6 together.

1 & 2.—LOCOMOTIVE REPAIRS AND RENEWALS AND RUNNING EXPENSES.

It will be seen that in 1892 the figure for Repairs, etc., varied from a minimum of 2.04 pence on the L. and S.W. to 4.40 pence on the North Eastern, and the Running Expenses from 5.52 pence on the Great Western to 6.81 pence on the London, Brighton and South Coast, or putting the two items together, the Total Locomotive Expenses varied from 7.92 pence on the Great Northern to 11.02 pence on the North Eastern, the averages being 2.76 pence for Repairs, 6.21 pence for Running, and 8.97 pence for the Total Locomotive Expenses per Train Mile.

Now, if you will look at the 1912 figures you will find they vary in the case of Repairs, etc., from 2.62 pence on the L. and S.W. to 5.78 pence on the North Eastern, and the Running Expenses from 7.09 pence on the Great Eastern to 10.17 pence on the L. and N.W., or putting the two items together, from 10.72 pence on the Great Eastern to 15.30 pence on the North Eastern, the averages being 3.78 pence for Repairs, etc., 8.82 pence for Running Expenses, and 12.60 pence for Total Locomotive Expenses. In the twenty years referred to the average expenses of the nine companies mentioned have therefore increased as follows :—

Repairs and Renewals	37	per cent.
Running Expenses	42	„ „
Total Locomotive Expenses	40	„ „

Speaking in general terms, the three main causes, I think, may be stated to be higher speeds, greater loads and larger and more complicated engines. In connection with the first reason, of course, it is a well-known fact that great

advances have been made ; but in order to be definite as to what has been done on the Great Eastern Railway, for example, I have looked at the time tables and have taken out some trains. The fastest train between Liverpool Street and Cromer in 1892 was 3hr. 35min. ; in 1912 it was 2hr. 55min. From Liverpool Street to Norwich in 1892 the fastest run was 3hr. 15min. ; in 1912 it was 2hr. 27min. The fastest run from Liverpool Street to Yarmouth in 1892 was 3hr. 15min. ; in 1912 it was 2hr. 30min. Many other examples could be given, and no doubt on some of the lines the increase in speeds would be more marked than on the Great Eastern, which is handicapped in this matter with a rather tortuous and to some extent hilly road, with consequent speed restrictions. In 1892 the trains mentioned above were, as a rule, made up of from 12 to 15 six-wheeled carriages, the weight of which may be taken at 13 tons each ; the maximum weight behind the engine might, I think, be taken at 195 tons, excluding passengers and luggage. The 1912 trains, however, were made up of from 10 to 14 bogie vehicles weighing 26 tons each ; the weight of the train of 14 coaches would therefore be 364 tons, or an increase of 86.66 per cent. in the twenty years.

I have not attempted to analyse the increased speed of goods trains ; but when it is remembered that most of the important companies now run express goods trains equipped with continuous brake, it must be agreed that considerable progress has been made. The loads have also largely increased, but are limited in many cases on the Great Eastern, if not on other lines, by the capacity of the refuge sidings. The maximum Great Eastern goods train load in 1892 was 40 trucks, or at 12 tons per truck, say 480 tons ; in 1912 it had increased to 50 trucks, or 600 tons, an increase of 25 per cent. I have in this connection taken the average weight per wagon to be the same, but as a matter of fact it ought to be taken at a higher figure, due to rather larger wagons and also, I think, better loading.

Now let us consider what effect this increased load and speed has upon our expenses. As locomotive engineers we have first to consider safe working, and secondly economical working, and in order to secure the first, namely, safety, it has been necessary not only to build heavier and more powerful locomotives, but also in many cases to use more expensive material in their construction. In 1892 the engines used for the Great Eastern express passenger trains were chiefly of the 2-4-0 type, with boilers pressed at 140lb.

per square inch. These engines weighed 39 tons empty and had a tractive power of 10,627lb. In 1912, however, the type of engine was either the 4-4-0, weighing empty nearly 48 tons, with a tractive power of 16,525lb., or the 4-6-0 type, weighing about 57½ tons, with a tractive power of 21,194lb., in both cases the boilers being pressed at 180lb. The weights mentioned do not include the tenders, which, if added, would give 55 tons, 65 tons and 75 tons respectively. The all-round value of an engine such as any of the above might fairly be taken at £55 per ton, and you have therefore to provide to-day an engine costing in the one case £3,575, and in the other £4,130, as against £3,025 twenty years ago.

