What were the investment dilemmas of the LNER in the inter-war years and did they successfully overcome them?

William Wilson MA TPM

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Front cover: Although the LNER's express passenger services were successful commercially, in particularly the *Silver Jubilee* (page 27), did the company put too much stress on its passenger services rather than the much larger goods traffic side of the business? The "Silver Jubilee" is seen leaving King Cross station behind A4 class 4-6-2 No. 2510 *Quicksilver* around 1935. HMRS Hemingway Collection, photo ABJ030

Rear cover: Electrification of the goods traffic on the Manchester–Sheffield–Wath lines happened eventually but the investment was too late to benefit the company (page 19). Seen are three of the Bo-Bo locomotives built for the route, in BR days and numbered in the early BR scheme as 26033, 26012 and 26010. HMRS John H Hills Collection, photo ABB767

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SOURCES AND ACKNOWLEDGEMENTS

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Considerable use was made of the railway records in The National Archives at Kew: the primary source of original LNER documentation. Information was obtained from Hansard, the National Records of Scotland, University of Glasgow Archives Services, National Railway Museum (NRM) and Great Eastern Railway Society (GERS). Use was made of contemporary issues of *The Railway Magazine*, *Railway Gazette* (NRM), *The Economist*, *LNER Magazine* 1927–1947 (GERS) and *The Engineer*.

A literature review was undertaken of relevant university thesis and articles in academic journals: together with articles, papers and books written by historians and commentators on the group railway companies.

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The responsibility for any remaining errors or omissions, and for all expressions of opinion, is the author's alone.

1. Introduction

THE PAPER INVESTIGATES reasons why the LNER made capital investment decisions. An examination of the company's struggle with financial stringency and necessary attempts to reduce costs forms part of the review.

The railways in the interwar years found it difficult to finance capital expenditure in the conventional way. As a result of the deficit on capital account and adverse trend of earnings, the LNER could not raise significant fresh capital on the market. This included rights issues. Rights issues were known as "further issues" until 1945, when pre-emption rights were established (a contractual clause giving a shareholder the right to buy additional shares in any future issue of the company's common stock before the shares are available to the general public).

As a consequence, railway companies resorted to sources other than the capital market to finance investment. These included loans from government bodies such as the Railway Finance Corporation, land sales, the realisation of non-railway investments, and the use of liquid surpluses in superannuation funds.

The arbitrary apportionment of working expenses to operating functions by the LNER presented particular difficulties about assessing capital spending and its impact on net revenue. The treatment of maintenance and renewals expenditure meant that railway accounts were "highly complicated" and difficult to interpret.[1]

Railways companies had a poor understanding of their costs. Whilst most companies are interested in maximizing their profits, railway companies usually sought relief from their problems primarily through reduction of total costs rather than increase of revenue. Being unaware of costs, meant that in general the railways had a poor idea of both how to cut costs and the relative profitability of cost-reducing investment.[2]

The LNER chiefly used return on investment to assess proposals for capital projects based on predicted savings in working expenses as a percentage return on net outlay. They considered no other criteria, such as life of the scheme, accurate timing of expected savings or discounted values, although new methods of control intended to improve return-on-investment calculations were being developed by railway managements in the United States.[3]

Much of the LNER investment was with government assistance. The only source of significant new money was the New Works Programme (NWP) 1935–40.

As part of the review the paper also examines the Chief Mechanical Engineer's approach to locomotive policy and the new build and re-build locomotive programmes. It also attempts to show that financial and investment considerations were not the only factors significantly restricting locomotive policy and that other constraints arose from technical and engineering differences. As far as possible these themes are related to LNER capital investment decisions.

