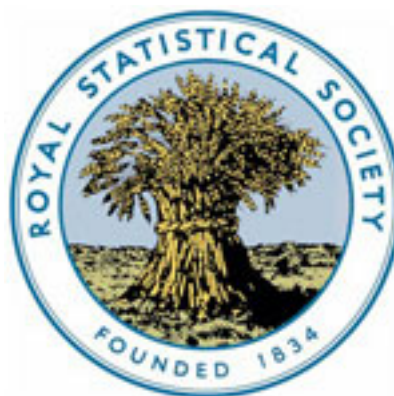


WILEY



English Express Trains in 1871; and a Comparison Between Them and Those of 1883

Author(s): H. B. Willock

Source: *Journal of the Statistical Society of London*, Vol. 47, No. 2 (Jun., 1884), pp. 259-311

Published by: [Wiley](#) for the [Royal Statistical Society](#)

Stable URL: <http://www.jstor.org/stable/2979189>

Accessed: 22/12/2014 22:02

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



Wiley and Royal Statistical Society are collaborating with JSTOR to digitize, preserve and extend access to *Journal of the Statistical Society of London*.

<http://www.jstor.org>

ENGLISH EXPRESS TRAINS *in* 1871; and a COMPARISON *between them*
and those of 1883.

By H. B. WILLOCK, ESQ., *Lieut. R.E.*

[Read before the Statistical Society, 22nd April, 1884. The PRESIDENT,
ROBERT GIFFEN, ESQ., LL.D., in the Chair.]

English Express Trains in 1871.

AT the conclusion of Mr. Foxwell's interesting and valuable paper on English Express Trains (*Journal of the Statistical Society*, September, 1883), he observes that the figures would be more interesting if we had a history of them for several decades past, so that we might see the record of growth.

The writer of this paper has therefore ventured to draw up statistics of the express trains in England for the year 1871, and to compare them in the most important points with the similar statistics for 1883, drawn up by Mr. Foxwell; as a slight instalment to the history of our railways.

The year 1871 has been chosen, because it was before third class passengers came generally into express trains (the Midland brought them in in April, 1872), and therefore affords a better comparison between the past and present state of affairs, than if 1873 had been chosen, by which time third class passengers were carried by the bulk of the express trains of most of the large companies.

The statistics have been worked out for the month of July, so that as fair a comparison as possible may be made; they have also been arranged, as far as practicable, in the same manner as those in the paper alluded to, so that the reader can readily make comparisons between particular points, which for the sake of brevity have not been done.

Mr. Foxwell's definitions of "journey-speed," and "running-average" have consequently been adopted; "journey-speed" being used to denote the average number of miles per hour, stoppages included, by which a train advances on its journey; whilst "running-average" is the average speed per hour while actually in motion, *i.e.*, the average speed excluding stoppages.

The statistics for 1883 drawn up by Mr. Foxwell are all derived from the working time tables of the various companies,

and hence to make an absolute and direct comparison between the two years, the figures given in this paper should have been derived from a similar source; but it appeared to be very difficult, if not impracticable to obtain the working time tables of all the companies for a time so long gone by as July, 1871, and therefore the principal source from which the materials for this paper have been derived is a Bradshaw of that time.

The distances have been taken as a rule from Mr. Foxwell's paper, altered where necessary, as in some cases the expresses do not run now over exactly the same ground as they did in 1871. The working time tables of subsequent years have often been drawn upon for information on various points, notably that of stoppages at ticket platforms (in some cases where particular trains have not been altered, a working time table of 1874-75 may really give all possible information about a train which ran in 1871), and in many cases the writer's own local knowledge proved to be useful.

The times of arrival and departure as given in Bradshaw have been taken as the correct ones, except in one or two instances, where there was reason to believe that they were not those really adhered to in working.

Thus it may be conceded that the distances and the total lengths of time in transit, and consequently the journey-speeds, are absolutely correct, and that the only source of error introduced by the writer's method of obtaining his figures is that the number of minutes stopped *en route* may occasionally be either slightly under or over estimated, and that thus the running-average may be in some cases only approximately correct.

Every possible care has however been taken to eliminate this source of error, and it is believed that the total amount of error is very small, and not sufficient to invalidate the general results, or to detract from their interest. In the worst cases the error introduced would not appear to affect the running-average more than 0.5 or 0.6 of 1 mile per hour; and where particular runs from one station to another are mentioned it is believed that this error is entirely absent.

It has been considered necessary thus to show how the figures for 1871 have been obtained, and to point out that they are only approximately and not absolutely correct: whilst those for 1883 may be taken as absolutely correct; so that there may be no danger of drawing unfounded inferences from the comparison of the two sets of results.

The writer however believes that for the purpose of practical comparison between the expresses of 1871 and those of 1883 this method of obtaining the figures is sufficiently accurate. This is

also the opinion of Mr. Foxwell, which he has been kind enough to allow the writer to quote here.

Definition of an Express.

Before considering in detail the express trains on the different railways, we must define what description of train can be considered as "express," or, in other words, "to what standard of journey-speed a train must attain" to be classified as express.

Mr. Foxwell's standard (which is made for him by the trains themselves) in 1883 is:—

Express in 1883	{	A train whose journey-speed	{	when gradients and stoppages
		j.s. = 40 miles per hour at least		are ordinary
		" = 39 " "		when stoppages are extra-ordinary
" = 36 " "	when gradients are extra-ordinary			

and hence it would appear desirable that we should maintain for the purpose of ready comparison, the same standard for 1871.

Now if this standard were taken for 1871, there would be only about 12 per cent. of the trains then called express represented. But Mr. Foxwell's standard includes "nearly the whole of the "distinctly fast trains of the present day;" and to include similarly most of the distinctly good trains of the year 1871, we must alter the standard to:—

Express in 1871	{	A train whose journey-speed	{	with ordinary gradients and
		j.s. = 36 miles per hour at least		stoppages
		" = 32 " "		with extraordinary gradients

Even with this low standard (viz., 36 miles per hour) certain trains which were considered expresses have to be omitted; thus the up day East Coast Scotch express had a journey-speed of only 34.2 miles per hour from Berwick to York. At the same time it appears that a standard of 36 miles per hour includes *nearly all the good trains which the companies themselves designated as express*; and this is undoubtedly the proper test of what should be called an express.

In order to avoid altogether excluding such trains as the East Coast one referred to, in some cases the time from one large town to another has been considered as a complete journey, e.g., Newcastle to York; as a train might be express from Berwick to Newcastle, and from Newcastle to York, but a long stoppage of 12 to 15 minutes at Newcastle prevents its being express from Berwick to York. This course has however only been adopted in a few cases (6 on the North Eastern and 3 on the Great Western); and then only from one large town to another, and not from one junction to another.

Now it must be borne in mind that the mere increase, shown by the following tables, in the number and average speed of expresses since 1871 does not give anything like an adequate idea of the *whole improvement* which has taken place in the twelve years :—

(a.) For the weight of the average express has increased very greatly; sometimes quite doubled; on an average perhaps two-thirds as heavy again.

(b.) Also the number of goods and mineral trains, through which these expresses have to make their way, has increased quite as much; in short, as Mr. Foxwell says, “each mile of speed above 40 miles an hour represents now twice as good a performance as “then.”

As to what caused the great increase in length and weight of trains it is evident the order was :—

- (1.) The Midland obtained access to London by its own line.
- (2.) The Midland in 1872 admitted third class passengers into express trains.
- (3.) Other companies soon did the same.
- (4.) Hence much longer trains; and also as competition increased more commodious and consequently heavier carriages were introduced.
- (5.) Then heavier and more powerful engines had to be constructed to draw these trains, and were made directly.
- (6.) This spur to locomotive improvement made still higher speeds (even with the increased weight of trains) possible, and competition eagerly seized this possibility.

The total number of distinct trains in 1871 examined and classified in this paper is 250: of which the speed is given in the following table :—

TABLE I.

Journey-Speed in Miles per Hour.	Number.	Per Cent.
Under 36	25	10'0
Between 36 and 37	74	29'6
„ 37 „ 38	58	23'2
„ 38 „ 39	36	14'4
„ 39 „ 40	28	11'2
„ 40 „ 41	13	5'2
„ 41 „ 42	4	1'6
„ 42 „ 43	6	2'4
„ 43 „ 44	1	0'4
„ 44 „ 45	3	1'2
„ 45 „ 46	2	0'8
Total	250	100'0

These trains are distributed between the various companies as shown below :—

TABLE II.

Name of Railway	Speed.										Total.	
	Under 36.	36 to 37.	37 to 38.	38 to 39.	39 to 40.	40 to 41.	41 to 42.	42 to 43.	43 to 44.	44 to 45.	45 to 46.	Number on each Line.
London and S. Western	—	2	3	—	—	2	—	—	—	—	—	7
Brighton and S. Coast.....	—	—	4	1	2	4	—	1	—	—	—	12
South Eastern	—	1	4	6	—	—	—	3	1	—	—	15
Chatham and Dover	—	2	—	—	3	—	—	—	—	1	—	6
Great Eastern	—	2	—	—	—	—	1	—	—	—	—	3
" Western.....	—	18	3	1	2	—	—	—	—	2	2	28
" Northern	—	3	6	8	8	2	3	1	—	—	—	31
Midland	—	7	11	5	6	2	—	1	—	—	—	32
North Western	—	17	18	5	3	2	—	—	—	—	—	45
Manchester, Sheffield, and Lincolnshire }	7	4	—	—	—	—	—	—	—	—	—	11
North Eastern	—	8	7	7	4	1	—	—	—	—	—	27
Glasgow and S. Western	4	—	—	—	—	—	—	—	—	—	—	4
North British	4	10	—	—	—	—	—	—	—	—	—	14
Caledonian	10	—	2	3	—	—	—	—	—	—	—	15
Totals	25	74	58	36	28	13	4	6	1	3	2	250

From this table it will be seen that if the 39—40 mile per hour standard had been maintained, such a line as the London and North Western would only be credited with five express trains.

Having now defined what an express train was in 1871, viz., one whose journey-speed was at least 36 miles per hour, unless it had exceptional difficulties to contend against, we will examine each railway in turn, and give :—

1. The number of distinct express trains ran by it, and the average of their—

- (a.) Times on journey.
- (b.) Journey-speed (j.s.).
- (c.) Number of minutes stopped on road.
- (d.) Running-average (r.a.).

2. The total express mileage.

3. The resulting express service between London and the chief towns on the line, and the average times and speeds of those journeys.

4. Long runs of at least 40 miles, stating the longest and quickest.

5. And where necessary the particulars of the best express.

And all of these will be compared with what was the case in 1883, and the improvements noted.

Afterwards a summary of results will be given, and also compared with the similar results of 1883.

And it should be remembered that in making these comparisons we are, as a general rule, comparing trains in 1871 with journey-speeds as low as 36 miles an hour, with trains in 1883, 85 per cent. of which have journey-speeds of at least 40 miles per hour.

The companies which ran expresses have already been enumerated; and we will now commence in the South of England and work northwards, where, in the Lancashire and Yorkshire district, we shall find the greatest improvements have been effected.

LONDON AND SOUTH WESTERN.

Distinct Expresses.

Miles.	Between	Number.	Average Time.	Journey-Speed.	Average Minutes Stopped.	Running-Average.	Total Mileage.
			H. M.				
171½	Waterlow and Exeter	2	4 16	40½	14	42½	—
83½	„ Salisbury	2	2 19	36	8	38½	—
47½	„ Basingstoke	3 (1 up)	1 18	36 ⁷ / ₁₀	1	37 ² / ₁₀	—
1871	Total	7	averaging	38 ³ / ₁₀	—	40	653
'83	„	3	„	41½	—	44½	*890

* Includes long runs of fast trains.

These seven trains were the only expresses on the line in 1871.

Express Service to Chief Towns.

Miles.	Between	Number.		Average					
				Time.		Journey-Speed.		Running-Average.	
		1871.	1883.	1871.	1883.	1871.	1883.	1871.	1883.
171½	London and Exeter	2	3	H. M.	H. M.	40½	41 ¹ / ₁₀	42½	44½
83½	„ Salisbury	4	4	4 16	4 10	39 ⁶ / ₁₀	40 ² / ₁₀	40 ⁷ / ₁₀	43
47½	„ Basingstoke....	7(3 up)	13	2 9	2 3	38 ² / ₁₀	41 ² / ₁₀	39 ² / ₁₀	43
The quickest trains to certain towns are—									
73½	London and Portsmouth....	up	up	2 5	1 55	35½	38½	—	—
79	„ Southampton	down	down	2 21	2 4	33 ⁶ / ₁₀	38½	—	—
115½	„ Bournemouth	„	„	3 50	3 9	30 ¹ / ₁₀	36½	—	—
145½	„ Weymouth	„	„	4 45	4 -	30½	36½	—	—

Long Runs.

- 2 Exeter and Yeovil.
- 4 Waterloo and Basingstoke.
- 3 Basingstoke and Vauxhall.
- 2 Salisbury and Yeovil (only 39½ miles).

Total 1871. 11 averaging 46 miles at 40 r.a.
 „ '83. 13 „ 47½ „ 44½ „

Longest.

1871. Yeovil to Exeter 48½ miles in 68 minutes = 42 ⁸/₁₀ r.a.
 '83. „ „ 48½ „ 63 „ = 46 ³/₅ „

Quickest in

1871. Basingstoke to Vauxhall 46½ miles in 64 minutes = 43½ r.a.
 '83. Already given.

Best Express.

1871. 2:10 London to Exeter in ^{H. M.} 4 15, j.s. = 40½, r.a. = 42½.
 '83. 2:30 „ „ 4 3, „ = 42½, „ = 45.

It will be seen that the improvement on this line is not great. The number of expresses in 1871 is actually greater than now, but three of them are only portions of Southampton trains. The Exeter expresses have been quickened; Bournemouth and Weymouth are much better off now than in 1871, although they are still without an express; but Southampton and Portsmouth are still very poorly served.

The long runs are about the same length, but the increase in their number is very slight; the increase in their speed is considerable.

LONDON, BRIGHTON, AND SOUTH COAST.

Distinct Expresses.

Miles.	Between	Number.	Average				Total Mileage.
			Time.	Journey-Speed.	Minutes Stopped.	Running-Average	
50½	Lond. Bridge and Brighton	6 (2 up)	H. M. 1 16	39 ⁵ / ₁₀	3	41½	—
85½	{ London Bridge and Portsmouth	2	2 12	38 ⁸ / ₁₀	10	42½	—
50	London Bridge and Lewes	2	1 20	37½	5	40	—
56	{ Three Bridges and Portsmouth	2 (down)	1 27	38 ⁹ / ₁₀	6	41½	—
1871	Total	12	averaging	38 ⁸ / ₁₀	—	41½	686
'83	„	13	„	41	—	41½	1,155*

* Includes long runs of fast trains.

Express Service to Chief Towns.

Miles.	Between London and	Number.		Average					
				Time.		Journey-Speed.		Running-Average.	
		1871.	1883.	1871.	1883.	1871.	1883.	1871.	1883.
50½	Brighton	6	8	H. M. 1 16	H. M. 1 13	39 $\frac{8}{10}$	41 $\frac{7}{10}$	41½	42
50	Lewes.....	2	4	1 20	1 15	37½	40	40	40½
65½	Eastbourne	none	3	1 55	1 38	34 $\frac{10}{10}$	40	—	41
85½	Portsmouth	4(1 up)	none	2 20	—	36 $\frac{0}{10}$	—	39 $\frac{4}{10}$	—

Long Runs—

- 5 Croydon and Brighton.
2 Three Bridges and Chichester.

1871. Total... 7 averaging 40 miles at 42 $\frac{5}{10}$ r.a.

'83. " ... 23 " 45½ " 42 " } or at 43½ r.a. beyond
Croydon, which makes
a fairer comparison

Quickest—

1871. Croydon to Brighton..... 40½ miles, in 54 minutes = 44 $\frac{4}{10}$ r.a.

'83. London Bge. to Brighton, 50½ " 65 " = 46 $\frac{2}{10}$ "

Here we see a very small increase in the number of distinct expresses, but there is a considerable increase in the journey-speeds; the running-average shows scarcely any increase.