Now all of you who have had practical experience of locomotive maintenance will know that the increased boiler pressure alone would be sufficient to account for some increased expense, but as an illustration of this I would state that the average mileage from boilers has been steadily decreasing. During the five years ending June, 1892, on the Great Eastern Railway, 324 boilers were condemned, having an average life of 14 years 4 months and having run an average mileage of 386,461, whilst during the five years ending June, 1912, the number of boilers condemned was 523, the average life being 11 years 3 months, and the mileage 281,294. In the period mentioned, therefore, the average age had decreased 21 per cent. and the average mileage 27 per cent. Had it been possible to obtain as good a mileage life in the latter period as in the former, the number of boilers required for replacements would only have been 380 instead of 523.

So far I have referred to complete boilers only. On the Great Eastern it has been the practice for many years to do comparatively little in the way of firebox patching or repairs other than stays. It was found that very often repairing a firebox meant as heavy a cost from a wages point of view as putting in a new firebox, and certainly the result was not so good, whilst with regard to the material cost, the credit obtained from the sale of the old copper box goes a long way towards paying for the new one. This being so, the number of complete new fireboxes has been increasing in a similar manner to that of the boilers. It is very evident that these facts must have had a serious effect upon the cost of repairs, but in order to see what it really means in money I have had taken out the cost of new fireboxes and boilers complete in the years 1891-2 and 1911-12.

In the first case it averaged 0.19 pence per train mile, and in the latter 0.43 pence per train mile, or looking at these figures in regard to the total cost of repairs (viz., 2.45 pence in 1892 and 3.63 pence in 1912), we find that whereas in 1892 this item only accounted for about 8 per cent., in 1912 it had increased to over 12 per cent. This diminution in the life of the boiler is very natural when you consider the increase in boiler pressure, coupled with the additional work performed by the engines of to-day.

So far, I have demonstrated that the life of the boiler and firebox, as judged by miles run, has been a decreasing quantity; but I have also endeavoured to look at the matter in connection with the work done. As regards passenger engines, the records of the loads drawn are not definite enough to base any calculations upon, but what I have found is that the engines in use 20 years ago consumed, with boilers pressed at 140lb., about 34 lb. of coal per square foot of firebox heating surface per 100 miles run; whereas the engines of to-day, without superheater, consume 44lb. of coal per square foot of firebox heating surface per 100 miles run, or an increase of about 30 per cent. With the goods engines I have been able to get more definite information as to the actual load drawn as well as miles run, and I find that, comparing some results obtained in 1891 with 1913, the consumption of coal per 100 tons load per 100 miles run per square foot of firebox heating surface has increased from 9.7lb. to 11.4lb., or about 17 per cent. I have been able also to compare these results with similar engines fitted with Schmidt's superheater, and the increased consumption mentioned above has entirely disappeared, and instead we have a slight decrease. This should, in my opinion, affect the life of the firebox, but I hesitate to say anything very definite about the effect of superheating upon the general cost of repairs without considerably more experience than I have had so far.

I have dealt at some length with the question of boiler repairs for two reasons, first because the condition of the boiler is of the utmost importance, and secondly, because the expenses in connection with boiler renewals are, in the case of the Great Eastern, much easier to identify than in the case of other details; but I must point out that in the case of boiler work my remarks have by no means covered the whole ground; for instance, the cost of renewal of stays and tubes, if taken out in detail, would be found to be no small sum, and one which, with the present engines, must

have considerably increased as compared with twenty years ago.

I would now like to refer to the subject of Tyres. When looking into this matter in 1895 I found that the cost of engine and tender tyre renewals was about .052 pence per mile. This figure did not include wages, but material only, and at that time the bulk of the tyres had a tensile strength of only 40 tons per square inch, and cost on an average £10 per ton. To-day, in considering this question, we have to remember that the tyres used are of a much harder quality, up to, in some cases, 60 to 70 tons per square inch, and that the cost has increased roughly in the same proportion as the quality, and I find that the mileage life has increased to the extent of about 10 per cent. I should explain that I am not comparing two engines of the same class, but express engines in use twenty years ago with the heavier express engines of to-day, and I estimate that the cost of tyre renewals, taking all these circumstances into account, is about double what it was and may be taken at 0.10 pence per mile.