The book is structured as follows. The next section discusses the progress of the railway companies between the Wars. There follows a section focused on the fundamental decline in earning power of the railway business. The next part explores the dire financial position of the LNER and its impact on investment. Attention is then focused on the investment performance of the LNER, including the NWP and the Grimsby Fish Dock. Next, there is an exploration of the approach the LNER took to electrification. It is followed by an examination of the impact the London Passenger Transport Board had on the LNER, an unfulfilled investment opportunity. The penultimate section focuses on the disputed topic of LNER Locomotive investment and the final section makes some concluding remarks and draws a few conclusions.

2. Overview of the railway companies between the Wars

AFTER 1918, THE government neither maintained the status quo nor nationalised the railways. Instead it pursued a middle way of regionalisation under private ownership. From 1 January 1923, under the Railways Act, 1921 the undertakings of 123 separate railway companies were amalgamated intact into one of four new regional monopolies. This prevented the insolvency of some of the smaller companies whose finances had been severely undermined by World War 1.[4] [5] [6]

Expenditure by the railway companies increased significantly between 1913 and 1920. The largest part of this increase resulted from wages concessions and the introduction of the eight-hour day.

The Act provided for "the reorganisation and more efficient and economical working of the railway system". From the point of view of management control this was the most important aspect of the 1921 Act and was the criterion by which the performance of the railways was to be judged.[7] [8] In fact the railway companies had an obligation to convince the Railway Rates Tribunal they were practising "efficient and economical working". The Railway Rates Tribunal, however, consistently concluded in its Annual Reports that there was no lack of either efficiency or economy in the management of the railways, although without disclosing on what basis these assertions were made. Nor was there any suggestion that a formal enquiry should be made into the management of any of the railways, despite their variations in practices.[9]

A different perspective on the Railway Rates Tribunal was recorded in 1935: Lord Stamp, President of the London Midland and Scottish Railway (LMS), told shareholders:

"There does not appear to be any likelihood of any further large scale outlay in the immediate future. We have a statutory obligation to show annually to the Railway Rates Tribunal that our affairs have been carried out with efficiency and economy and any new outlay for electrification must comply with that test."

The government paid £60 million including interest, but before taxes, in satisfaction of claims made by railway companies for compensation under the Regulation of the Forces Act, 1871 or the Ministry of Transport Act, 1919 arising from the possession of the railways by the Crown. The part allocated to LNER constituent companies was £18 million.[10]

The 1921 Act provided for rates and fares to be fixed at a level which gave the railway companies a "standard revenue" approximately the free net revenues of constituent and subsidiary companies of each amalgamated company in 1913 (the year referred to in Section 58 of the Act) with certain allowances for unproductive capital and capital expended since 1913.[11] A Railways Rates Tribunal decided all rates, not merely maxima as previously. There were fundamental weaknesses in the capital structure and financial performance of the railway companies. Railway profitability was weak, and never reached the "standard revenue" (net revenue) of £51.4 million.

The growth in road competition and the inability of railway companies to compete effectively, particularly with road haulage during the 1920s and 1930s, greatly reduced revenue available. Railway companies accused the government of favouring road haulage, while restricting its ability to use flexible pricing because it was held to nationally agreed rate cards (decided by the Railway Rates Tribunal). The railways were under an obligation to act as common carriers, to publish their rates, to avoid undue preference and to charge according to the value of each commodity rather than the cost of handling it.[12]

A Royal Commission on Transport criticized the lack of organization and wasteful competition within the road haulage industry.[13] In 1932, a Ministry of Transport Conference recommended a licensing system to regulate and control entry to the industry.[14] The Road and Rail Traffic Act, 1933 established a differential licensing system for operators.

The economies of scale envisaged by the 1923 amalgamations, in accordance with the general trend in outside industry at the time, were never fully realised. Little progress was made in eliminating duplicated routes and stations.