The reason for this is that formerly all the expresses stopped at Croydon, for the Victoria portion to be attached or detached, and some at Redhill or Three Bridges in addition; whereas now none stop at either of the two latter places, and a good many do not stop at Croydon: the City and the West End being served by separate trains.

The actual service of express trains to Brighton does not show a very great improvement; but the total service, taking express and fast trains, has increased from ten trains to sixteen trains. The quickest train to Brighton in 1871 took 1 hour 15 minutes, stopping at Croydon; the quickest now takes 1 hour 5 minutes, without any stop. The decrease of 10 minutes, raising as it does the journey-speed from 40 $\frac{8}{10}$ to 46 $\frac{2}{10}$, is as much as can be expected.

The service to Eastbourne and Lewes was very small, and has been greatly improved, as now there are numerous fast trains besides the expresses enumerated above.

The Portsmouth service in 1871 was express, which it is not now. The quickest train then took 2 hours 10 minutes, whereas the quickest now takes 2 hours 21 minutes.

The number of long runs shows a surprising increase, and the speed a slight one.

The service generally on this line shows a considerable improvement, both in number of trains and punctuality, and also in the quality of the rolling stock.

SOUTH EASTERN.

Distinct Expresses.

Miles.	Between	Number.	Average				Total Mileage.
			Time.	Journey- Speed.	Minutes Stopped.	Running- Average	
74½	Cannon St. and Dover	4	H. M. 1 45	42½	—	42½	—
68¼	„ Canterbury...	6	1 46	38½	4	40½	—
59½	„ St. Leonards.	1 (down)	1 37	36⅞	6	39⅞	—
33	„ Tunbridge } Wells	2	— 52	38	2	39½	—
54	„ Ashford	2	1 28	37⅞	3	38⅞	—
1871	Total	15	averaging	39⅞	—	40½	941
'83	„	12	„	41½	—	41¼	940

The express service to the chief towns in 1871 is fairly represented above.

Long Runs—

4 Cannon St. and Dover.

6 New Cross and Canterbury.

1872. Total... 10 averaging 68 miles at 40⅞ r.a.

'83. „ ... 12 „ 66¼ „ 42½ „

The longest and quickest in 1871 was from Cannon Street to Dover in 1 hour 39 minutes = 45 r.a., exactly the same as now.

The improvement on this line is greater than the above figures would seem to show; the express mileage remains the same, but the service to the continent has been greatly improved.

The six trains to Canterbury are the summer seaside trains to Ramsgate; similar ones run now at about the same speed, but of course are no longer expresses; if we deduct their mileage, viz., 409, from the 1871 figure, we should find that the express mileage has increased 408 miles, which is very considerable.

The four continental mails ran in 1871 exactly in the same time as they do now, and are certainly very fine trains; in 1871 only five trains (three of these broad gauge) in all England were faster, and only three others of about the same speed.

Two extra continental trains now run *viâ* Dover, and also the two tidals trains *viâ* Folkestone. In 1871 the special tidal trains only ran on certain days, the passengers being conveyed by the ordinary trains when their times suited. The improvement of

this tidal train service between London and Paris is undoubtedly very great, amounting to $1\frac{1}{2}$ hours decrease of time at least.

The time to St. Leonards shows a decrease of 5 minutes, and an increase in journey-speed of about 2 miles per hour, on a very hilly road. The quickest time to Ramsgate is 22 minutes less than formerly.

It should be observed that on short lines like this and the other Southern Railways there is not much occasion to increase the speeds to a high figure as on the longer lines. If the speed of the continental trains were increased 5 miles per hour, to $47\frac{2}{3}$ miles per hour, which is a very high speed, there would only be a saving of 10 minutes in the time to Dover; whilst on a long journey of 400 miles, *e.g.*, to Edinburgh, an increase of speed from 40 to only 43 miles per hour decreases the time on journey 42 minutes, which is really worth saving.

LONDON, CHATHAM, AND DOVER.

Distinct Expresses.

Miles.	Between	Number.	Average				Total Mileage.
			Time.	Journey-Speed.	Minutes Stopped.	Running-Average.	
78	Victoria and Dover	6	H. M. 2 -	39	8	$41\frac{3}{4}$	468
1871	Total	6	averaging	39	—	$41\frac{3}{4}$	468
'83	„	9	„	42	—	$43\frac{1}{8}$	690

Express Service to Chief Towns.

Miles.	Between London and	Number.		Average					
				Time.		Journey-Speed.		Running-Average.	
		1871.	1883.	1871.	1883.	1871.	1883.	1871.	1883.
79	Ramsgate.....	1 up	2	H. M. 2 12	2 -	36	$39\frac{1}{2}$	$39\frac{1}{2}$	$42\frac{1}{2}$
78	Dover	6	7	2 -	1 52	39	$41\frac{1}{2}$	$41\frac{1}{2}$	43
$61\frac{1}{2}$	Canterbury	4	4	1 36	1 28	$38\frac{6}{10}$	42	$41\frac{1}{8}$	$43\frac{1}{2}$
34	Chatham	5 (2 up)	3	- 52	- 51	$39\frac{1}{2}$	40	40	$41\frac{1}{2}$

Long Runs.

- 1 Herne Hill to Dover.
- 1 „ Faversham.
- 1 „ Sittingbourne.

1871. Total.... 3 averaging 54 miles at $42\frac{6}{10}$ r.a.
 '83. „ 8 „ 63 „ 45 „

*Longest and Quickest.*1871. Herne Hill to Dover in 1 hour 36 minutes = $46\frac{1}{4}$ r.a.

83. Quickest, the same.

Longest, Victoria to Dover at $44\frac{3}{8}$ r.a.

The six expresses given above in 1871 comprised the four continental mails and the morning up from, and afternoon down to Dover. These two Dover trains are slightly slower now than they were in 1871. The four continental mails run now almost exactly as in 1871. Two other continental trains, one up and one down, have been added about two years ago.

The company has also started a fast train each way to Ramsgate (the Granville express).

This line, like the South Eastern, ran in 1871 fast seaside trains to Margate and Ramsgate, but they were not express for any part of their journey.

The best train on the line was the 7.40 a.m. to Dover, which runs now exactly as it did then. In 1871 it was the quickest train in England except the two Flying Dutchman trains (broad gauge) on the Great Western; these also have not been altered in the twelve years. Two other trains on the Great Western, one broad gauge and one narrow, were almost as quick as the Chatham one.

Generally on this line there has been an increase in the number of fast trains, but no increase in their speed. In the table of distinct expresses the journey-speed is lower in 1871 than in 1883, because the two Dover trains are included in the former year; whereas for 1883 only continental trains are shown, the Dover trains having ceased to be express; excluding these the journey-speeds would be about the same in both years.

GREAT WESTERN.

Distinct Expresses.

Miles.	Between	Number.	Average				Total Mile-age.
			Time.	Journey-Speed.	Minutes Stopped.	Running-Average.	
194	Paddington and Exeter	2	H. M. 4 15	$45\frac{3}{4}$	23	$50\frac{1}{8}$	—
118½	„ Bristol	7 (4 up)	3 15	$36\frac{1}{2}$	23	$41\frac{3}{10}$	—
77	„ Swindon ...	1 up	1 45	44	5	$46\frac{1}{8}$	—
75½	Exeter and Bristol	2	2 5	36	10	$39\frac{1}{10}$	—
171	Paddington and Shrewsbury .	3 (1 up)	4 40	$36\frac{6}{10}$	28	$40\frac{6}{10}$	—
129½	„ Birmingham	5 (3 „)	3 24	38	14	$40\frac{8}{10}$	—
63	„ Oxford	1 down	1 45	36	5	$37\frac{5}{8}$	—
36	„ Reading ...	6 (4 up)	— 58	$37\frac{1}{2}$	2	$38\frac{5}{10}$	—
44½	Gloucester and Newport	1 down	1 10	$38\frac{1}{2}$	2	$39\frac{8}{10}$	—
1871	Total	28	averaging	38	—	$41\frac{4}{8}$	2,928
'83	„	18	„	42	—	$46\frac{1}{4}$	2,600

Express Service to Chief Towns.

Miles.	Between London and	Number.		Average					
				Time.		Journey-Speed.		Running-Average.	
		1871.	1883.	1871.	1883.	1871.	1883.	1871.	1883.
246½	Plymouth	2	4	H. M. 6 12	H. M. 6 7	39 $\frac{7}{10}$	40½	44½	45½
228	Birkenhead ..	none	2	Quickest 7 —	5 16	32½	43½	—	46
220	Torquay	2	4	5 32	5 21	40	41	46 $\frac{3}{10}$	47
213	Chester	none	2	Quickest 6 10	4 57	34½	43	—	46½
194	Exeter	2	4	4 15	4 15	45 $\frac{3}{4}$	45 $\frac{3}{4}$	50½	50½
171	Shrewsbury..	3 (1 up)	2	4 40	3 53	36 $\frac{6}{10}$	44	40 $\frac{6}{10}$	46½
170½	Cardiff	none	1	Quickest 4 58	4 21	34 $\frac{2}{3}$	39½	—	43½
129½	Birmingham	8	4	3 19	2 56	38 $\frac{2}{10}$	44	41 $\frac{7}{10}$	46
120	Worcester	2	1	3 20	2 58	36	40½	40	45
118½	Bristol	9 (5 up)	10	3 6	2 49	38 $\frac{2}{10}$	42	43	46½
114	Gloucester....	2	1	3 5	2 53	37	39½	41½	43
106½	Bath	9 (5 up)	10	2 45	2 30	38 $\frac{9}{11}$	42½	42 $\frac{7}{10}$	46 $\frac{3}{4}$
77	Swindon.....	8 (5 ,,)	13	1 47	1 41	43 $\frac{3}{8}$	46	45 $\frac{3}{10}$	47½
63	Oxford	9 (4 ,,)	5	1 36	1 28	39½	43½	42	44½
122½	Cheltenham .	none		Quickest 3 30	3 15	35	37 $\frac{3}{8}$	—	—
168	Weymouth...	„		5 15	4 20	32	38 $\frac{3}{4}$	—	—
216	Swansea.....	„		6 35	6 —	32 $\frac{1}{2}$	36	—	—
285½	Milford	„		8 40	8 —	32 $\frac{6}{10}$	35 $\frac{6}{8}$	—	—

Long Runs.

- 2 Paddington and Swindon.
- 2 Bristol and Taunton.
- 1 Reading and Swindon.
- 1 Didcot and Paddington.
- 4 Oxford and Leamington.
- 1 „ Paddington.

1871. Total.... 11 averaging 52 miles at 47½ r.a.

'83. „ 24 „ 56 „ 48½ „

Longest and Quickest, 1871 and 1883.

Paddington and Swindon, 77 miles, in 1 hour 27 minutes = 53½ r.a.

The best train in 1871 was the 11.45 Paddington to Exeter, the Flying Dutchman, j.s. = 45 $\frac{3}{4}$, r.a. = 50½. This train runs in exactly the same time now, and is also the best train at the present time.

The best train on the northern section was the 7.30 a.m. Birmingham to Paddington; time 2 hours 55 minutes, j.s. = $44\frac{2}{10}$, r.a. = $45\frac{9}{10}$. This train also runs in exactly the same time now.

These results appear at first sight to indicate that very little progress has been made on the line: the express mileage being actually 328 miles less in 1883 than in 1871; but in reality a good deal of improvement has been made. On studying the tables of distinct expresses and of express service, it will be seen that the running-average has increased about $4\frac{1}{2}$ miles per hour, to $46\frac{1}{2}$, a very substantial increase.

The express train service to Plymouth, Torquay, and Exeter has been doubled, although the time has remained about the same; but an increase of speed could hardly be expected, as it was then so very high.

Chester and Birkenhead possess an express service which they did not in 1871; to the latter place the decrease in time, 1 hour 44 minutes, is very great, the journey-speed having risen more than 10 miles per hour. To Bristol, the number of trains has only increased by one, but there is a very substantial increase in speed.

The express service to Oxford, Birmingham, and Shrewsbury shows a decrease in number of trains. This does not mean that trains have been taken off, but that the trains which were express in 1871, and enumerated above, are still running at about the same rate now as they did then, and cannot now be classified as express. Similarly, the six expresses between Paddington and Reading are all running now, but have ceased to be express.

The Great Western appears to be conservative, and not to like time table alterations unless absolutely driven to them. Still there has been good progress made on most parts of the line, except on the South Wales section: Cheltenham, Swansea, and Milford being still poorly served. There is a monopoly at each of these places.

The number of long runs has been doubled, and their average length slightly increased; the increase in their speed is not great, but then it was exceptionally high in 1871.

The Great Western run very good trains to places where there is competition, and it was the first company to attempt really high speed.

Great praise is due to it for the improvement in rolling stock, which is now as good as any in the kingdom.

GREAT EASTERN.

Distinct Expresses.

Miles.	Between	Number.	Average				Total Mileage.
			Time.	Journey-Speed.	Minutes Stopped.	Running-Average.	
51½	{ Bishopsgate and Colchester	1 down	H. M. 1 15	41	—	41	—
55	{ Bishopsgate and Cambridge	2	1 30	36½	3	37 ⁹ / ₁₀	—
1871	Total	3	averaging	37 ⁹ / ₁₀	—	38 ⁸ / ₁₀	161
'83	"	34	"	41	—	43½	3,040

Service to Chief Towns.

Miles.	Between London and	Number.		Average Time.		Journey-Speed.	
		1871.	1883.	1871.	1883.	1871.	1883.
123½	Norwich <i>via</i> Ely	None	1	H. M. Quickest 3 53	3 10	31 ⁸ / ₁₀	39½
113½	" Ipswich	"	None	3 35	3 4	31½	37½
121	Yarmouth	"	"	3 45	3 21	32 ³ / ₁₀	36½
68½	Ipswich	1	3	1 52	1 43	36½	40
51½	Colchester	1	13	1 15	1 13	41	42½
55	Cambridge	2	17	1 30	1 20	36½	41½

The line to Lincoln and Doncaster was not opened in 1871.

Long Runs.

1871. 1 of 51½ miles at 41 r.a.
'83. 24 averaging 56½ " 42½ "

This line has, as will be seen from the above figures, undergone a most wonderful change. It has built a splendid station in London, vastly improved its road and rolling stock, and has inaugurated a good service of express trains.

In 1871 it was in a most deplorable condition; the train service to the principal towns was wretched. The trains shown above to Norwich and Yarmouth were by far the quickest to those places; for example, the next quickest train to Yarmouth to that shown above took 4 hours 35 minutes, with a journey-speed of under 27 miles an hour.

Now this has all been changed, and Ipswich, Colchester, and Cambridge have all very good express services. The amount of its express mileage now (3,040 miles) is very great; and from being by far the worst express line it now takes a very high place indeed.

We now come to the great trunk lines to the North of England and Scotland, and we shall see that they have all made great progress in the past twelve years.

The Great Northern was then, as now, the first as regards speed; and the London and North Western first, in both years, as regards mileage.

A great improvement, especially to Scotland, took place in 1872 and 1873 on these lines, and improvements have since been made in the service to the chief towns almost every few months.

GREAT NORTHERN.

Distinct Expresses.