Before going on to speak of Running Expenses I would just mention that, in addition to the larger boiler and harder tyres, we have to keep in repair more expensive motion and cylinders, and, in fact, every detail of the engine has had to be strengthened up to meet the altered conditions. It must also be remembered that, although in the last twenty years or more there has been no radical change of design, we have seen many what I should call refinements added, most of which not only increase the first cost, but also the cost of upkeep. Take for example the sight feed or mechanical lubricators, or again steam, air or water sanding apparatus. Many engines are now fitted with power reversing gear, water pick up fittings and steam heating apparatus.

It is very generally accepted by locomotive engineers that, if an engine is suitable for the work it is required to do, its life can be prolonged almost indefinitely by renewing the various details as they wear out. An engine, therefore, is eventually condemned because it is unsuitable, or in other words, has, by the effluxion of time, become obsolete. The increased demands which have been made upon locomotive power in recent years have naturally had the effect of increasing the number of obsolete or inadequate engines, which is another factor in the increase in the cost of repairs or rather renewals.

In looking now at the question of Running Expenses we have the same set of circumstances to account for the increased cost, and it is, I should assume, the fact that on all our railways, even those engines which were in existence twenty years ago are doing harder work than they used to do and thus consuming more coal and water. The coal I have already referred to in connection with the life of the boiler and firebox, and I find, upon looking at the cost of fuel upon the Great Eastern for the six months ending June, 1912, compared with the same period in 1892, an increase of just over 30 per cent. Though the extended use of superheaters should materially reduce the coal and water bill, it must not be expected that the running costs will ever come down to those in vogue twenty years ago. And it should be remembered that the water used in a superheater engine is more in proportion to the coal than is the case in an engine using ordinary saturated steam, due in the main to the reduced heating surface incidental to the large smoke tubes. This appears to be one direction in which some further economy may be effected.

After Fuel, the biggest item in connection with Running Expenses is, of course, Wages, and I find that the cost per mile under this head has increased to the extent of about 17 per cent. This is due in part to a direct increase in the rate of wages paid and in part to the restrictions placed upon railway companies by the Board of Trade in connection with hours of duty of enginemen, and it must be borne in mind that these restrictions, necessitating as they do the double-manning of engines, have a further indirect effect upon the cost of both Repairs and Running, as from my experience I consider that enginemen are more careful with an engine upon which they are always working than when they are being shifted about from engine to engine.

3 & 4.—CARRIAGE REPAIRS AND RENEWALS.

I now come to the question of Carriage Repairs. I am not sure whether any members of this Institution are specially concerned in this branch of my subject, but as every locomotive engineer is liable to have both carriages and wagons under his charge, I have thought it best to devote a few remarks to them.

I have, as I mentioned before, taken out the cost of Repairs and Renewals both per passenger train mile and

per vehicle, with the result that the average cost per mile was 2.61 pence in the earlier period and had increased to 3.36 pence in the later, or 28 per cent. The increase per vehicle was from £37 12s. to £49 17s., or 32 per cent. It is, I think, not surprising that the increase is found to be in nearly the same proportion, as it is not so much the number of vehicles forming a train which has altered as the length and weight of the individual carriages. In 1892 the main line stock on the Great Eastern consisted generally of six-wheeled vehicles, and I will just make a comparison between one or two of these vehicles and modern bogie coaches, taking for examples a first class carriage, a third class carriage and a composite carriage.

FIRST CLASS CARRIAGE.

	1892.	1912.
Length	34ft. 6in. and 31ft. 6in.	50ft.
Weight empty ...	13 tons 15 cwt.	13 tons 27 tons 6 cwt.
No. of passengers	30	24
Weight per passr.	9.1 cwt.	10.8 cwt.
		15.1 cwt.

THIRD CLASS CARRIAGE.

	1892	1912.
Length	34ft. 6in.	50ft.
Weight empty ...	13 tons 3 cwt.	26 tons 10 cwt.
No. of passengers	60	56
Weight per passr.	4.4 cwt.	9.4 cwt.

COMPOSITE CARRIAGE.

	1892	1912.
Length	34ft. 6in.	50ft.
Weight empty ...	12 tons 16 cwt.	26 tons 7 cwt.
No. of passengers	10 first & 20 third	12 first & 32 third
Weight per passr.	8.5 cwt.	11.4 cwt.