To reduce the value of loans from the USA granted during World War 1, the David Lloyd George coalition government took measures to drive down the level of prices (deflation). The pound was revalued in 1920 (gold standard rate: the pound actually returned to the gold standard in April 1925), while prices roughly halved, achieved by raising interest rates to unprecedented peacetime levels. By 1922 most of the revaluation, and the price fall, had been achieved, with a devastating impact on industrial output as a result of strikes, mainly in the coal industry, and employment. Deflation in fact continued until 1934.[15]

The railways entered a period of decline, in part attributable to the developments in the overall economic history of the UK, including the decline of the Victorian staple industries and particularly the General Strike of 1926 (involving about one-quarter of Britain's organised work force) together with the depression of 1929–1933. Lack of investment and changes in transport policy also played a part. The control of monopoly, obligation to carry and statutory control of rates were fundamental examples of legislation not keeping pace with economic realities.[16]

3. Diminishing Earnings Power

THE RAILWAY UNDERTAKINGS of the four groups had absorbed more and more capital but this investment had only checked the fall in earnings. Fixed-interest securities of the group companies (the bulk of their capital) tended to absorb all, or nearly all, of net revenue. Reserves fell from 10.6% of capital employed in 1922 to 5.3% in 1932, and overall in 1921–39 interest and dividend payments (£760 million) far exceeded net railway revenue (£600 million).[17]

Between 1929 and 1938 gross receipts of the four group railway companies fell by 12.1%, compared with an improvement of 6% in *The Economist* index of Business Activity.[18]

By the end of the 1930s capital investment was significant, but a large part was for the LNER suburban electrification under the London Passenger Transport (Agreement) Act, 1935 (see London Passenger Transport Board).[19] Further investment was required for the modernisation of systems but this was needed when the deficit on capital accounts and the adverse trend of earnings precluded the raising of substantial fresh capital on the market. In 1926 the deficit on the LNER capital account was £20.6 million, by 1928 it had reduced to £14.1 million as the result of an issue of preference stock.

By 1938 the deficit had increased to about £22.5 million, as capital expended increasingly exceeded capital raised on the market.

There were good grounds for regarding the railways as over-capitalised by reason of inflated expenditure on their construction, and because of irreversible decline in the earning capacity of their assets by the 1930s.

According to the *Accountant* the "present and prospective earning powers of the British railways are inadequate for the payment of any dividends on a large and increasing proportion of the capital structure".[20] Commentators argued that reducing the nominal value of the shares to a figure justified by current earnings was a solution to the poor percentage return on capital by the railway companies. The LNER's net revenue in 1932 was 37% lower than 1923, primarily as a result of the recession in the late 1920s and early 1930s.

Writing down the capital and asset values, would have improved the apparent rate of profitability, but also weakened the management's hand in its twin campaigns to cut the (relatively) generous pay and conditions that their employees had achieved after World War 1 and the "unfair" regulatory regime within which it worked.

The railway companies mounted a "square deal" campaign in 1938. Behind the campaign was the ineffective attempt of the railways, since 1929, to achieve the removal of remaining restrictions on pricing and equal terms with the road carriers. The consequences of that failure involved a continuous loss of highly remunerative traffic to road haulage. The possibility of the government introducing any reforms was prevented by the outbreak of World War 2.

According to *The Economist*, if all parts of railway operating had been conducted with the same relative success as the passenger business during the late 1920s and 1930s, then this would have resulted in improved overall results. There are two principal means of combating the continued loss of short-distance traffic to road haulage and the increasing radius of road haulage services: improving the loading of freight trains and wagons; and increasing the work obtained from locomotives. Apart from the LMS there was no improvement in the freight train load between 1929 and 1937: the LNER showed an appreciable reduction.[21]

Table 3.1: Deficit on LNER Capital Account

	1926		1928	
	£	£	£	£
Total capital expended		342,986,348		342,415,454
Issued Stock	221,972,483		221,972,483	
Debentures and Loans	91,709,300		97,722,199	
Premiums on Stock and Debentures	7,615,790		7,369,212	
Miscellaneous Funds	1,022,400		1,179,750	
Deficit	20,666,375		14,171,810	
	342,986,348	342,986,348	342,415,454	342,415,454
Source: LNER Report & Accounts				