Miles.	Between	Number.	Average				Total Mileage.
			Time.	Journey-Speed.	Minutes Stopped.	Running-Average.	
			H. M.				
188	King's Cross and York	9(4 up)	4 49	39	19	41 $\frac{8}{10}$	—
185 $\frac{1}{2}$	„ Leeds ..	6(5,,)	4 43	39 $\frac{8}{10}$	20	43 $\frac{3}{10}$	—
138 $\frac{1}{2}$	„ Retford	3(1,,)	3 34	38 $\frac{7}{10}$	13	41 $\frac{1}{8}$	—
26	Hitchin and Cambridge	3(1,,)	— 40	39	2	41	—
22 $\frac{1}{2}$	Nottingham & Grantham	10(3,,)	— 35	38 $\frac{1}{10}$	2	40 $\frac{1}{2}$	—
1871	Total	31	averaging	38 $\frac{9}{10}$	—	42	3,520
'83	„	67	„	43	—	46 $\frac{3}{4}$	6,780

Service to Chief Towns.

Miles.	Between London and	Number.		Average					
				Time.		Journey-Speed.		Running-Average.	
		1871.	1883.	1871.	1883.	1871.	1883.	1871.	1883.
				H. M.	H. M.				
203	Manchester	7 (4 up)	14	5 10	4 51	39 $\frac{3}{10}$	41 $\frac{5}{10}$	43	45
199	Stockport.....	7	7	5 17	5 3	37 $\frac{9}{10}$	39 $\frac{1}{2}$	42	44
197	Hull.....	5 (3 up)	3	5 14	4 56	37 $\frac{9}{10}$	40	41 $\frac{7}{10}$	44 $\frac{3}{4}$
193	Bradford.....	9 (5 ")	9	5 3	4 35	38 $\frac{2}{10}$	42	42 $\frac{7}{10}$	46 $\frac{3}{4}$
188	York.....	11 (5 ")	19	4 53	4 20	38 $\frac{1}{10}$	43 $\frac{2}{5}$	41 $\frac{1}{2}$	46 $\frac{2}{5}$
185 $\frac{1}{2}$	Leeds.....	10	13	4 44	4 21	39 $\frac{2}{10}$	42 $\frac{2}{5}$	42 $\frac{2}{10}$	46 $\frac{1}{4}$
162	Sheffield.....	10	17	4 -	3 40	40 $\frac{1}{2}$	44 $\frac{1}{2}$	43 $\frac{1}{2}$	47
156	Doncaster.....	15 (9 up)	21	3 53	3 35	40 $\frac{1}{5}$	43 $\frac{1}{2}$	43 $\frac{1}{2}$	46 $\frac{2}{5}$
130 $\frac{1}{2}$	Lincoln.....	3 (1 ")	6	3 28	3 11	37 $\frac{1}{2}$	41	42 $\frac{1}{2}$	46 $\frac{1}{4}$
127 $\frac{3}{4}$	Nottingham.....	12 (4 ")	19	3 16	3 -	39	42 $\frac{1}{2}$	42 $\frac{2}{10}$	46 $\frac{1}{2}$
105 $\frac{1}{2}$	Grantham.....	19 (11 up)	36	2 33	2 17	41 $\frac{3}{10}$	46	43 $\frac{3}{10}$	47 $\frac{3}{4}$
76 $\frac{1}{4}$	Peterborough..	20 (11 ")	29	1 47	1 37	42 $\frac{1}{10}$	47	43 $\frac{1}{2}$	48 $\frac{1}{10}$
58	Cambridge....	4 (1 ")	7	1 31	1 21	38 $\frac{2}{10}$	42 $\frac{2}{5}$	42	45

Long Runs.

7	King's Cross and Peterborough.
1	" " Huntingdon.
1	Retford and York.
6	Peterborough and Holloway.
4	" " Hitchin.

1871. Total.... 19 averaging 66 $\frac{2}{3}$ miles at 44 $\frac{1}{2}$ r.a.

'83. " 49 " 73 $\frac{3}{4}$ " 50 "

Longest and Quickest, 1871. King's Cross and Peterborough, 76 $\frac{1}{4}$ miles in 1 hour 37 minutes = 47 r.a.

Longest, 1883. King's Cross and Grantham, 105 $\frac{1}{4}$ miles, in 2 hours 4 minutes = 51 r.a.

Quickest, 1883. Grantham and Doncaster in 58 minutes = 52 $\frac{1}{4}$ r.a.

It will be seen from the above figures that in 1871 the Great Northern had a very good train service. All the trains to Manchester, Sheffield, and Leeds, and most of those to York and Nottingham, would even now be considered express; so that the great improvements which have been made on the line are all the more creditable to it.

The express mileage has increased 92 per cent., the average journey-speed 4 $\frac{1}{10}$ miles per hour, and the running-average 4 $\frac{3}{4}$ miles per hour. The long runs have increased in number by 30, or 158 per cent., and in speed by 5 $\frac{1}{2}$ miles per hour. It will also be noticed that their average length has increased. Now a good many trains do not stop at Peterborough, Retford, and Doncaster, whilst in 1871 all stopped at Peterborough and Retford, and only one did not stop at Doncaster.

In the service to chief towns we see an enormous increase in the number of expresses to Manchester, to which place the

competition is very keen. The increase in speed is not so marked, as the Manchester, Sheffield, and Lincoln line is so very steep, and the running on it in 1871 so good, that any improvement, without decreasing the number of stoppages, was difficult. The increase in average journey-speed is principally caused by the new $4\frac{1}{2}$ hours special expresses, which make only two stops. We shall refer to the Manchester service further on.

The York service shows a marked improvement, both in number of trains and in speed. To Leeds the increase in speed is very considerable; the number of trains has not so largely increased; but then the service in 1871 was a very good one. Nottingham and Sheffield are also much better off: at both these places there is an active competition with the Midland; whilst to Hull, where there is no competition, the improvement is not so great.

We will now place side by side the best expresses of the Great Northern, Midland, and North Western, both in 1871 and 1883, for comparison.

	G.N. 2.45 P.M. London to Leeds.	MID. 8 A.M. Sheffield to London.	NORTH WESTERN. 7.15 A.M. down. Irish Mail.
1871			
Time	H. M.	H. M.	H. M.
Journey-speed ...	4 27	3 55	6 35 (as at present)
Running-average..	$41\frac{3}{8}$	$40\frac{1}{2}$	$40\frac{1}{10}$
	$44\frac{1}{2}$	$43\frac{1}{2}$	42
	G.N. 1.15 King's Cross to York.	MID. 10.0 London to Leeds.	NORTH WESTERN. 7.30 Birmingham to London.
1883			
Time	H. M.	H. M.	H. M.
Journey-speed ...	4 5	4 30	2 35
Running-average..	46	$45\frac{1}{2}$	$43\frac{3}{4}$
	$49\frac{1}{4}$	48	$46\frac{2}{5}$

The quickest train to York in 1871 took 4 hours 30 minutes, j.s. $41\frac{3}{8}$, r.a. $43\frac{7}{10}$, which may be compared with the above.

Note.—In Table II the Great Northern is credited with an express with journey-speed of over 42 miles per hour, which is apparently quicker than the one given above for 1871. It is however only the portion of a Manchester express (5 p.m.) between King's Cross and Retford. The one given above is the quickest from start to finish.

Similarly the Midland is credited with an express of over 42 miles per hour; this is a part of a Leeds express from Trent (where it leaves the Manchester train) to Leeds.

The quickest express on the Great Northern shows a very considerable advance in speed over 1871; so also does the Midland one. The advance on the North Western is not so marked.

MIDLAND.

Distinct Expresses.

Miles.	Between	Number.	Average				Total Mileage.
			Time.	Journey-Speed.	Minutes Stopped.	Running-Average.	
189	St. Pancras & Manchester.	8	H. M.				
198	„ Leeds	2	5 5	37½	30	41¼	—
99½	„ Leicester	3 (1 up)	5 15	37- ⁷ / ₁₀	36	42 ⁶ / ₁₀	—
128½	„ Derby	1 up	2 36	38½	10	40¼	—
78	Trent and Leeds.....	5 (2 up)	3 35	36 nearly	25	40 ⁶ / ₁₀	—
38½	„ Sheffield	4 (3 „)	2 —	39	8	41 ⁷ / ₁₀	—
36¼	Derby to Sheffield	6 (2 „)	1 —	38½	2	39 ⁷ / ₁₀	—
39½	Sheffield to Leeds	1 down	— 58	37½	2	38 ⁶ / ₁₀	—
20	Rugby to Leicester.....	2 „	1 5	36½	4	38 ⁶ / ₁₀	—
1871	Total.....	32	averaging	37½	—	40 ⁶ / ₁₀	3,175
'83	„	66	„	41½	—	45	8,860

Service to Chief Towns.

Miles.	Between London and	Number.		Average.					
				Time.		Journey-Speed.		Running-Average.	
		1871.	1883.	1871.	1883.	1871.	1883.	1871.	1883.
211½	Bradford	6	13	H. M.	H. M.	38 ² / ₁₀	42 ⁸ / ₁₀	42 ⁸ / ₁₀	46
198	Leeds	6	15	5 32	5 5	39 ² / ₁₀	43½	44	46½
158½	Sheffield	9 (5 up)	16	4 4	3 40	39	44½	42 ⁸ / ₁₀	47
189	Manchester	8	11	5 5	4 44	37½	40½	41½	44 ² / ₁₀
183½	Stockport	8	11	5 3	4 32	36½	40½	41	44½
128½	Derby	10	15	3 20	3 1	38 ⁶ / ₁₀	42½	42 ² / ₁₀	} 46½
—	„ via Melton	—	6	—	3 21	—	41	—	
126½	Nottingham	9	16	3 17	2 46	38½	44 ⁶ / ₁₀	42	47½
99½	Leicester	17 (8 up)	20	2 30	2 14	39 ⁷ / ₁₀	4+½	42	47
49½	Bedford.....	14 (6 up)	17	1 14	1 8	40 ² / ₁₀	44	42	45½

Long Runs.

- 1 St. Pancras and Bedford.
- 7 Kentish Town and Bedford.
- 3 „ Leicester.
- 4 Bedford and Leicester.
- 5 Derby and Woodley Junction.

1871. Total... 20* averaging 56½ miles at 42½ r.a.

'83. „ 104† „ 53 „ 46½ „

Longest Run.

1871. Kentish Town to Leicester, 97½ miles, in 2 8 = 45½ r.a.

'83. St. Pancras to Leicester, 99½ „ 2 7 = 47 „

* 7 of these have conditional stops.

† 16 „

Quickest Run.

- H. M.
1871. Kentish Town to Bedford, 48 miles in 1 1 = 47½ r.a.
 '83. Liverpool to Stockport, 37¼ miles, at 50⅔ r.a.
 And St. Pancras to Kettering, 72¼ miles, at 49½ r.a.

On this line there has been very great progress. The number of expresses has been more than doubled, the average journey-speed is 4 miles per hour greater, and the mileage has increased 147 per cent. The number of long runs has increased 400 per cent., and their speed by 3¼ miles per hour. Of course a large proportion of this increase is due to the opening of new lines on which expresses are run. Thus the opening of the Cheshire lines to Liverpool has given a batch of expresses; the Settle and Carlisle line, making the Midland a through line to Scotland, another (and this is perhaps the most important one); and the new line from Masborough to York, on which expresses are run. Then there is the Kettering and Manton line, on the opening of which the company started a new service to Nottingham and Leeds; this however is only an alternative route; and lastly it has started an express service from Bristol to Derby, none of the trains on which line came within the definition of express in 1871.

The service to some of the towns has been enormously increased; notably to Nottingham, Sheffield, Leeds, and Bradford.

The speed of the long runs in 1871 was extremely creditable; notably the run from Kentish Town to Bedford.

We will now compare the service of the Great Northern and Midland to Leeds in 1871 and in 1883.

	Great Northern.	Midland.
1871.		
Quickest time.....	H. M. 4 28	H. M. 4 56
Journey-speed	41⅔	40⅓
Running average	44½	44
1883.		
Quickest time.....	H. M. 4 -	H. M. 4 30
Journey-speed	46⅔	45½
Running-average	49	48
<i>Total Service—</i>		
1871.		
Number of trains	10	6
Average time	H. M. 4 44	H. M. 5 3
„ journey-speed	39⅔	39⅓
Running-average	42⅔	44
1883.		
Number of trains	13	15
Average time	H. M. 4 21	H. M. 4 37
„ journey-speed	42½	43½
Running average	46¼	46½

This table shows the advantage of competition.

LONDON AND NORTH WESTERN.

Distinct Expresses.

Miles.	Between	Number.	Average				Total Mileage.
			Time.	Journey- Speed.	Minutes Stopped.	Running- Average.	
			H. M.				
31½	Liverpool & Manchester	4 (1 up)	— 50	37½	3	40½	—
263¾	Euston and Holyhead...	4	6 42½	39 ⁸ / ₁₀	19½	41½	—
299¼	„ Carlisle ...	6 (2 up)	8 3	37½	37	40½	—
186½	„ Manchester	8	5 5	37 ¹ / ₈	26	40½	—
189 }	„ Liverpool...	1 up	5 20	36½	30	40	—
193¾	„ Birmingham	2	3 2	37½	16	40 ⁵ / ₁₀	—
113	„ Crewe	4 (1 up)	4 16	37	20	40 ⁶ / ₈	—
158	„ Stafford	1 down	3 35	37¼	16	40½	—
133¾	„ Rugby	1 up	2 10	38½	8	40 ³ / ₈	—
82¾	„ Bletchley ..	5 (3 up)	1 15	37½	4	39½	—
46¾	Stafford and Wigan ...	1 down	1 40	36 ³ / ₁₀	13	41 ⁸ / ₁₀	—
60½	Rugby and Birmingham	6 (4 up)	— 49	36½	2½	37½	—
30	Crewe and Chester	2	— 35	36½	—	36½	—
21¼							
1871	Total	45	averaging	37½	—	40½	6,273
'83	„	82	„	40½	—	43 ⁷ / ₁₀	10,405

Service to Chief Towns.

Miles.	Between London and	Number.		Average					
				Time.		Journey- Speed.		Running- Average.	
		1871.	1883.	1871.	1883.	1871.	1883.	1871.	1883.
				H. M.	H. M.				
299¼	Carlisle	6 (2 up)	7	8 3	7 28	37½	40	40½	43½
209¼	Preston	7 (2 „)	8	5 28	5 6	38½	41	41½	44½
193¾	Liverpool	6	10	5 12	4 45	37½	40 ⁹ / ₈	40½	44½
186½	Manchester ...	11 (5 up)	17	5 5	4 46	37½	39 ³ / ₈	40½	43½
189 }									
—	Stockport	11	17	10 minutes less	—	—	—	—	—
182¼	Warrington	8 (2 up)	12	4 46	4 33	38 ² / ₁₀	40	41½	44½
179	Chester	6 (2 „)	9	4 33	4 25	39½	40 ³ / ₈	41½	44
163	Shrewsbury	2	3	4 27	4 3	36 ⁹ / ₁₀	40¼	40 ² / ₈	44 ³ / ₈
158	Crewe	20	34	4 5	3 48	38 ⁷ / ₁₀	41 ³ / ₈	41 ² / ₁₀	44 ³ / ₈
113	Birmingham ...	10	8	3 8	2 45	37	41 ² / ₈	40 ⁷ / ₁₀	44 ³ / ₈
82¾	Rugby	27 (12 up)	50	2 4	1 57	40	42	41 ² / ₁₀	44 ³ / ₈
67¾	Northampton ...	6 (1 „)	21	1 49	1 32	37 ¹ / ₁₀	43	41½	44 ³ / ₈
31½	Liverpool and Manchester...	4 (1 „)	20	— 50	— 45	37½	42	40½*	45*

* Between Manchester and Edge Hill 43⁹/₁₀ 47½

Long Runs.

- 5 Euston and Rugby.
- 3 Willesden and Rugby.
- 1 Euston and Blisworth.
- 1 Camden and Blisworth.
- 4 Willesden and Blisworth.
- 2 Euston and Bletchley.
- 13 Willesden and Bletchley.
- 1 Watford and Blisworth.
- 8 Rugby and Stafford.
- 5 " Crewe.
- 4 Chester and Holyhead.
- 3 " Stafford.
- 2 Carlisle and Preston.
- 2 " Carnforth.
- 2 " Oxenholme.