You will note the increases are by no means small, but they are still more pronounced if we take special vehicles, such as Dining Cars, into consideration. In 1892 there was one Dining Car Train on the Great Eastern running from the North in connection with the Continental service; now we have one Breakfast Car Train, three Luncheon Car Trains, two Tea Car Trains, and seven Dining Car Trains leaving Liverpool Street daily, even in the winter train service and corresponding trains up, and in the summer there are several others. The expenses incidental to trains of

this sort, which of course must be corridored right through, are out of all comparison with the class of train in use twenty years ago. There is also the fact that on the suburban services 54ft. bogie vehicles are taking the place of 27ft. four-wheeled stock. It must also be remembered that the internal fittings are much more luxurious than they used to be, and the provision of lavatory accommodation on all trains travelling any considerable distance and steam heating is another additional expense, whilst the improved lighting of our trains must not be forgotten.

I think, without going into any detailed criticism of the expenses of the various companies, I ought just to say that it could not be expected that such companies as the Great Eastern, London and South Western, and London, Brighton and South Coast would require to spend anything like so much per vehicle as companies like the London and North Western, Great Northern, Great Western, and Midland, all of which have sleeping cars and a big proportion of main line stock, while the three first named have a lot of vehicles in their suburban services.

5 & 6.—WAGON REPAIRS AND RENEWALS.

The question of Wagon Repairs and Renewals is quite different to that of either Engines or Carriages, and it will be noticed that, while the cost per goods train mile has gone up about 53 per cent., the average cost per vehicle has remained almost stationary. There has been comparatively little development in the size and weight of the wagons used. Of course, the average tonnage is steadily on the increase, but owing to special circumstances connected with the trade of the country it has been found impracticable to introduce to any great extent the large wagons such, for instance, as those used in America. The question is further complicated when considering the train mile cost by the fact of the large number of private traders' wagons hauled by the various railway companies. I have already mentioned the point of goods trains being fitted with continuous brakes; this is an increasing quantity and no doubt helps considerably to account for the increase in the train mile cost, as the vehicles used for braked trains have to be specially equipped with brakes, screw couplings, etc. The figures I have given are based upon the capital stock of the various companies, as shown in their published accounts, but it must be remembered that, as a rule, there are other vehicles beyond

the capital number which have to be kept in repair, and accordingly the actual cost per vehicle would be less than that I have shown; the same remark of course applies to the carriages.

In an address of this nature it is impossible to enter more fully into detail, and I have endeavoured to touch upon the principal points connected with the cost of repairs and renewals of rolling stock; but I would just like to add a few words as to possible future developments.

In connection with locomotives the practical adoption of superheating is, although beyond the experimental stage, still comparatively in its infancy, and I have no doubt improvements in this direction and also in regard to feed water heating will effect economies both in repair and running costs.

I have taken no account in my address of improved machinery, and particularly the use of high speed steel, both of which have helped materially to keep down shop costs. This matter will no doubt continually be moving in the right direction; against it, however, we have to meet higher wages. As to whether the steam locomotive will ever be entirely superseded by electricity or by some form of internal combustion engine is beyond my powers to forecast. I do think, however, that there are possibilities of such being the case, and I would strongly urge upon all young locomotive engineers to keep well up-to-date in these branches of the profession.

With regard to carriage and wagon stock, the increased use of iron and steel, not only for underframes, but also for body work, is in my opinion the most likely development.

In conclusion, I would like to express a hope that your Institution, of which you have done me the honour to elect me President, may have a successful future in store and continue to be of use in many ways to its members.

LOCOMOTIVES—TABLE I.

AVERAGE TRAIN MILES PER ANNUM, FIVE YEARS ENDED JUNE 30TH, 1912, AND PARTICULARS OF AVERAGE ANNUAL EXPENSES CONNECTED WITH MAINTENANCE OF ENGINES FOR FIVE YEARS ENDED JUNE 30TH, 1912, AND FIVE YEARS ENDED JUNE 30TH, 1892