4. LNER Financial Position

IN THE YEARS prior to World War 1 British railway companies were generally not well managed. Some managers continued railway employment into the 1920s and this was probably reflected unfavourably in the performance and culture of group companies. The North Eastern Railway (NER) was the best-managed railway company before the grouping (the top performer in cost inefficiency and productivity growth), but it is difficult to gauge what influence managers formerly with the NER had on LNER operation and systems.[22] The NER produced a third of LNER net revenue. Ralph Wedgwood, appointed Chief General Manager (CGM) of the company (acting as Chief Officer), was formerly General Manager of the NER. He was the main influence in uniting the LNER into a group. Wedgwood retired on 3 March 1939 and was succeeded by Charles Newton formerly Chief Accountant and then Divisional General Manager, Southern Area, LNER.

The assets of 33 railway companies (seven constituents and 26 subsidiaries) were transferred to the LNER with effect from 1 January 1923. The stockholders received LNER stock in exchange for their holdings. The constituent and subsidiary companies were then wound-up.

The high level of debentures and fixed dividend prior charges was a problem for the LNER throughout its existence. Fixed-interest securities represented 90% of the capital at 1 January 1923, significantly higher than the three other railway companies.

The LNER was the weakest of the railway companies owing to its reliance on serving heavy industry in the North East (coal, iron and steel, shipbuilding), inherited from the NER and from Lancashire across to Humberside, originating from the Great Central Railway (GCR) (coal). The company earned two-thirds of its revenue from freight services. The General Strike and protracted stoppage in the coal industry in 1926 had a disastrous effect on traffic receipts, with gross receipts down 16.7% and net receipts 63.8% compared with 1925.[23] Competing with road haulage was hampered by the inherent low productivity and high costs of many of the operating methods used by the LNER. The company inherited a higher proportion of secondary and branch lines returning little or no profit than any of the other three groups.

Only for 1923 were full dividends paid, and although those due on the guaranteed stock were met in every subsequent year, dividends on the preference and other more junior stock followed the year by year fortunes of the company. The company paid no dividend on its Deferred Ordinary stock after 1925. There were several occasions when reserves were drawn upon to maintain a payment on the Preferred Ordinary stock. At the 1932 AGM, however, William Whitelaw LNER Chairman, announced that no further transfers from reserves could be made for the purpose of paying dividends, in view of the insufficiency of net revenue. The auditors in issuing the certificate on the accounts (for several years) withheld their endorsement of the adequacy of the provisions for renewals. It is likely this influenced the Board in making their decision.

Table 4.1: LNER Revenue and Expenditure 1923–38: Railway Business

	(A) Traffic receipts (£m)	(B) Traffic expenses (£m)	(C) Net Revenue (£m) (A – B)	(D) Operating ratio (%) (B/A)	(E) Income from other sources (£m)	(F) Total net income (£m) (C + E)
1923	61.3	50.1	11.2	81.7	2.8	14.0
1924	59.8	50.5	9.3	84.4	2.4	11.7
1925	58.2	50.1	8.1	86.1	2.0	10.1
1926	48.6	45.6	3.0	93.8	1.6	4.6
1927	59.4	48.9	10.5	82.3	1.7	12.2
1928	54.1	43.3	10.8	80.0	0.5	11.3
1929	55.6	43.3	12.3	77.9	0.7	13.0
1930	52.4	41.9	10.5	80.0	0.7	11.2
1931	47.2	38.2	9.0	80.1	0.4	9.4
1932	42.7	35.7	7.0	83.6	0.2	7.2
1933	42.7	35.2	7.5	82.4	0.2	7.7
1934	44.9	36.9	8.0	82.2	0.3	8.3
1935	45.1	37.1	8.0	82.3	0.4	8.4
1936	46.9	38.2	8.7	81.4	0.4	9.1
1937	49.1	39.5	9.6	80.7	0.5	10.1
1938	46.6	40.5	6.1	86.9	0.6	6.7
Source: LNER Annual Accounts						