1871. Total.... 56 averaging 60 miles at 41 r.a.
 '83. " 98 " 60 " 45 "
 Of these in 1871 19 over 60 miles averaged 78 miles at 41½ r.a.
 " '83 53 " 72 " 44 "

Over the Westmoreland Hills in

1871. 6 averaged 68 miles at 36½ r.a.
 '83. 12 " 60¾ " 43 "

Longest Runs.

H. M.

1871. Preston to Carlisle, 90 miles in 2 27 = 36 ⁷/₁₀ r.a. Over steep gradients
 Holyhead to Chester, 84½ " 2 5 = 40½ "
 '83. Nuneaton to Willesden 91½ " 1 57 = 47 "

Quickest.

H. M.

1871. Rugby to Stafford 50¾ miles in 1 7 = 45½ r.a.
 '83. Northampton to Willesden 60¼ " 1 10 = 51¾ "

Quickest over Steep Gradients.

H. M.

1871. Carlisle to Carnforth 62¾ miles in 1 33 = 40½ r.a.
 '83. " " " 1 25 = 44¼ "

Up limited mail in both cases.

We will now give for comparison the best train to Liverpool in 1871 and 1883.

	Train.	Time.	Journey-Speed.	Running-Average.	
1871.....	} 2.45 P.M. down {	H. M. 5 0	38 ⁷ / ₁₀	41½	} to Edge Hill
'83.....		4 30	43	46 ⁵ / ₈	

The increase in express mileage amounts to more than 65 per cent., the increase in journey-speed $3\frac{1}{6}$ miles per hour, and in running-average about $3\frac{1}{2}$ miles per hour.

The mileage of long runs has increased 75 per cent., and the speed by 4 miles per hour.

The increase in mileage is not so great as that of the Midland, but then no new lines on which express running is done (except the Northampton loop) have been opened in the twelve years; also the service in 1871 was a good one.

The speed in 1871 was not so great as that of either the Great Northern or the Midland, but having usually the shortest route to the towns at which there was competition, it was not necessary for the line to run so fast as its competitors.

In 1871 the North Western had a practical monopoly at Liverpool; now there is an active and keen competition there, and hence we see a great improvement in the service to this town from London, and also in the service from Manchester.

The service to this latter town has also been greatly improved; the competition to it being severer than ever.

The mails to Holyhead were the same in 1871 as now. These trains were decidedly very good ones when they were first put on, now they are relatively slow; but then the company has had no inducement to accelerate them.

Carlisle is much better off now than then; Crewe and Rugby have an enormous increase in their service. It will be seen that the proportionate increase in service to these two towns is much larger than to most other places; the reason being that now the traffic having become so heavy, it has been found necessary to run separate trains to each large place, instead of one train serving several by detaching a few carriages at the junction for each particular town. As a good example we instance the 10 a.m. express, which train in 1871 served Birmingham, Liverpool, Manchester, and all parts of Scotland; whilst at present the 10 a.m. serves Edinburgh, Glasgow, and Perth only; another train at 10 10 a.m. serves Liverpool and Manchester, one at 9.30 a.m. serves Birmingham, and a fourth at 11 a.m. goes to places in the north of Scotland.

To Birmingham the service has not improved so much as to most places. The average time is 18 minutes less, but the expresses are two less in number now than in 1871. However now there are several fast trains, which, though not express, only take a few minutes longer on the road than some of the trains which are classed as express.

Northampton has obtained great advantages by the opening of the new loop line, which places it on a main line instead of being as formerly on a branch.

We may now compare the best express of this company and of the Great Northern to Scotland both in 1871 and 1883. (It will be remembered that at the earlier time the Midland route to Scotland was not opened.)

East Coast Route.					West Coast Route.				
1871.									
8.10 p.m. down, King's Cross to					8.40 p.m. down Limited Mail.				
	Miles.	Time.		Journey-Speed.	Running-Average.	Miles.	Time.	Journey-Speed.	Running-Average.
		H.	M.				H. M.		
Edinburgh	392½	9	55	39 ⁶ / ₁₀	41 ⁸ / ₁₀	400¼	10 33	37 ⁹ / ₁₀	40 ⁷ / ₁₀
Glasgow	439¾	11	40	37 ⁷ / ₁₀	41½	403¾	10 42	37 ⁷ / ₁₀	40½

1883.									
8.40 a.m. up from Glasgow.					10 a.m. down.				
	Miles.	Time.		Journey-Speed.	Running-Average.	Miles.	Time.	Journey-Speed.	Running-Average.
		H.	M.				H. M.		
Edinburgh	—	9	—	43 ³ / ₅	48	—	9 50	40 ² / ₅	44 ² / ₅
Glasgow	—	10	20	42½	47	—	10 —	40 ¹ / ₂	44

These figures show a striking improvement. It should be remembered in comparing the journey-speeds that in 1871 the quickest trains by both routes were night ones, which had no long stoppages; and these are compared with day trains in 1883, which had long ones; viz., 30 minutes at York by the East Coast, and 20 minutes at Preston by the West Coast.

It should be noticed on the East Coast line that the journey-speed to Edinburgh in 1883 is nearly 2 miles per hour faster than the running-average was in 1871.

The distance to Glasgow by the West Coast line in 1871 was 2¼ miles longer than it is now: the trains running then *via* Coatbridge to Buchanan Street, and not by the direct line from Motherwell through Rutherglen to the Central station as at present.

MANCHESTER, SHEFFIELD, AND LINCOLNSHIRE.

Distinct Expresses.

Miles.	Between	Number.	Average				Total Mile-age.
			Time.	Journey-Speed.	Minutes Stopped.	Running-Average	
			H. M.				
64½	Retford and Manchester	7 (4 up)	1 50	35 ² / ₁₁	10	38 ⁷ / ₁₀	—
35¾	Barnsley "	4	— 59	36 ³ / ₁₀	3	38 ³ / ₁₀	—
1871	Total	11	averaging	36	—	38 ⁴ / ₅	594
'83	"	49	"	43	—	44 ² / ₅	2,318

The express service to the chief towns from London has been given under the head of the Great Northern. There were no long runs in 1871.

Here we see an enormous increase in express mileage; but of this 1,096 miles are due to the present Liverpool and Manchester service on the Cheshire lines; still deducting this amount the express mileage would be 1,222 miles, and the increase 105 per cent. which is very large.

The speed of the ordinary expresses to Manchester was in 1871 very good indeed, so much so that the average time between Retford and Manchester has only been reduced $3\frac{1}{2}$ minutes, but the trains are heavier now than in 1871.

The expresses to Barnsley formed part of a through service from Manchester to York, the route lying from Barnsley to Normanton over the Midland, and thence by the North Eastern line.

We will here give the best expresses by all three routes between London and Manchester, and also the total service for 1871 and 1883.

	G. N. & M. S. & L.	Midland.	North Western.
--	--------------------	----------	----------------

Best Express, 1871.

Train	6.45 A.M. up	10 A.M. down	2.45 P.M. down
	H. M.	H. M.	H. M.
Time	5 5	5 -	4 55
Journey-speed	$39\frac{3}{10}$	$37\frac{3}{8}$	$38\frac{3}{8}$
Running-average	44	$41\frac{1}{2}$	$41\frac{3}{8}$

Best Express, 1883.

	H. M.	H. M.	H. M.
Time	4 30	4 35	4 30
Journey-speed	45	$41\frac{3}{8}$	42
Running-average	$46\frac{3}{8}$	$45\frac{1}{8}$	$45\frac{3}{8}$

Total Service.

	1871.	1883.	1871.	1883.	1871.	1883.
Number	7	14	8	11	11	17
	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.
Average time	5 10	4 51	5 5	4 44	5 5	4 46
„ journey-speed	$39\frac{3}{10}$	$41\frac{5}{8}$	$37\frac{1}{8}$	$40\frac{1}{2}$	$37\frac{1}{2}$	$39\frac{3}{8}$
Running-average	43	45	$41\frac{1}{2}$	$44\frac{3}{8}$	$40\frac{1}{2}$	$43\frac{3}{8}$

Total number of trains 1871 26
 „ '83 42

The improvement in this service, as will be seen from the above, is very great, although the service in 1871 was an excellent one.

The Great Northern & M. S. and L. are far to the front in both years as regards speed.

The journey-speed of the fastest train by all routes in 1883 is higher than their respective running-averages in 1871.

NORTH EASTERN.

Distinct Expresses.

Miles.	Between.	Number.	Average.				Total Mile- age.
			Time.	Journey- Speed.	Minutes Stopped.	Running- Average.	
147	York and Berwick	2 down	H. M.				—
80½	„ Newcastle ...	5 (2 up)	3 48	38 ⁷ / ₁₀	10	40 ⁴ / ₁₀	—
67	Newcastle and Berwick	3 („)	2 11	36 ⁷ / ₁₀	6	38 ³ / ₁₀	—
26	Leeds and York	4 (3 up)	1 48	37 ² / ₁₀	3	38 ³ / ₁₀	—
54	„ Hull	2	— 40	39	2	41	—
42½	York and Scarborough	2 up	1 28	36 ⁶ / ₁₀	5	39	—
57½	Edinburgh and Berwick	9 (4 up)	1 10	36 ⁶ / ₁₀	3	38 ⁴ / ₁₀	—
1871	Total	27	averaging	37½	—	39	1,711
'83	„	19	„	40½	—	43½	2,112

Service to Chief Towns.

Miles.	Between London and	Number.		Average					
				Time.		Journey-Speed.		Running- Average.	
		1871.	1883.	1871.	1883.	1871.	1883.	1871.	1883.
335	Berwick	2 down	6	H. M.	H. M.				
268½	Newcastle ...	5 (1 up)	10	8 37	8 1	38 ⁸ / ₁₀	41 ³ / ₁₀	42 ² / ₁₀	45 ³ / ₁₀
232½	Darlington ...	6	11	7 5	6 28	37 ⁷ / ₁₀	41 ¹ / ₁₀	41 ¹ / ₁₀	46
230¾	Scarborough.	1 up	8	6 17	5 43	36 ⁹ / ₁₀	40 ³ / ₁₀	41 ¹ / ₁₀	45 ² / ₁₀
				6 25	5 42	36	40 ³ / ₁₀	39 ² / ₁₀	45 ⁵ / ₁₀

Long Runs.

- 1 Berwick and Edinburgh.
- 2 York and Newcastle.
- 1 Newcastle and Berwick.
- 3 York and Darlington.
- 1 York and Scarborough.*

1871. Total.... 8 averaging 57½ miles at 39 ²/₁₀ r.a.
 '83. „ 20 „ 56 „ 44 ³/₁₀ „

* There are two other long runs between York and Scarborough, but their running-average is only 34½.

Longest Run.

		H. M.
1871.	York and Newcastle, 80½ miles in	1 55 = 41 $\frac{2}{15}$ r.a.
'83.	„ „	1 42 = 47½ „

Quickest Run.

		MIN.
1871.	York to Darlington, 44½ miles in	62 = 42 $\frac{2}{10}$ r.a.
'83.	„ „	53 = 50 „

It will be seen that the service on this line was not particularly good in 1871. The running-average speed is more than 1 mile below the average of all the lines in England. The up day Scotch train was forwarded so slowly that it failed to be express, the speed from Berwick to York being only 34.2 miles per hour. The number of expresses in 1871 is larger than in 1883. It has been previously noticed that on this line trains have been given as express from York to Newcastle, and from Newcastle to Berwick; thus making what now counts as one train, to count as two or even three distinct trains. The express service has increased, as the total mileage shows an increase of 23 per cent.

The speed of the trains has increased considerably, but it is still below the general running-average. The service to Scarborough has been very much improved, not only by quickening the trains, but by their fitting the Great Northern trains at York better, and curtailing the stoppage at that place.

We will refer to the Scotch service later on.

SCOTCH COMPANIES.

GLASGOW AND SOUTH WESTERN.

Distinct Expresses.

	Miles.	Between	Number.	Average				Total Mileage.
				Time.	Journey-Speed.	Minutes Stopped.	Running-Average.	
1871	125	} Glasgow and Carlisle	4	H. M. 3 42	33 $\frac{1}{2}$	20	37 $\frac{1}{2}$	500
'83	115½		8	2 46	41 $\frac{2}{3}$	7	43½	922

Note.—Long runs in 1871 nil.

In 1871 this line could hardly be said to have an express service. The four trains given above in connection with the North Western; but that company works chiefly in conjunction with the Caledonian, so that these trains were chiefly intended to serve towns between Carlisle and Glasgow, and not so much as a through service from England to Glasgow.

The present good trains were put on when the Midland extended its line to Carlisle.

NORTH BRITISH.

Distinct Expresses.

	Miles.	Between	Number.	Average				Total Mileage.
				Time.	Journey-Speed.	Minutes Stopped.	Running-Average.	
1871 {	47 $\frac{1}{4}$	Edinburgh & Glasgow	10	H. M.				473
	98 $\frac{1}{4}$	„ Carlisle	4	1 17 $\frac{1}{2}$	36 $\frac{1}{2}$	4 $\frac{1}{2}$	38 $\frac{8}{10}$	393
				3 8	31 $\frac{3}{10}$	16	34 $\frac{1}{4}$	866
'83 {	—	Edinburgh & Glasgow	5	1 14	38 $\frac{1}{2}$	—	41	825
	—	„ Carlisle	6	2 29	39 $\frac{1}{2}$	—	41	

Long Runs.

- 1 Hawick and Carlisle.
- 1 Haymarket and Cowlairs.
- 2 Glasgow and Haymarket.

1871. Total 4, averaging 44 $\frac{1}{2}$ miles at 38 $\frac{1}{7}$ r.a.
 '83. „ 7 „ 60 $\frac{1}{2}$ „ 40 $\frac{1}{3}$ „

The remarks given above for the Glasgow and South Western apply similarly to this line as regards its Edinburgh and Carlisle service. That between Edinburgh and Glasgow has undergone very little change, and was relatively better in 1871 than it is now.

CALEDONIAN.

Distinct Expresses.

Miles.	Between	Number.	Average				Total Mileage.
			Time.	Journey-Speed.	Minutes Stopped.	Running-Average.	
47 $\frac{1}{4}$	Edinbro' and Glasgow Carlisle and Glasgow.. „ and Edinbro'..	6 (2 up)	H. M.				—
104 $\frac{1}{2}$		1 down	1 19	35 $\frac{9}{10}$	5	38 $\frac{3}{10}$	—
101		8 (3 up)	2 55	35 $\frac{8}{10}$	10	38	—
			2 44	37	9	39 $\frac{3}{10}$	—
1871	Total	15	averaging	36 $\frac{1}{2}$	—	38 $\frac{6}{10}$	1,196
'83	„	16	„	40 $\frac{1}{3}$	—	42 $\frac{1}{4}$	1,156

Long Runs.

- 2 Carlisle and Beattock.
- 2 " and Carstairs.
- 1 Carstairs and Lockerbie.

1871. Total ... 5, averaging 55 miles at 40½ r.a.
 '83. " ... 8 " 59½ " 45½ "

H. M.

1871. Longest and Quickest ... Carlisle to Carstairs in 1 44=42 r.a.
 '83. " " " 1 35=48½ "
 '83. Quickest Carlisle to Beattock in - 48=49½ "

There is no increase of express mileage to show on this line, but there is a most marked increase in speed.

There are two fewer expresses between Edinburgh and Glasgow, but on the other hand there is an express service from Perth to Dundee, whereas formerly the trains stopped at nearly all the stations between those places. This service was started on the opening of the Tay Bridge, when the North British put on express trains from Glasgow to Dundee (these had to be discontinued when the bridge fell); Dundee then found the great advantage of having a competitive line.

We will now give the total express service between London and Scotland by the East Coast and West Coast lines in 1871, and compare it with the present service given by these companies. The quickest train to Scotland has already been given.

To and from Edinburgh.