	Average for 5 years.	Great Eastern.	Great Northern.	Great Western.	Lancashire and Yorkshire.	London and North-Western.	London and South-Western.	London and Brighton.	Midland.	North-Eastern.
Percentage—Goods miles	1912 1892	37 38	44 49	38 50	29 40	37 48	22 27	16 17	54 59	40 57
Train miles per Engine	1912 1892	20,410 21,718	17,325 23,206	19,116 20,582	12,810 15,852	18,000 17,570	25,608 22,632	22,076 21,540	16,731 20,034	14,247 16,484
Cost of Eng. Maintenance per train mile	1912 1892	3.63d 2.45d	3.15d 2.20d	4.37d 2.88d	4.19d 3.38d	3.38d 2.59d	2.62d 2.04d	3.16d 2.30d	3.76d 2.63d	5.78d 4.40d
Running Expenses per train mile	1912 1892	7.09d 5.75d	8.85d 5.72d	7.81d 5.52d	9.64d 6.74d	10.17d 6.13d	8.76d 6.63d	8.74d 6.81d	8.86d 6.01d	9.54d 6.62d
Capital Stock of Engines	1912 1892	1,085 800	1,285 824	2,686 1,624	1,408 987	2,652 2,323	772 557	555 410	2,803 1,897	2,003 1,529

CARRIAGES—TABLE II.

AVERAGE TRAIN MILES PER ANNUM, FIVE YEARS ENDED JUNE 30TH, 1912, AND PARTICULARS OF AVERAGE ANNUAL EXPENSES CONNECTED WITH MAINTENANCE OF CARRIAGES FOR FIVE YEARS ENDED JUNE 30TH, 1912, AND FIVE YEARS ENDED JUNE 30TH, 1892.

	Average for 5 years.	Great Eastern.	Great Northern.	Great Western.	Lancashire and Yorkshire.	London and North-Western.	London and South-Western.	London, Brighton and South Coast.	Midland.	North-Eastern.
Percentage—Pass. miles	1912 1892	63 62	56 51	62 50	71 60	63 52	78 73	84 83	46 41	60 43
Passenger miles per Vehicle	1912 1892	2,631 3,096	3,895 3,850	4,088 3,334	2,743 3,406	3,639 3,648	3,655 2,976	3,321 2,606	3,955 3,816	3,663 3,586
Cost of Carr. Maintenance per pass. train mile	1912 1892	3.51d 2.15d	3.27d 2.58d	3.35d 2.72d	3.11d 3.20d	4.04d 3.47d	2.55d 2.10d	2.66d 1.67d	3.28d 2.56d	4.51d 3.03d
Cost of Carr. Maintenance per Vehicle	1912 1892	£38 9 0 £28 0 0	£53 3 0 £41 12 0	£57 2 0 £39 6 0	£35 12 0 £45 10 0	£61 6 0 £52 14 0	£38 18 0 £26 4 0	£36 17 0 £18 6 0	£54 6 0 £40 14 0	£68 18 0 £45 6 0
Stock of Carriages	1912 1892	5,304 3,431	3,232 2,514	7,735 5,046	4,686 2,713	8,220 5,754	4,218 3,064	3,112 2,817	5,479 4,024	4,652 3,041

WAGONS—TABLE III.

AVERAGE TRAIN MILES PER ANNUM, FIVE YEARS ENDED JUNE 30TH, 1912, AND PARTICULARS OF AVERAGE ANNUAL EXPENSES CONNECTED WITH MAINTENANCE OF WAGONS FOR FIVE YEARS ENDED JUNE 30TH, 1912, AND FIVE YEARS ENDED JUNE 30TH, 1892.

	Average for 5 years.	Great Eastern.	Great Northern.	Great Western.	Lancashire and Yorkshire.	London and North-Western.	London and South-Western.	London, Brighton and South Coast.	Midland.	North-Eastern.
Percentage—Goods miles	1912 1892	37 38	44 49	38 50	29 40	37 48	22 27	16 17	54 59	40 57
Goods miles per Vehicle	1912 1892	303 438	243 380	283 400	154 298	233 360	299 392	191 300	214 238	102 182
Cost of Wgn. Maintenance per goods train mile	1912 1892	3.45d 2.50d	3.35d 2.13d	4.56d 2.55d	5.32d 3.20d	4.41d 1.59d	3.53d 3.66d	6.00d 4.10d	3.55d 4.88d	14.63d 7.30d
Cost of Wgn. Maintenance per Vehicle	1912 1892	£4 7 0 £4 12 0	£3 8 0 £3 8 0	£5 8 0 £4 6 0	£3 8 0 £4 0 0	£4 6 0 £2 4 0	£4 8 0 £6 0 0	£4 15 0 £3 12 0	£3 3 0 £4 16 0	£6 4 0 £5 10 0
Stock of Wagons	1912 1892	26,993 15,311	39,764 24,375	69,605 42,184	33,553 20,993	76,398 55,126	14,536 8,934	10,074 7,133	117,610 95,214	113,145 79,366