5. LNER Investment Performance

LNER POLICY WAS to confine capital expenditure to projects of modest size producing a high return, consisting mainly of savings in cost rather than increases in revenue. Wedgwood felt that a 10% return was required before new works were justified.[24]

Shareholders frequently argued that further capital expenditure should be avoided until such time as dividends could be improved on existing stocks.[25] In the *Railway Gazette* Whitelaw claimed that "without the large sums spent on capital expenditure…, a considerable part of the reductions in (operating) expenditure would have been impossible."[26] This is somewhat disingenuous: up to 1930, about £12 million gross had been spent on capital works, but of the reduction of £9.8 million in operating costs since 1923, most was due to falling traffic, and only about 15% could be attributable to benefits from new investment.[27]

An LNER annual capital programme was drawn up, together with a projection for the future. A New Works section within the CGM's department examined and progressed major projects, some of which required Parliamentary approval. A pipeline was maintained, from which projects were selected for inclusion in the forward capital programme. A forecast of expenditure for one year ahead, and for later years, was published in the Annual Report; but rarely was the forecast matched by achievement. This was due to a combination of inaccurate planning and enforced delays in putting the work in hand, either for technical reasons or because of a need to postpone expenditure.[28]

From 1930, a form of revenue budget was also prepared which consisted of a system known as the 'ration', and was used to indicate limits on expenditure for the spending departments. In most years a detailed programme of expenditure was compiled for each category of rolling stock, but this made no distinction between capital and revenue; nor did the programmes coincide with financial years.[29]

LMS budgetary control was very efficient. The cost analysis of the group companies reported in the 1938 published accounts did not separate savings achieved in net expenditure resulting from reduced working from those expected to be permanent, irrespective of the volume of traffic. In *The Economist's* opinion it was an increase in gross receipts, rather than the temporary savings in costs, that stockholders needed to turn for actual recovery.[30]

Funding of new rolling stock construction was mainly provided from the renewals account, and only in exceptional cases was money appropriated from capital.

Table 5.1: LNER Activity 1923–38: Whole Business (arising from all sources)

Year 31 December	(a) Paid-Up Share Capital (£million)	Net Capital Expenditure (£)	Gross Receipts (£)	(c) Net Receipts (£)	Compare (c) to (a) (%)
1923	252.95	767,835	67,026,326	14,047,220	5.6
1924	259.41	1,293,576	65,250,201	11,717,667	4.5
1925	259.41	694,285	63,546,727	10,129,063	3.9
1926	259.41	1,810,347	53,460,471	4,636,877	1.8
1927	259.41	383,381	64,830,609	12,184,477	4.7
1928	259.41	580,667	61,423,959	11,277,759	4.3
1929	259.41	699,102	63,295,455	13,061,250	5.0
1930	259.41	2,835,971	59,825,408	11,168,749	4.3
1931	259.41	1,210,089	53,828,366	9,424,609	3.6
1932	259.41	1,054,131	48,678,699	7,166,857	2.8
1933	259.41	727,148	48,789,284	7,723,119	3.0
1934	259.41	1,256,949	51,376,256	8,348,146	3.2
1935	259.41	220,406	51,818,934	8,371,372	3.2
1936	259.41	182,461	53,943,907	9,141,395	3.5
1937	259.41	852,905	56,430,244	10,107,442	3.9
1938	259.41	3,160,655	53,565,814	6,653,167	2.6

The capital investment compared to gross receipts underlines the extent to which the level of capital investment depended on government assistance.
Source: LNER Annual Reports and Accounts

The costs of renewal, maintenance and running the locomotive fleet formed the LNER's second largest area of functional expense. The 1923 Accounts, for example, show these costs amounted to 26.47% of traffic receipts, whilst traffic expenses were 27.8%.