Year.	East Coast Route.				West Coast Route.			
	Number.	Average			Number.	Average		
		Time.	Journey-Speed.	Running-Average.		Time.	Journey-Speed.	Running-Average.
1871.....	2 down	H. M. 10 12	38½	41 ⁷ / ₁₀	3 (1 up)	H. M. 10 42	37 ² / ₅	40 ³ / ₁₀
Also these fast	4 (3 up)	11 10	35½	38 ⁸ / ₁₀	5 (2 ,,)	11 17	35½	39½
1883.....	6	9 31	41½	45½	4	9 55	40½	44½
Also these fast	5	10 17	38	—	5	10 48	37	—

To and from Glasgow.

1871.....	1 down	11 40	37 ⁷ / ₁₀	41½	3 (1 up)	10 52	37 ¹ / ₅	40
Also these fast	5 (3 up)	12 51	34½	39½	5 (2 ,,)	11 42	34½	38½
1883.....	3	10 35	41½	45½	4	10 2	40	43½
Also these fast	6	11 50	37	—	5	—	—	—

Taking Express and Fast together.

	Year.	Edinburgh.	Journey-Speed.	Glasgow.	Journey-Speed.
East Coast	1871	2 exp. + 4 fast	6 avge. $36\frac{3}{4}$	1 exp. + 5 fast	6 av. $34\frac{7}{10}$
	'83	6 ,, + 5 ,,	11 ,, $39\frac{3}{4}$	3 ,, + 6 ,,	9 ,, $38\frac{1}{2}$
West Coast	'71	3 ,, + 5 ,,	8 ,, $36\frac{1}{2}$	3 ,, + 5 ,,	8 ,, $35\frac{1}{2}$
	'83	4 ,, + 5 ,,	9 ,, $38\frac{1}{2}$	4 ,, + 5 ,,	9 ,, $38\frac{1}{2}$
Totals	1871	—	14 ,, $36\frac{1}{4}$	—	14 ,, $35\frac{1}{7}$
	'83	(includes Midland)	27 ,, $39\frac{1}{8}$	—	25 ,, $38\frac{3}{8}$

From the above we see what an enormous improvement has been made in the service to Scotland. It will be noticed that there is a greater improvement in the Edinburgh service than in that to Glasgow, and also on the East Coast line than the West Coast. It is curious that in 1871 the service to Scotland was so much better than that from Scotland.

The greatest improvement has been made in the day trains; taking those to Edinburgh, we find that by the East Coast route in 1871 the 10.0 a.m. from King's Cross took 10 hours 30 minutes, and the up train 10.20 from Edinburgh took 11 hours (this train was not express); whilst in 1883 both up and down trains took only 9 hours.

On the West Coast route in 1871 the—

10 a.m. down from Euston took 11 hours 10 minutes, } Neither
 the 10.15 a.m. up from Edinburgh took 11 hours 15 minutes } express;

in 1883 the 10.0 a.m. down took 9 hours 50 minutes, and the 10.0 a.m. up took 10 hours.

By 1873 the East Coast had quickened to 9 hours 30 minutes both up and down, and the West Coast to 10 hours 25 minutes down, and 10 hours 15 minutes up.

Having now examined the train service of all the lines which ran expresses, we may sum up the total results.

We will first give the number of miles of line owned by each company which ran expresses, and also the number of miles of line on which those expresses ran; this latter amount will include joint lines, and also foreign lines over which any company ran its express trains.

TABLE III.

Name of Company.	Length of Line Owned.			Length of Line on which Expresses Ran in		
	1871.	1883.	Increase Per Cent.	1871.	1883.	Increase Per Cent.
North Western	1,506 $\frac{3}{4}$	1,773	17	576 $\frac{1}{4}$	612	6
Great Northern	491	605	23	265 $\frac{3}{4}$	290 $\frac{1}{2}$	9
Midland	848 $\frac{1}{2}$	1,260	48	311	728 $\frac{3}{4}$	134
Great Western, B. & } E. S. Devon, &c..... }	1,714 $\frac{3}{4}$	2,267	32	356 $\frac{1}{2}$	462	29
North Eastern	1,308 $\frac{3}{4}$	1,519	16	327 $\frac{1}{4}$	301 $\frac{1}{4}$	-8
Caledonian	704	767	9	179 $\frac{1}{4}$	197 $\frac{3}{4}$	10
South Eastern	346	382	10	120 $\frac{1}{2}$	131	9
North British.....	767	984	28	145 $\frac{1}{2}$	145 $\frac{1}{2}$
Brighton	370 $\frac{1}{4}$	435 $\frac{3}{4}$	17	118 $\frac{3}{4}$	88 $\frac{3}{4}$	-25
South Western	560 $\frac{3}{4}$	796 $\frac{1}{2}$	41	171 $\frac{1}{2}$	171 $\frac{1}{2}$
M. S. & L.	254 $\frac{1}{2}$	290	14	72	148 $\frac{3}{4}$	107
G. & S. W.	265	329	24	125	115 $\frac{1}{4}$	-8
Chatham.....	136	153	12	78	98	25
Great Eastern	748 $\frac{1}{2}$	907	21	106 $\frac{1}{4}$	314 $\frac{3}{4}$	197
				2,953 $\frac{1}{2}$	3,805 $\frac{1}{4}$	—
Less joint lines counted twice				13 $\frac{1}{2}$	137	—
				2,940	3,668	24'7

This table shows that as a rule but a small portion of each company's system is utilised for express trains; and also that generally speaking the express running now is done on nearly the same lines as in 1871.

The Great Eastern stands highest in increase of line over which its expresses run. This is chiefly due to the opening of the line to Doncaster, and that now there are expresses to Norwich and Harwich, whereas formerly there were no expresses beyond Cambridge and Colchester.

The Midland takes second place, owing to the opening of the Settle and Carlisle, Marple and Liverpool, and Kettering and Nottingham lines, and also to its now running expresses from Bristol to Derby, Sheffield to York, and Milford to Hull, and also over the Staveley and Eckington line.

The Manchester, Sheffield, and Lincoln stands third, and owes its large increase to the opening of the Cheshire lines to Liverpool.

After these companies there is a great drop, and we come to the Great Western, which has extended its expresses from Shrewsbury to Birkenhead, and from Swindon to Cardiff.

The Chatham and Dover now runs expresses from Faversham to Westgate.

The Caledonian has put on expresses between Dundee and Perth, and the South Eastern between Canterbury and Ramsgate.

The only new express service on the Great Northern is from Grantham to Lincoln.

On the North Western no new service has been inaugurated, but the 6 per cent. increase is due to the opening of the Northampton loop, and by some of the Manchester trains using the North Stafford line from Colwich to Stone. The very small increase on these two last mentioned lines makes the very large increase in their service all the more creditable to them, and shows that their efforts have been to increase the accommodation to the towns they already served, and not so much to enlarge the sphere of their action.

Of the remaining lines the South Western and North British have remained stationary; the others all show a decrease.

That on the Glasgow and South Western is due to their Carlisle and Glasgow expresses running over the new direct line from Kilmarnock to Glasgow, instead of by the older and longer line *viâ* Paisley.

The North Eastern have no expresses between Leeds and York, which formerly they had.

The Brighton Company has extended its expresses from Lewes to Eastbourne, but on the other hand it has now no expresses to Portsmouth.

We will next give the number and mileage of expresses run by each company, and also their speed for 1871 and 1883, and the increases in all three, arranging the companies according to the length of their express mileage in 1871.

TABLE IV.

Name of Company.	Number of Distinct Expresses.		Average Journey-Speed.		Running-Average.		Total Express Mileage.			Present Order as regards Mileage.	
	1871.	1883.	1871.	Increase.	1871.	1883.	Increase.	1871.	1883.		Total Increase.
North Western	45	82	37½	40½	40½	43½	3½	6,273	10,405	4,132	65
Great Northern	31	67	38½	43	42	46½	4½	3,520	6,780	3,260	92
Midland	32	66	37½	41½	40½	45	4½	3,175	8,860	5,685	147
Great Western.....	28	18	38	42	41½	46½	4½	2,928	2,600	- 328	- 11
North Eastern	27	19	37½	40½	39	43½	4½	1,711	2,112	401	23
Caledonian	15	16	36½	40½	38½	42½	4½	1,196	1,156	- 40	- 3.4
South Eastern	15	12	39½	41½	40½	41½	1½	941	940	- 1
North British	14	11	34½	39	36½	41	4½	866	825	- 41	- 4.8
Brighton	12	13	38½	41	41½	41½	½	686	1,155	469	68
South Western.....	7	8	38½	41½	40	44½	4½	653	890	237	36
M. S. and L.	11	49	36	43	38½	44½	6	594	2,318	1,724	290
G. and S. W.	4	8	33½	41½	37½	43½	6½	500	922	422	84
Chatham	6	9	39	42	41½	43½	1½	468	690	222	47
Great Eastern	3	34	37½	41	38½	43½	4½	161	3,040	2,879	1,788
Total	250	407	37½	41½	40½	44½	4	23,672	42,693	19,021	80

* Increase per cent. 62.8.

The foregoing table shows in a few figures the enormous development of the express service on our railways in the last twelve years.

The number of distinct expresses has increased 62·8 per cent., and their mileage 80 per cent.; while the length of line on which they are run has only increased 24·7 per cent. Both the average journey-speed and the running-average have increased 4 miles per hour; while the size and weight of the trains have enormously increased, probably some 30 to 50 per cent. as Mr. Foxwell says.

It will be seen that as regards amount of express mileage the order of the several companies has changed a good deal.

The North Western still keeps its place at the head of the list; the Great Northern and Midland have changed places, owing to great increase in length of the latter line; the Great Eastern has jumped from the bottom to the fourth place, and the Sheffield line has gone up in the world considerably.

Arranging the companies according to their running-speeds in 1871 and 1883 we have:—

TABLE V.

Name of Company.	Running-Average.		Order.	
	1871.	1883.	1871.	1883.
Great Northern	42	46 $\frac{3}{4}$	1	1
Great Western	41 $\frac{1}{2}$	46 $\frac{1}{2}$	2	2
Chatham & Dover	41 $\frac{3}{4}$	43 $\frac{1}{2}$	3	10
Brighton	41 $\frac{1}{2}$	41 $\frac{3}{8}$	4	13
Midland	40 $\frac{9}{10}$	45	5	3
South Eastern	40 $\frac{1}{2}$	41 $\frac{3}{4}$	6	12
North Western	40 $\frac{1}{2}$	43 $\frac{7}{10}$	7	6
South „	40	44 $\frac{1}{2}$	8	5
North Eastern	39	43 $\frac{1}{4}$	9	9
Great „	38 $\frac{8}{10}$	43 $\frac{1}{4}$	10	8
Caledonian	38 $\frac{9}{10}$	42 $\frac{3}{4}$	11	11
M. S. & L.	38 $\frac{1}{2}$	44 $\frac{3}{8}$	12	4
G. & S. W.	37 $\frac{1}{2}$	43 $\frac{1}{2}$	13	7
North British	36 $\frac{7}{10}$	41	14	14
Average	40 $\frac{4}{10}$	44 $\frac{1}{2}$	—	—

It will be seen that most of the companies have made substantial increases in their speed, though their order has changed a great deal. Only one company, the Brighton, has not increased its speed, and this is undoubtedly due to the present very crowded state of the line between London and Croydon, which renders high speed on it almost impossible. All the great companies have increased by more than the average amount, except the North Western.

The South Eastern and Chatham lines do not show a very large increase, but it should be remembered that their continental expresses (which form the bulk of their express service) were very good in 1871.

We will next give the average number of express journeys made on each mile of line on which expresses are run, which will show which company gives the greatest average service on a given line :—

TABLE VI.

Name of Railway.	Average Number of Express Journeys on each Mile.		
	1871.	1883.	Increase.
North Western	10·9	17·0	6·1
Midland	10·2	12·1	1·9
Great Northern	13·2	23·4	10·2
„ Eastern	1·5	9·6	8·1
„ Western	8·2	5·6	-2·6
North Eastern	5·2	7·0	1·8
M. S. & L.	8·2	15·6	7·4
Caledonian	6·7	5·8	-0·9
G. & S. W.	4·0	8·0	4·0
North British.....	6·0	5·6	-0·4
Brighton.....	5·7	13·1	7·4
South Eastern	7·8	7·1	-0·7
„ Western	3·8	5·2	1·4
Chatham and Dover ...	6·0	7·0	1·0
Average	6·95	10·15	3·2

The portion of line on which the greatest number of express journeys was made in—

1871.	L. and N. W., Euston and Rugby,	27 journeys.
'83.	„ „ „	51 „
'83.	Cheshire Lines, Warrington and Liverpool,	51.

The Great Northern shows not only the greatest number of journeys per mile in 1871, but also the greatest improvement; it is however a short line, and has no long arms extending into comparatively thinly populated districts, like the North Western has from Chester to Holyhead, and Preston to Carlisle, or the Midland from Skipton to Carlisle. The M. S. and L. owes its large increase to the opening of the Cheshire lines.

The enormous increase on the line from London to Rugby is very noticeable.

TABLE VII.—*Long Runs.*

Name of Company.	1871.				1883. Increase in				
	Num- ber.	Average Dis- tance.	Running- Average.	Mile- age.	Num- ber.	Average Dis- tance.	Running- Average.	Mileage.	
								Total.	Per Cent.
		Miles.				Miles.			
North Western	56	60	41	3,360	42	4	2,520	75
G. Northern	19	66 $\frac{3}{4}$	44 $\frac{1}{2}$	1,268	30	7	5 $\frac{1}{2}$	2,348	185
Midland	20	56 $\frac{3}{4}$	42 $\frac{3}{4}$	1,135	84	-3 $\frac{3}{4}$	3 $\frac{3}{4}$	4,377	385
South Eastern	10	68	40 $\frac{2}{3}$	680	2	-1 $\frac{3}{4}$	1 $\frac{1}{2}$	115	17
Great Western	11	52	47 $\frac{3}{4}$	572	13	4	3 $\frac{3}{4}$	772	135
South „	11	46	40	506	2	1 $\frac{1}{3}$	4 $\frac{3}{8}$	109	21
North Eastern	8	57 $\frac{1}{2}$	39 $\frac{9}{10}$	460	12	-1 $\frac{1}{2}$	4 $\frac{7}{10}$	660	143
Brighton	7	40	42 $\frac{2}{7}$	280	16	5 $\frac{1}{2}$	9 $\frac{9}{14}$	767	238
Caledonian	5	55	40 $\frac{1}{3}$	275	3	4 $\frac{1}{2}$	5 $\frac{3}{8}$	201	73
North British	4	44 $\frac{1}{2}$	38 $\frac{1}{7}$	178	3	16	2 $\frac{1}{2}$	245	137
Chatham	3	54	42 $\frac{9}{10}$	162	5	9	2 $\frac{4}{10}$	342	211
Great Eastern	1	51 $\frac{1}{4}$	41	51	23	5 $\frac{1}{2}$	1 $\frac{1}{2}$	1,311	2,570
M. S. & L.	Nil	—	—	—	8	48 $\frac{3}{4}$	43 $\frac{1}{2}$	390	—
G. & S. W.	„	—	—	—	8	58 $\frac{1}{2}$	44 $\frac{1}{3}$	468	—
Total	155	57 $\frac{1}{2}$	42	8,927	251	1 $\frac{1}{2}$	3 $\frac{3}{4}$	14,625	163

From this table it will be seen that the average length of these long runs has remained about the same, but the number has increased 162 per cent., the mileage 163 per cent., and the running-average 3 $\frac{3}{4}$ miles per hour.

The increase on the Midland is especially worthy of notice, that of the North Western is not so great as on some other lines, but in 1871 it had a very large number, more than one-third of the whole, amounting to 37 per cent. of the total long run mileage.

In 1871 the long runs formed 37·7 per cent. of the total express mileage; and in 1883 they formed 55·6 per cent. of it.

The average journey-speed has increased 10·7 per cent., whilst the running-average has only increased 9·9 per cent. These facts considered together show that part of the increase in journey-speed in 1883 has been attained by the trains making fewer stoppages.

TABLE VIII.—*Fastest Runs.*

Name of Railway.	1871.			1883.
	Between	Distance.	Running-Average.	Increase in Speed.
Great Western.....	Paddington and Swindon	77½	53½	None
Midland	Kentish Town and Bedford	48	47½	3½
Great Northern	King's Cross and Peterboro'	76½	47	5½
Chatham	Herne Hill and Dover	74	46½	None
North Western.....	Rugby and Stafford	50¾	45½	6½
South Eastern	Cannon Street and Dover	74½	45	None
Brighton	Croydon and Brighton	40	44½	2½
South Western.....	Basingstoke and Vauxhall	46½	43½	3
North Eastern	York to Darlington	44½	42 ⁸ / ₁₀	7 ⁸ / ₁₀
Caledonian	Carlisle and Carstairs	73½	42	7½
Great Eastern	Bishopsgate and Colchester	51½	41	7½

Fastest over Steep Gradients.

Midland	Kentish Town and Leicester	97½	45¾	1¼
Caledonian	Carlisle and Carstairs	73½	42	6½
Midland	Derby to Woodley	52	41 ⁶ / ₁₀	2¾
North Western.....	Carlisle and Carnforth	62¾	40¾	3¾
„ British	„ Hawick	45½	39	3

Note.—The last column shows the increase of speed of the fastest run in 1883, but this run is not necessarily over the same ground as the fastest run in 1871, except in the cases of the fastest runs over steep gradients, where the run is over the same ground in both years.

In the latter part of the above table the increase on the Caledonian should be noticed.

TABLE IX.—*Longest Runs in 1871.*

Name of Line.	Between	Distance.
Midland	Kentish Town and Leicester	Miles. 97½
North Western	Preston and Carlisle	90
„	Chester and Holyhead	84½
„	Euston and Rugby	82¾
North Eastern	York and Newcastle	80½
Great Western	Paddington and Swindon	77½
„ Northern	King's Cross and Peterborough.....	76½
North Western	Rugby and Crewe	75½
South Eastern	Cannon Street and Dover	74½
Chatham	Herne Hill and Dover	74
Caledonian	Carlisle and Carstairs	73½

TABLE X.—Towns best supplied with Expresses in 1871.

Distance.	Between	Number of Express Journeys per Day.	
		1871.	1883.
82 $\frac{3}{4}$	Rugby and London	27	50
186 $\frac{1}{2}$ —203	Manchester "	26	42
181 $\frac{1}{2}$ —199	Stockport "	26	35
126 $\frac{1}{2}$ —127 $\frac{3}{4}$	Nottingham "	21	35
158	Crewe "	20	34
76 $\frac{1}{4}$	Peterborough "	20	29
158 $\frac{1}{2}$ —162	Sheffield "	19	33
105 $\frac{1}{2}$	Grantham "	19	37
113—129 $\frac{1}{4}$	Birmingham "	18	12
99 $\frac{1}{4}$	Leicester "	17	26
185 $\frac{1}{2}$ —198	Leeds "	16	28
193—211 $\frac{1}{2}$	Bradford "	15	22
156	Doncaster "	15	27
49 $\frac{3}{4}$	Bedford "	14	17
188	York "	11	20
128 $\frac{2}{3}$	Derby "	10	21
31 $\frac{1}{2}$	Liverpool and Manchester	4	52

TABLE XI.—Quickest Time between London and Important Towns during Summer.

Miles.		Up or Down.	1871.		1883.		Company.		
			Time.	Journey-Speed.	Decrease in Time.	Increase in Journey-Speed.			
								H.	M.
540 $\frac{1}{4}$	Aberdeen	d.	15	40	34 $\frac{2}{3}$	—	50	2	N. Western and Caln.
47 $\frac{3}{4}$	Basingstoke	"	1	7	42 $\frac{3}{4}$	—	4	2 $\frac{3}{4}$	South Western
106 $\frac{3}{4}$	Bath	"	2	13	48	—	—	—	Great "
49 $\frac{3}{4}$	Bedford	"	1	8	44	—	8	5 $\frac{3}{4}$	Midland
335	Berwick	"	8	20	40 $\frac{1}{5}$	—	42	3 $\frac{3}{5}$	G.N. and N.E.
228 $\frac{1}{4}$	Birkenhead	up	7	—	32 $\frac{1}{2}$	—	52	12 $\frac{1}{2}$	Great Western
113	Birmingham	"	2	57	38 $\frac{3}{10}$	—	22	5 $\frac{1}{2}$	North "
129 $\frac{1}{4}$	"	"	2	55	44 $\frac{2}{10}$	—	13	3 $\frac{9}{10}$	Great "
115 $\frac{1}{2}$	Bournemouth	d.	3	50	30 $\frac{6}{10}$	—	41	6 $\frac{1}{2}$	South "
193	Bradford	"	4	45	40 $\frac{9}{10}$	—	30	4 $\frac{2}{5}$	Great Northern
209 $\frac{1}{2}$	"	"	5	20	39 $\frac{3}{10}$	—	25	3 $\frac{3}{10}$	Midland
50 $\frac{3}{4}$	Brighton	"	1	15	40 $\frac{4}{10}$	—	10	6 $\frac{1}{2}$	L.B. and S.C.
118 $\frac{1}{2}$	Bristol	both	2	36	45 $\frac{1}{2}$	—	—	—	Great Western
163	Buxton	up	4	57	32 $\frac{2}{10}$	—	52	7 $\frac{1}{10}$	Midland
55	Cambridge	d.	1	30	36 $\frac{2}{5}$	—	15	7 $\frac{5}{10}$	Great Eastern
58	"	both	1	30	38 $\frac{1}{4}$	—	15	8 $\frac{1}{2}$	" Northern
68	Canterbury	d.	1	46	38 $\frac{9}{10}$	—	8	2 $\frac{3}{4}$	South Eastern
61 $\frac{3}{4}$	"	"	1	31	40 $\frac{7}{10}$	—	8	5 $\frac{7}{8}$	Lon.Chat. and Dover
170 $\frac{1}{4}$	Cardiff	up	4	58	34 $\frac{2}{5}$	—	37	5	Great Western
299 $\frac{1}{2}$	Carlisle	d.	7	48	38 $\frac{4}{10}$	—	33	3	North "
34	Chatham	"	—	50	40 $\frac{4}{5}$	—	—	—	Lon.Chat. and Dover
122 $\frac{1}{2}$	Cheltenham	"	3	30	35	—	15	2 $\frac{2}{3}$	Great Western
179	Chester	"	4	18	41 $\frac{6}{10}$	—	8	1 $\frac{4}{10}$	North "
213	"	"	6	10	34 $\frac{2}{5}$	—	20	9 $\frac{1}{2}$	Great "
152 $\frac{1}{4}$	Chesterfield	both	3	35	42 $\frac{2}{3}$	—	17	3 $\frac{2}{3}$	Midland "

TABLE XI *Contd.*—*Quickest Time between London and Important Towns.*

Miles.		Up or Down	1871.		1883.		Company.		
			Time.		Journey- Speed.	Decrease in Time.		Increase in Journey- Speed.	
			H.	M.					H.
51½	Colchester	d.	1	15	41	—	5	3½	Great Eastern
94	Coventry	up	2	30	37½	—	26	7½	North Western
158	Crewes	d.	3	50	41½	—	20	3½	" "
232½	Darlington	"	6	3	38½	—	44	5½	G.N. and N.E.
128½	Derby	both	3	10	40½	—	17	4	Midland
156	Doncaster	d.	3	38	43	—	25	5½	Great Northern
74½	Dover	"	1	39	45	—	—	—	South Eastern
78	"	"	1	45	44½	—	—	—	Lon.Chat. and Dover
330	Dublin	"	11	30	28½	—	—	—	North Western
471½	Dundee	"	13	25	35½	1	15	3½	N.W. and Caledn.
254	Durham	"	6	45	37½	—	46	4½	G.N. and N.E.
65½	Eastbourne	"	1	55	34½	—	20	7½	L.B. and S.C.
392½	Edinburgh	"	9	55	39½	—	55	4	East Coast
400½	"	"	10	33	37½	—	43	2½	West "
69½	Ely	"	2	1	34½	—	23	8½	Great Eastern
171½	Exeter	"	4	15	40½	—	12	2	South Western
194	"	both	4	15	45½	—	1	—	Great "
312½	Falmouth	d.	9	30	32½	1	—	4	" "
69	Folkestone	both	2	—	34½	—	15	5	South Eastern
403½	Glasgow	d.	10	42	37½	—	42	2½	West Coast
439½	"	"	11	40	37½	1	20	4½	East "
105½	Grantham	"	2	26	43½	—	22	7½	Great Northern
114	Gloucester	"	3	—	38	—	7	1½	" Western
199½	Halifax	"	5	10	38½	—	25	3½	" Northern
68½	Harwich	"	2	15	30½	—	29	8½	" Eastern
60½	Hastings	both	1	42	36	—	5	1½	South "
263½	Holyhead	d.	6	35	40	—	—	—	North Western
188½	Huddersfield	both	5	—	37½	—	25	3½	G.N. and M.S. & L.
197	Hull	up	5	10	38½	—	20	2½	G.N. and N.E.
594½	Inverness	d.	18	5	33	1	25	2½	W.Coast & Highland
68½	Ipswich	"	1	52	36½	—	12	4½	Great Eastern
230½	Lancaster	"	6	—	38½	—	20	2½	North Western
106	Leamington	up	2	25	43½	—	12	4	Great "
185½	Leeds	d.	4	28	41½	—	28	4½	" Northern
196	"	both	4	56	40½	—	26	5½	Midland
99½	Leicester	d.	2	14	43½	—	7	3½	" "
130½	Lincoln	"	3	25	38½	—	20	4½	Great Northern
193½	Liverpool	"	5	—	38½	—	30	4½	North Western
170	Macclesfield	"	4	30	37½	—	25	3½	" "
203	Manchester	up	5	5	39½	—	35	5½	G.N. and M.S. & L.
189	"	d.	4	55	38½	—	25	3½	North Western
189	"	"	5	—	37½	—	25	4	Midland
73½	Margate	up	2	—	37	—	15	5	Lon.Chat. and Dover
238½	Middlesborough	d.	6	30	36½	—	46	4½	G.N. and N.E.
285½	Milford Haven	"	8	40	32½	—	40	2½	Great Western
120	Newark	"	2	48	43	—	12	3	" Northern
268½	Newcastle	"	6	35	40½	—	28	3½	G. N. and N. E.
158½	Newport	up	4	32	35½	—	28	3½	Great Western
67½	Northampton	d.	1	45	38½	—	23	9½	North "
113½	Norwich	"	3	35	31½	—	31	5½	Great Eastern
127½	Nottingham	"	3	5	41½	—	17	4½	" Northern
126½	"	"	3	5	41	—	30	7	Midland

TABLE XI Contd.—Quickest Time between London and Important Towns.

Miles.		1871.		1883.		Company.		
		Time.		Decrease in Time.	Increase in Journey- Speed.			
		H.	M.					
63½	Oxford up	1	25	44 ⁶ / ₁₀	—	7	4 ⁴ / ₁₀	Great Western
326½	Penzance d.	10	19	31 ¹ / ₂	—	1	24	5
450½	Perth "	12	19	36½	—	54	3	N. Western and Caln.
462	" "	12	49	36	1	19	4	G.N., N.E., and N.B.
76½	Peterborough "	1	37	47	—	7	3½	Great Northern
246½	Plymouth up	6	10	39 ⁶ / ₁₀	—	10	1½	" Western
73½	Portsmouth "	2	5	35½	—	10	3¼	South "
209½	Preston d.	5	19	39¼	—	29	4	North "
79	Ramsgate up	2	12	36	—	12	3½	Lon. Chat. and Dover
83½	" (from L.B.) d.	2	28	33 ³ / ₅	—	22	6 ² / ₅	South Eastern
36	Reading "	—	45	48	—	1	— ⁶ / ₁₀	Great Western
138½	Retford "	3	11	43½	—	17	4½	" Northern
82½	Rugby "	1	55	43½	—	10	4½	North Western
83	Salisbury "	2	—	41 ³ / ₄	—	4	1¼	South "
230½	Scarboro' up	6	25	36	—	50	5½	G.N. and N.E.
162	Sheffield "	3	52	41 ⁸ / ₁₀	—	29	6 ¹ / ₁₀	" and M.S. & L.
158½	" "	3	55	40½	—	20	5½	Midland
163	Shrewsbury up	4	25	36 ² / ₁₀	—	37	6 ¹ / ₁₀	North Western
171	" both	4	40	36 ⁶ / ₁₀	—	53	8½	Great "
223	Skipton d.	6	9	36½	—	47	5¼	Midland
79	Southampton "	2	21	33 ⁶ / ₁₀	—	17	4½	South Western
133½	Stafford "	3	11	42	—	11	2½	North "
184	Stockport "	4	43	39	—	24	3½	" "
183½	" up	4	55	37½	—	37	5¼	Midland
199	" "	5	5	39 ¹ / ₁₀	—	6	9 ¹ / ₁₀	G.N. and M. S. & L.
666	Stroome Ferry d.	22	20	29 ⁸ / ₁₀	1	30	2 ² / ₁₀	W. Coast & Highland
216	Swansea up	6	35	32½	—	35	3¼	Great Western
77	Swindon both	1	27	53½	—	—	—	Great Western
220	Torquay up	5	30	40	—	18	2½	" "
175	Wakefield d.	4	6	42 ⁷ / ₁₀	—	26	5	" Northern
182½	Warrington "	4	28	40 ¹ / ₁₀	—	3	½	North Western
168	Weymouth "	5	15	32	—	55	6½	Great "
244½	Whitby "	7	15	33 ⁷ / ₁₀	—	50	4 ³ / ₁₀	G.N. and N.E.
69½	Helmsdale "	23	30	29 ² / ₁₀	2	30	3 ² / ₁₀	W. Coast & Highland
	for Wick			Extreme north point of railway in 1871.				
194	Wigan d.	5	1	38½	—	27	3½	North Western
141	Wolverhampton up	3	20	42 ³ / ₁₀	—	16	3 ⁷ / ₁₀	Great Western
120	Worcester both	3	20	36	—	22	4½	" "
121½	Yarmouth d.	3	45	32 ³ / ₁₀	—	24	4	" Eastern
124½	Yeovil "	3	15	38¼	—	14	2¾	South Western
188	York "	4	30	41½	—	35	6½	Great Northern

We have now given the principal statistics of the English express trains of 1871, and compared them in the most important points with those of 1883. But there are several points which have hardly been alluded to, these are:—

1st. The greatly increased weight of the "express" trains. The weight has probably increased some 50 to 60 per cent., as stated by Mr. Foxwell. Part of this increase is no doubt due to the

ordinary increase of traffic, but by far the greater part must be due to the introduction of third class passengers into express trains. Experience has shown that the larger the facilities which are offered to this class of passengers, the greater becomes the traffic.

It is no doubt difficult to estimate the exact increase in the weight of trains, but as an example we would draw attention to some statistics given by Mr. Findlay, general manager of the London and North Western Railway, in 1875 (*vide* "Minutes, Proceedings of "Institution of Civil Engineers," vol. xli, part 3). This gentleman states that the weight of the 5 p.m. express from Euston which was 149 tons in 1863, increased to 174 tons in 1866, to 201 tons in 1869, and to 257 tons in 1872; and no doubt this increase has gone on, though at perhaps not such a rapid rate, as now the tendency is to increase the number of trains, rather than to increase their size and weight.

2nd. The greatly increased punctuality.

3rd. The much greater immunity from accidents, and lastly the great improvements which have been made in the rolling stock, and in appliances for working the line, continuous brakes, block telegraph, interlocking of points and signals, &c.