The LNER needed to earn £14.5 million per year in total net revenue, increasing slightly year on year, to pay full dividends. To have achieved this regularly would have enabled the company to raise money on the market. Alternatively, a further £l million in net revenue would have enabled a substantial amount of investment to be self-financed, without the risk of excessive depletion of reserves. It was not achieved, however, and capital expenditure was limited to that funded by renewals funds and government assistance.

LNER Investment in the 1920s

Despite the adverse trading conditions from which the LNER suffered in the 1920s, rolling stock investment during the period was comparatively high, the 1923 Rolling Stock Renewal Programme being representative. Once the Programme had been completed, the Chief Accountant produced a report in January 1926. The underspend comparing actual expenditure with the authorised estimate was £280,363, but after taking into account cancelled orders of £152,605 the net underspend was £127,758 or 3.7%.

The 1924 Rolling Stock Renewal Programme was larger at £5.37 million.

Construction of new passenger vehicles

414 vehicles built in company's own workshops
290 vehicles for London suburban services built by contractor
704 vehicles Expenditure £1.7 million
Over 500 vehicles were broken up.

Locomotive Programme

104 engines built in the company's workshops
20 4-6-2s built by North British Locomotive Co. Ltd
12 4-4-0s built by Kitson & Co. Ltd
12 4-4-0s built by Sir WG Armstrong, Whitworth & Co. Ltd
125 Robinson O4 2-8-0s from Railway Operating Division. Cost £250,000
(See Gresley's Locomotive Policy)

273 locomotives. Cost £1.27 million

Wagon-building Programme

11,750 vehicles built in the company's workshops
80 refrigerator vans built by contractor
300 goods brake vans built by contractor

12,130 wagons Cost £2.4 million
Total £5.37 million

(Source: *Railway Magazine*. January to June 1924, pp, 149, 150)

Mechanised Marshalling Yard at Whitemoor

During the 1920s LNER investment included facilities to speed up the distribution of freight. The LNER opened Britain's first mechanised marshalling yard at Whitemoor. Work began in 1925 with the Up Yard being completed in 1929 at an estimated cost of £259,596. The Down Yard was added in 1933.[31] The CGM stated that congestion at that point was costing the company £95,000 a year, and the new yard would enable this to be cut by a third, giving a 12.4% return on the investment.[32]

New Goods Depot and Warehouse at East Smithfield

A new goods depot and warehouse at East Smithfield, estimated cost £176,679, was opened in 1929. It was thought that additional revenue of £33,000 would be generated, of which half would be needed to cover expenses. The balance, together with savings of £2,500 in handling costs, gave the required 10% return.[33] [34]

Railway depots could form clusters in certain locations, as each competing company wished to ensure it had a share of the trade. An instance was the concentration of depots on the final stretch of the GER line running into the Fenchurch Street area. Within less than a mile, there were six depots, including GER East Smithfield (first opened 1864).[35]

The new LNER East Smithfield depot and warehouse was intended exclusively for the handling of butter, bacon and similar produce from the continent. It was a three storey building located in the heart of the London produce market area.

Loaded wagons arrived on the middle floor of the warehouse. Traffic intended for immediate delivery to the City was lowered through shafts to the floor below, where it was transferred to waiting motor trucks. Traffic for storage passed to the floor above by electric lifts. This method of operation simplified handling and reduced working costs.[36] Smithfield Goods closed on 30 July 1962.

Table 5.2: Actual Expenditure on 1923 Rolling Stock Renewal Programme

	Shops	Contract	Total	Net authorised	Saving
	£	£	£	£	£
Locomotives*	446,526	1,000	447,526	499,210	51,684
Carriages	538,263	–	538,263	545,893	7,630
Wagons	1,650,891	687,893	2,338,784	2,407,228	68,444
Total	2,635,680	688,893	3,324,573	3,452,331	127,758

Source: RAIL 390/566
* Locomotives & tenders

Government assistance to the railway companies

Trade Facilities Acts

The Trade Facilities Acts were a series of Acts that were designed to alleviate the problem of large scale unemployment in the aftermath of the First World War. Acts were passed in 1921, 1922, 1924, 1925 and 1926 by four successive governments. The Acts enabled companies to borrow money, with the capital and interest guaranteed by the HM Treasury, for projects which would create employment.