As regards punctuality it is not very easy to obtain statistics, but there is no doubt that it is more nearly attained now than it was twelve years ago.

Altogether it will be seen that the improvement effected in the last twelve years is very great. On some lines it is more, and on others less, but in every case it is considerable. It will be seen from the tables of express service that generally towns at which there is competition have benefited more than those where there is none, unless they happen to lie on a main line to places at which there is competition. This improvement will no doubt go on. The number of trains will increase, and so will their average speed, but there are indications that the maximum practical speed has on some lines almost been reached. Some margin must be left. Trains will, with every care, occasionally start a minute or two late; they may be stopped and delayed at signals and junctions; and high winds and slippery rails will affect their speed; and hence it is necessary to allow some margin of time to cover these contingencies; otherwise punctuality, which is as desirable as high speed, would be the exception and not the rule, as it should be.

It does not seem possible to decrease the length of time of stoppages; as the traffic increases, and there are more persons travelling, it naturally takes a longer time to get them and their luggage in and out of the trains.

Although the speed of the quickest trains at present may not

be very greatly increased, still the others may gradually approach their standard, and thus the average speed throughout the country be raised by a very considerable amount. At present the average speed is $41\frac{3}{4}$ miles per hour, and the Great Western Exeter trains have a speed of $45\frac{3}{4}$ miles per hour; so that an increase of speed of at least 4 miles per hour might, if found necessary, be made, without the locomotives having to run any faster than they do on some lines at present; probably, however, owing to the very hilly nature of parts of our country, this will not be the case; but the average may very likely be raised in time to some $43\frac{1}{2}$ miles per hour. The difficulties of increasing the speed however become greater as the traffic increases, and the trains become heavier and the lines more crowded.

Many other points might have been compared between our past and present train service, but enough has been given to show that we have every reason to feel satisfied that the control of our national highways has not been placed in incompetent hands, and that it is quite unnecessary for us to consider the question of the acquisition of the railways by the State as long as we are as well served as we are now, and as long as the same energy is displayed in their management as has been the case up to the present time.

In conclusion, the writer would wish to express the great obligations he is under to Mr. Foxwell, both for his kind permission to use his figures, and also for his valuable help and advice on many points.

DISCUSSION *on* LIEUTENANT WILLOCK'S PAPER.

MR. R. PRICE WILLIAMS said he would in the first place beg to thank the author for his exceedingly interesting and valuable paper. It was impossible to over estimate the amount of time and labour he must have devoted to its preparation. He could not help thinking, however, that the problem of determining the increase of the speed of express trains in the eventful period dealt with by the author, was of a rather more complex character than that involved in the mere record of the difference in the rate of speed. In point of fact, during the twelve years 1871-83 a complete revolution had occurred in railway travelling, which had been brought about mainly by the conveyance of third class passengers by express trains: a course initiated by the Midland Company in 1872, and which was very quickly followed by all the other railway companies north of the Thames. The effect of this was not only to require longer and heavier trains, and a more powerful class of engines, but the vast increase in the number of third class passengers necessitated in many cases a complete rearrangement of the train service, and dividing the train into two portions. It was this large increase in the number of third class passengers, coupled with the depletion which followed in the already scant number of passengers in the second class carriages, which undoubtedly led to the abolition of second class carriages by the Midland Company. Strange to say, the company which has so far benefited most by this remarkable change in railway policy, is the London and North Western Railway. For instance, as will be seen from a reference to the following table, the number of third class passengers on that line, which in 1871 only amounted to 5,800,000, has increased to 45,556,000 in 1882,* an increase of 685 per cent.; the third class receipts in the meantime having increased from 334,000*l.* to 2,166,000*l.*, an increase of 547 per cent. The number of first and second class passengers have decreased in the period referred to 9·92 per cent. and 40·28 per cent. respectively; the gross receipts in the case of the second class having remained almost stationary. One chief element affecting the speed of express trains is the difficulty of working the slow and fast traffic on the same line of rails, as illustrated by the train service diagram of the Great Northern Railway which he had placed upon the walls. From this it would be seen that in some cases as many as seven passenger, goods, and mineral trains had to be shunted at stations, or passed on to relief lines between Peterborough and London, to make way for the express trains. The red lines on the diagram indicated the passenger trains; the blue, the goods; and the black, the coal trains; but such was the

* See Table I in Appendix to Discussion, kindly furnished by Mr. R. Price Williams.

perfection to which the working of the block system had now reached, that the large and mixed traffic on that railway was carried on without the slightest risk of accident. He thought the author had not sufficiently taken into account the growth of the goods and mineral traffic in the period in question, which had been very great, much larger in fact than in the case of the passenger traffic, and that this had a material effect in retarding the increase of the speed of the express passenger trains; for instance, while the increase in the passenger receipts in the course of these twelve years has been 26 per cent., that of the goods and minerals had been as much as 43 per cent., and the increase in the tonnage nearly 67 per cent.

Passenger Traffic.

				Increase.	
		£		Per cent.	
1882	} Gross receipts.....	{	3,936,949	—	—
'83			3,124,538	—	—
			812,411	26	00

Goods and Mineral Traffic.

		Tonnage.	Increase.	Gross Receipts.	Increase.
		£		Per cent.	
1882		35,351,924	—	6,229,278	—
'83		21,175,602	—	4,362,515	—
		14,176,302	66	1,866,763	42

This explained to some extent the reason why the increase in the speed of the London and North Western express trains had not been so conspicuous as in the cases of some of the other railways mentioned by the author. The traffic on this, the premier line, was so enormous, and the growth, both of passenger and goods traffic, in the period referred to had been so large, that although the company had now four lines of way to Rugby, three to Nuneaton, and four lines from Stratford to Crewe, it was almost impossible to increase the speed of the express passenger trains to any great extent. He considered that when the company had four lines of way from London to Crewe, one main cause of the difficulty in quickening the speed of the express trains would be removed. He had heard Mr. Webb, the company's locomotive engineer, say, if he only could calculate upon having a clear road between London and Manchester, he would engage to do the distance in half the time now taken by their quickest trains. Another important matter affecting the increase of the speed of express trains, and to which the author has drawn attention, was the effect of the gradients. In order to afford some idea of the large and

instantaneous effect of the inexorable law of gravity in reducing or accelerating the speed of trains, he had placed upon the walls a speed diagram, showing the speed of some of the London and North Western passenger trains between Crewe and Preston; on this section there were a series of 1 in 100 gradients, over what was generally known as the "Coppul Bank." The lower earth coloured line on the diagram represented a section of the line, and in order that the outline of the speed might compare symmetrically with that of the gradient, he had, as would be seen, inverted the ordinates representing the speeds; the red coloured line above the gradient section showed the speed of the "Down Scotch Express" between Crewe and Preston, the "Flying Scotchman," as it was called; and that immediately below it represented the up Scotch express between Preston and Crewe; the blue coloured outline showing the speed of stopping trains. The effect in the reduction of the speed of the Scotch express up the 1 in 100 gradients at Coppul was very marked, the reduction in the speed in the short distance of one mile being from 55 to 35 miles an hour. Similarly the effect of the accelerating force of gravity was also very discernible on the descending gradients; and it would not fail to be noticed how rarely a speed of 60 miles an hour was maintained, except at the bottom of descending gradients and on the level. He should mention that the speed of these trains had been taken by himself and an assistant at each quarter mile post with a chronograph, and it would be observed that although that speed had been attained on several portions of the line, yet owing to the effect of these gradients, the occasional slackening of speed at junctions (notably on one portion of the line, where renewals of way were proceeding), the average speed of this, the quickest train of the London and North Western Railway, only averaged 55 miles an hour. On the other hand, during the period dealt with in the paper, a variety of causes had materially contributed to increase the speed of express trains, and amongst these might be mentioned the introduction of continuous breaks, the general adoption of which on all express trains had been such as to enable them to be stopped in about one-sixth of the time that would have been possible with the ordinary engine and guard's breaks. How instantaneously these breaks acted would be clearly seen from a reference to the remarkable outline of the speed of the stopping trains between Preston and Crewe, as shown on the diagram. The great improvement which had been made in the permanent way through the introduction of a much better and more durable class of material, viz., Bessemer steel rails, had also largely contributed to the acceleration of the speed of the trains, inasmuch as the trains were not now subject to the constant slackenings of speed due to the renewals of the way; the average life of a steel rail was about ten times that of an iron one, and all the main lines are now laid with this splendid material. The adoption of steel for locomotive boilers, which allow of much higher working pressure being obtained, has also tended to operate in the same direction, and it was due to Mr. Webb, whom he was glad to see present on this occasion, to say that it was he who first had the

courage to adopt it, when other people were inclined to disbelieve in the new material; and now he believed steel had entirely replaced iron in the construction of locomotive boilers on the London and North Western Railway, and other companies were beginning to follow Mr. Webb's example.

Mr. E. M. M. JOHNSTONE, of Dublin, having made a few remarks,

Mr. GEORGE FINDLAY said it appeared to him that the conclusions that had been drawn with regard to third class traffic were not altogether borne out by the actual circumstances of the case, because although prior to 1871 third class passengers were not generally carried by express trains, yet they were to a great extent by fast trains; and his view was that on the whole the change produced by the Midland Company had not been a commercial success, nor had it led to any great increase of third class passengers for long distances. In London, Birmingham, Liverpool, and Manchester, the tendency of the population had been to find an outlet within a radius of 15 or 20 miles; but to a third class passenger a journey between Liverpool and London, or between Scotland and England, meant one of necessity, involving considerable expense, which would not voluntarily be incurred. His view was that there had been a great development of short third class passengers, but not of long distance traffic. One of the most important points that railway managers and directors had to deal with at the present time was the enormous increase in the weight of trains, and the speed which had been brought about by competition. He had no hesitation in saying that if the express traffic of the country was managed upon commercial principles, it would be totally unnecessary to run such frequent trains between London and Manchester. No doubt the public now had greater facilities for getting from one point to another; but, as a matter of fact, the profit from the passenger traffic of the country had not increased as might have been expected, considering the large amount of accommodation that had been given. The increased weight of the trains had also arisen from the spirit of competition. Lavatory and saloon carriages were now run, and the paying load of these trains had proceeded in inverse ratio according to the speed and accommodation given. Increased traction power was required to drag these enormous trains at a speed of 40 to 50 miles an hour, and he believed greater punctuality had been observed, but not without an enormous expenditure. As far as the London and North Western were concerned, they had practically duplicated the line between London and Crewe. The remark in the paper as to the non-acceleration of the service between London and Holyhead pointed to this, that the principal trains between these places were the Irish mails, which were run at a given speed under a contract which terminated a year ago. By the new contract the speed was to be increased to $46\frac{1}{4}$ miles an hour, and the directors were now considering with the Post Office the question of a similar acceleration of speed by the limited mails between London and

Carlisle. In 1864 the limited mail train, exclusive of the engine, measured 204 ft. 6 in. in length, and consisted of two brake vans, two post office vans, and four carriages. In 1874 the length was increased, by the conversion of four-wheeled vehicles to six-wheeled, to 249 ft. 6 in., the number of vehicles being the same as in 1864; but in 1884 the length had increased to 463 ft., and there were thirteen vehicles instead of eight. The average length of each carriage in 1864 was 25 ft. $6\frac{3}{4}$ in.; in 1874 it was 31 ft. $2\frac{1}{2}$ in.; and in 1884 it was 35 ft. $7\frac{3}{8}$ in. In 1864 the total weight of the train was 54 tons 19 cwt. 1 qr.; in 1874 it was 75 tons 3 cwt. 3 qrs.; and in 1884 it was 155 tons 18 cwt. and 2 qrs. It would readily be seen what an enormous power was necessary to drag such a train through the country at a speed of 40 or 41 miles an hour, and to maintain punctuality. One point in regard to the profitable working of the traffic had not been alluded to. When the Midland determined to carry third class passengers by all trains, they did away with second class carriages, and reduced the fares for first class from an average of 2*d.* a mile to $1\frac{1}{2}$ *d.* The result had been that between 1874 and 1882 the London and North Western, who had to follow to a certain extent, had an increase of $3\frac{1}{2}$ million passenger train miles run per annum, and the cost of working these trains was hardly covered by the increased earnings, so that an enormous amount of work had been done for the public for practically no return. During the same period, the Great Western, which was in an exceptional position with regard to a great part of their system, ran an additional passenger mileage of 4,800,000 miles, and earned about 3*s.* 10*d.* per train mile. Although it was not equal to their average earning, yet they made a considerable profit upon their passenger business. The increased passenger train mileage of the Midland was 5,277,000 miles, and they earned an additional increase of only 343,000*l.*; so that whatever the Midland might have done for the public, there could be no doubt that commercially it had not been a success, as they had only earned on their increased mileage 1*s.* 9*d.* per train mile, a sum which would little more than cover the actual locomotive, carriage, and wagon expenses. The fact therefore was that during the eight years from 1874 to 1882, both the Midland and the London and North Western had been doing an enormous amount of increased work for the public without any profit as far as they themselves were concerned. That was borne out by a comparison of the average earnings per train mile of the same companies. Taking the half-year ending December, 1883, and comparing with the same period in 1871, it appeared, so far as the London and North Western were concerned, that whilst in 1871 the average earning per passenger train mile was 5*s.* $2\frac{3}{4}$ *d.*, in 1883 it was 4*s.* $5\frac{1}{2}$ *d.* The earning on the Midland in 1871 was 4*s.* 1*d.* per train mile, but in 1883 it was only 3*s.* $6\frac{3}{4}$ *d.*; whilst in the same period the Great Western fell from 5*s.* 3*d.* to 5*s.* 1*d.* He therefore considered that if the express passenger traffic had been worked upon commercial principles, the large amount of extra mileage would never have been run; and he had no hesitation in saying that although for three or four months in the summer the Scotch traffic taxed all the energies of the three great lines between

England and Scotland, yet in winter one service would be quite sufficient to carry all the passengers. Railway companies were unpopular; but if ever the time came when the State took over the railways of the kingdom, the public would find that the Government would not give such facilities as arose from the competition between the different companies.

Mr. F. W. WEBB said that as locomotive engineer of the London and North Western, he had had to contend with constantly increasing weights of trains, especially during the last decade. In January last he told Mr. Findlay that he must either run two engines with the limited mail or have the load reduced, the train at that time, exclusive of the locomotive, passengers, parcels and mails, weighing 168 tons. One carriage was taken off, so that the speed was still maintained with one engine. If two engines were run it would mean in wages over 400% to the company per year for that train alone. The London and North Western was favourably situated with regard to gradients as compared with some other companies, and that had enabled him up to the present time to work with lighter engines, his heaviest express engines not weighing more than 36 tons, exclusive of the tender. He believed that the London and North Western was the only great company which adopted the method of picking up water at full speed without having to stop, but instead of this, some companies were running with tenders carrying 3,500 gallons of water. The tenders with the heaviest trains on the London and North Western only carried 1,800 gallons, but now with that quantity and with the present weight of some of the trains they were come to their limit, and he had been trying to meet the case by making the water and the fuel go further. He had twenty compound engines now running, doing the express service between Crewe and London, and between London and Holyhead, and for the heavy night trains he was building still larger engines. He was enabled to do that on the compound principle in a way that would not be possible with the ordinary type of engine. In the ordinary construction he was tied down by the length of the coupling rods, but in the compound engine, as one pair of wheels was driven by steam from the boiler, and the other pair by the exhaust steam from the first pair of cylinders, he needed no coupling rods, and was able to place the wheels further apart, and so get in a larger firebox. Last year the engines on the London and North Western ran over 45 million miles, which was about equal to a mile and a half every second of time, or 90 miles a minute, or round the world every $4\frac{1}{4}$ hours. He had also calculated that every hour throughout the year 14 cwt. of steel disappeared off the rails on the London and North Western system. With regard to the amount of fuel required to do the work, he found that in the early days of the Liverpool and Manchester line, 1 lb. of fuel per ton per mile was consumed for a speed of 15 miles an hour; but taking the present speed of 45 miles an hour, with trains of over 200 tons weight, the compound engine consumed from London to Carlisle 29 lbs. a mile, so that some progress has been made between that time and the present in economising the

fuel, and consequently the amount of water required to do a certain amount of work.

Mr. E. FOXWELL said he agreed with Mr. Findlay that probably not one-half or even one-quarter as much improvement would have taken place had the railways been under Government control. There were now 42 expresses per day between London and Manchester, run by three competing companies, and it was unlikely that there would have been more than one-third of that number under Government management; while in all probability the speed would have been less, the carriages not so comfortable, and the fares not so low. And though such frequent opportunities for quick transit were a very great benefit to the country, yet the mere speed by itself was not the whole advantage; for in order to attain high speeds the workmanship of the engines and carriages, and the permanent way, must be attended to more thoroughly, and all the industries associated with railway work must be kept up to the highest pitch of excellence. He thought time might be saved in two details, the putting in of lamps, and the putting in of luggage. Large numbers of passengers could get into a train in less than one minute, as was proved in the case of the Underground Railways, but luggage took four or five minutes. Some improvement was therefore possible in the way in which luggage was stored on the platforms, and the vans might be divided into compartments, and the luggage got ready for the coming stations. Perhaps the lamps might be deposited by some overhead apparatus, and so a great deal of time be saved.

Mr. JAMES MOWATT, taking with Lieutenant Willock and Mr. Foxwell the standpoint that a good express service implied a high standard of efficiency, said that in 1871, the year for which the speeds of the South Eastern continental trains were given, the Franco-German war had just ceased, and the train service between London and Paris had to emerge out of a transition state, not affording a good standard of comparison. But before the Franco-German war the mail used to run between Dover and London, over the crowded joint lines and junctions between Redhill and London, doing the entire distance of 88 miles in two hours, or 44 miles an hour, only one mile an hour slower than the 45 miles an hour of to-day. Again, he recollected that so long as 1862, the year of the London Exhibition, the journey between London and Paris was made in $9\frac{1}{4}$ hours, though round by Redhill, thirteen miles longer than by the present Sevenoaks route, besides halting at Redhill or Tunbridge, with poorer steamers and harbours, and an omnibus transit through Boulogne. And there were two day tidal trains, and one before and one after breakfast, instead of one as at present. Query, ought credit to be taken for improvement? As the third class question had been introduced, he once heard a gentleman of Bristol say at a Great Western meeting, "You make a great mistake in dividing mankind into three classes, there are only two—people who can pay, and people who cannot; these latter will incline to the

cheapest way." They form the great mass of mankind. Why not then take a good omnibus class and rate as the standard, with such other classes as circumstances required? As to the Midland Railway and its supposed innovation of two classes only; there was no inherent necessity for three. Till a comparatively recent date, there were many trains with only two first and second, or first and third, or again, first and second with long distance third class passengers travelling in the second class carriages; in other words, the same carriage, but with different tariffs for local and through passengers. Government, with its want of elasticity, managing the railways would be a mistake; not even the evils of reckless competition would be outweighed by a Government doing, as would be likely, not what was wanted, but what it fancied ought to be wanted. In India Government had trains run right through all night long in some parts, regardless of its not paying, and being contrary to the known habits of the people. As to the lighting of trains alluded to, electricity may obviate this, and save both time and money: in the Pullman trains between London and Brighton the whole train was in a moment lit up only just while going through the tunnels.

The PRESIDENT, in proposing a vote of thanks to Lieutenant Willock for the very able paper he had read, said he was sure that the Society was much indebted to the author for the labour which he had spent upon the paper, and also to Mr. Foxwell, who first took up the subject. The Society, and through the Society, the public, had been placed in possession of a great amount of information as to the improvement in the means of communication during the last twelve or thirteen years. One result of bringing such a novel subject before the Society had been that comparatively few of the members who usually took part in the discussions had been prepared to speak upon it. They had to accept the conclusions of Mr. Willock and Mr. Foxwell, without being in a position to criticise them. One or two gentlemen such as Mr. Price Williams and Mr. Findlay, who were experts in the matter, were quite competent to discuss it; but the greater number must confess that they were not acquainted with the subject of the speed of express trains. Still, so far as they could judge from the arrangement of the paper, it was really a most excellent contribution to statistical study, and he was quite sure from the method which had been followed, and the care exercised, that the facts were to be depended upon, and the conclusions to be trusted. The discussion also had given them a great amount of information as to the improved means of railway communication during the last twelve years; and Mr. Findlay and Mr. Webb were especially to be thanked. He did not propose to thank Mr. Price Williams in the same special way, because the members of the Society were well acquainted with him, and knew the services he had rendered. He did not intend to dwell upon the subject under discussion, but only to say one word in recognition of the fact that the railway companies of this country had done a great deal in a short period to improve the means of

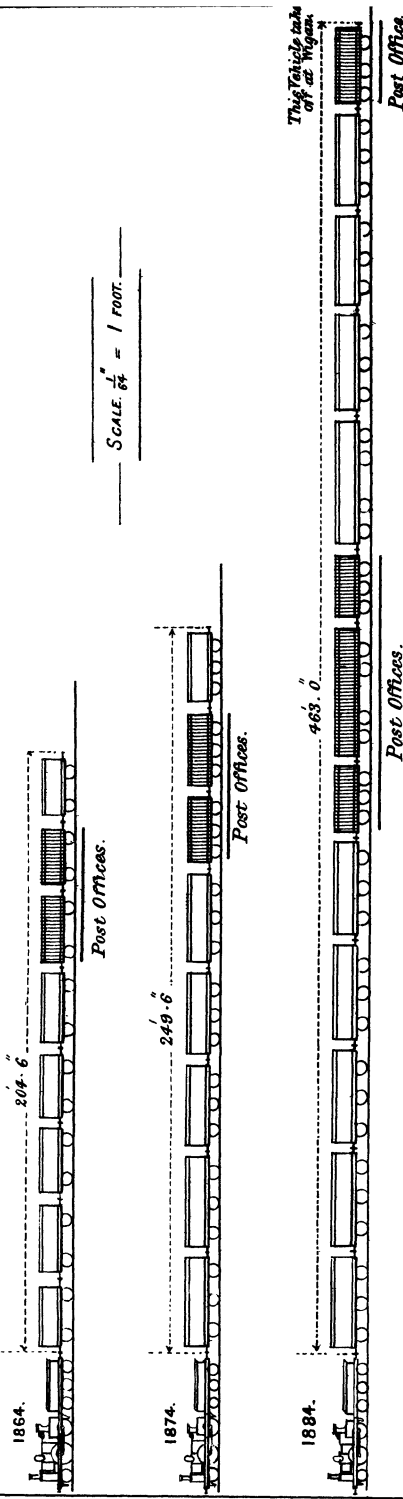
communication. There could be no doubt that this improvement was a great civilising influence. The trade of the country, and its education (using the word in its larger sense), had both benefited by it, and the improvement had in fact been so great that the England of twelve or thirteen years ago could hardly be recognised as the England of the present time. The services which railway managers and chiefs had rendered to the country were so great, that they ought to be fully recognised in all discussions on the subject. Whatever complaints were made from time to time, with more or less justice, by different classes, it must at least be acknowledged that in the matter of express service an enormous improvement had taken place, and he believed that no other country in the world derived such advantage from its railway system as this country, in the way of accommodation to the public.

Sir R. W. RAWSON said, if Mr. Findlay and Mr. Webb would give to the Council the tables from which they quoted, they would form a very valuable appendix to the paper.*

Lieutenant WILLOCK, in reply, thanked the Society for the very kind way in which the paper had been received. With regard to Mr. Price Williams's remarks, that he had said but little about the complete arrangements of traffic, &c., which affected the speed of trains, he had only attempted to deal with the parts of the subject that an outsider could obtain knowledge of; the other points could only be properly treated by a person who had a practical knowledge of the working of railways. With regard to the conveyance of third class passengers by fast trains, he had looked at an old "Bradshaw" of 1871, and he noticed that they were carried by more fast trains on the northern than on the southern and western lines. He thought it would be a very bad thing indeed for the country if all the railways were managed by one body. The Paris and Lyons Railway had a monopoly from Paris and Marseilles, and they only ran two good trains during the day, both for first class passengers only, and even these were not really fast trains according to our ideas, as their journey-speeds were only about 36 miles per hour. Third class passengers took about twenty-two hours on the road, the speed being under 25 miles per hour. He could scarcely agree with Mr. Foxwell that all stoppages could be reduced to one minute, for passengers needed refreshment.

* Mr. Findlay in accordance with this suggestion has kindly furnished the Tables II and III in the appendix to this discussion, and the accompanying Diagram.

DIAGRAM SHEWING THE LENGTH AND WEIGHT OF THE LIMITED MAIL TRAIN IN 1864, 1874, 1884



	1864	1874.	1884.
LIMITED MAIL	LIMITED MAIL	LIMITED MAIL	LIMITED MAIL.
Total length of train over all not including engine	204' 6"	249' 6"	463' 0"
Number of Carriages	8	8	13
Average length of each carriage over buffers	25' 6 $\frac{3}{4}$ "	31' 2 $\frac{1}{2}$ "	35' 7 $\frac{1}{2}$ "
Total weight of train not including engine	T. C. qrs. 54 19 I	T. C. qrs. 75 3 3	T. C. qrs. 165 4 I
Average weight of each carriage	T. C. qrs. 6.17 I Q	T. C. qrs. 9 8 O O	T. C. qrs. 12.14 O 19

Harrison & Sons. Lith. S. Martins Lane. W.C

APPENDIX to DISCUSSION on LIEUTENANT WILLOCK'S PAPER.

TABLE I.—Passenger Traffic, 1871-82.

	London and North Western Railway.			Midland Railway.			Great Northern Railway.		
	Number.	Increase. Per cent.	Amount. £	Number.	Increase. Per cent.	Amount. £	Number.	Increase. Per cent.	Amount. £
1st Class—									
1882	2,492,707	Per cent.	553,183	1,901,645	Per cent.	297,434	952,720	Per cent.	179,566
'71	2,739,777	Decrease.	310,306	1,149,450		205,470	833,558	Decrease.	210,917
		— 9'02		753,195	65'42	91,964	129,162	15'68	31,351
Decrease	247,070					(abolished)			
2nd Class—									
1882	4,096,420		398,130				2,070,408		125,060
'71	5,746,506		391,759				4,004,808		323,121
Decrease	1,650,126	— 22'72	6,371				1,984,400	Decrease.	200,061
								— 93'43	— 61'54
3rd Class—									
1882	45,556,133		2,166,422	28,648,480		1,490,939	20,850,060		834,416
'71	5,861,294	Increase.	334,773	17,940,895	47'60	1,063,304	6,032,265	Increase.	802,079
		673'23		10,707,595		427,625	14,317,795	237'35	532,337
Total Passenger Traffic and Mails—									
1882									
'71									
Total Goods and Minerals—									
1882									
'71									
Miles Open—									
1882	1,775			1,375			772		
'71	1,514½			989			544		
				386	39'03		228	42	
	260½								

TABLE II.—*Passenger Train Mileage and Earnings per Train Mile on London and North Western, Midland, and Great Western Railways from 1871 to 1883, the Results in each case up to the end of 1882 being based upon the adjusted Figures shown in the Statements of Accounts of the respective Companies published in subsequent Half Years.*

Railway.	Passenger.			
	Half-Year ending 30th June.		Half-Year ending 31st December.	
	Train Mileage.	Earnings per Mile.	Train Mileage.	Earnings per Mile.
<i>London & N. Western—</i>		<i>s. d.</i>		<i>s. d.</i>
1871	6,213,654	4 5	6,657,675	5 2½
'72	6,640,852	4 6½	7,120,140	5 1½
'73	6,866,227	4 8½	7,414,981	5 3½
'74	7,045,587	4 9½	7,416,706	5 4½
'75	7,207,701	4 8½	7,721,634	5 2½
'76	7,413,254	4 7½	8,045,701	4 11½
'77	7,798,489	4 4½	8,224,436	4 11
'78	7,830,086	4 4½	8,315,277	4 11
'79	7,766,157	4 2½	8,321,025	4 8
'80	8,002,673	4 2½	8,700,221	4 7'418
'81	8,308,331	4 0'994	9,058,191	4 6'360
'82	8,598,244	4 2'003	9,389,561	4 5'975
'83	8,969,727	4 1'172	9,796,002	4 5'557
<i>Midland—</i>				
1871	3,662,160	3 4½	3,783,642	4 1
'72	3,600,321	3 8½	3,605,936	4 6
'73	3,334,205	4 5	3,609,373	4 11
'74	3,423,539	4 7	3,775,170	4 11½
'75	3,707,026	4 6½	4,148,494	4 9½
'76	4,136,421	4 3½	4,721,613	4 6½
'77	4,486,079	4 1½	4,869,910	4 4½
'78	4,563,111	4 1½	5,057,065	4 3½
'79	4,680,828	3 9½	5,352,130	3 11½
'80	5,291,322	3 6½	6,290,723	3 6'603
'81	6,022,486	3 2'296	6,567,845	3 6'373
'82	6,159,417	3 4'530	6,638,928	3 7'009
'83	6,258,604	3 3'739	6,846,796	3 6'764
<i>Great Western—</i>				
1871	3,980,935	5 3½	4,143,212	5 3
'72	4,141,162	5 4	4,408,118	5 2½
'73	4,374,420	5 3	4,454,349	5 5½
'74	4,388,589	5 6½	4,647,916	5 4½
'75	4,556,120	5 5½	4,797,727	5 3½
'76*	6,068,762	5 3½	6,090,137	5 2½
'77	6,028,350	5 2	6,152,772	5 2½
'78	6,240,485	5 ½	6,431,682	4 11½
'79	6,200,715	4 10½	6,384,180	4 11½
'80	6,487,360	4 11	6,715,039	4 9½
'81†	5,434,756	4 7½	6,988,102	5 1'505
'82	6,661,723	4 8'427	7,123,721	5 1'778
'83	6,881,768	4 7'220	7,416,389	5 1'182

* Great Western absorbed Bristol and Exeter, South Devon, and other lines.

† Great Western half-yearly accounts which had previously been made up to January and July, now made up to June and December.

TABLE III.—*Passenger Receipts of London and North Western, Midland, and Great Western Railways.*

Statement showing Increase or Decrease of Year 1882 over Year 1874.

	London and North Western.		Midland.		Great Western.	
	Increase.	Decrease.	Increase.	Decrease.	Increase.	Decrease.
Miles constructed	1744	—	417½	—	714	—
Passenger train mileage	11	—	36½	—	46½	—
Earnings on excess passenger mileage, 1882 over 1874 }	24½	—	74½	—	53½	—
	1s. 3'72d.	—	1s. 9'842d.	—	3s. 10'45d.	—
Number of passengers and receipts—						
1st class passengers.....	—	640,479	—	—	—	117,652
" receipts.....	—	£210,298	—	—	—	£58,948
2nd class passengers	—	2,093,213	—	—	2,734,971	—
" receipts.....	—	£166,397	—	—	£203,250	—
1st and 2nd class passengers	—	2,733,692	—	2,067,680	2,617,319	—
" receipts	—	£376,695	—	£122,488	£144,302	—
3rd class passengers.....	32½	—	—	—	15½	—
" receipts.....	25½	—	—	—	44	—
	11,226,246	—	7,292,701	—	11,512,629	—
	£439,826	—	£465,648	—	£582,964	—
Total passengers of all three classes	19½	—	21½	—	42	—
	8,492,554	—	5,225,021	—	14,129,948	—
Total receipts from all three classes	2	—	24	—	34½	—
	£63,131	—	£343,210	—	£727,266	—

Note.—These figures exclude receipts from season tickets, parcels, mails, &c., in each case.