The London Electric Railway took advantage of the assistance available under this legislation, as did the South Eastern and Chatham section of the Southern Railway. The Great Eastern Railway (GER) did not make an application. Recorded in Hansard are:

• Great Eastern Railway: although the Trade Facilities Committee was prepared to consider an application from the GER for assistance in raising capital for electrification of their suburban lines, the GER did not make an application.[37]

• London Electric Railway/City and South London Railway: the Treasury guaranteed the principal and interest of issues of debentures to be made by the London Electric Railway Company and the City and South London Railway Company up to a combined total amount of £5 million for the extension of the London Electric Railway from Golders Green to Edgware (completed 1924), the new link between Camden Town and Euston (reopened 20 April 1924), the reconstruction of the City & South London Railway (reopened throughout 1 December 1924) and new rolling stock and car sheds.[38]

• South Eastern and Chatham Railway: the Treasury expressed its willingness, on the recommendation of the Advisory Committee under the Trade Facilities Act, to guarantee the principal and interest of a loan of £6.5 million to be raised for electrifying the suburban service of the South Eastern and Chatham section of the Southern Railway, and for the erection of a power station.[39]

Otherwise Government assistance to the railway companies for investment came on three main occasions: Remission of Rail Passenger Duty, The Development (Loan Guarantees and Grants) Act, 1929 and the NWP.

Remission of Rail Passenger Duty

The government repealed Railway Passenger Duty in the Finance Act, 1929. The remission enabled the railway companies to undertake a programme of capital expenditure amounting to £6.5 million.[40] The amount assessed for the LNER was £1.5 million. The majority of the works had been completed by 1934 and the cost up to 31 December 1934 was £1,353,669.[41]

The LNER benefited from the additional up and down lines (6 miles 30 chains) between Gidea Park Junction and Shenfield (which opened in 1934) as part of the remission. The estimated costs were:[42]

	£
Works	593,838
Land and property	66,000
Signalling	46,437
Total	706,275

Table 5.3: Extract from Schedule of Schemes under Development (Loan Guarantees and Grants) Act, 1929. May 1930 to August 1931

No.	Description	Total cost (1) (£)	Amount qualifying for grant (2) (£)	Period from approval to commencement of works (months)	Duration of works (months)	Scale of grant (%)
1	Romford–Shenfield Widening	858,048	717,548	To be completed by 31 December 1933		1st 5 yrs. 5 2nd 5 yrs. 3½ 3rd 5 yrs. 1½
3	Whitemoor Marshalling Yard	351,074	277,176	5	24	1st 5 yrs. 5 2nd 5 yrs. 3½ 3rd 5 yrs. 1½
5	Temple Mills Marshalling Yard	108,192	45,695	1	15	1st 5 yrs. 5 2nd 5 yrs. 3½ 3rd 5 yrs. 1½
9	Ferme Park Marshalling Yard	75,580	50,750	3	15	1st 5 yrs. 5 2nd 5 yrs. 3½ 3rd 5 yrs. 1½
20	York main line widening	405,280	302,153	3	18	1st 5 yrs. 5 2nd 5 yrs. 3½ 3rd 5 yrs. 1½
23	Parkestone Improvements	481,000	429,305	6	30	1st 5 yrs. 5 2nd 5 yrs. 1 (3)

Source: RAIL 390/759

(1) Excluding interest during construction (2) Capital expenditure on works excluding land (3) Period of grant 10 years.

The annual additional maintenance costs were estimated at:

	£	£
Tracks	6,500	
Signalling	1,000	
Total		7,500
Less:		
Savings on closing of two signal boxes	940	
Saving of delay to freight trains	3,100	
		4,040
Net additional cost		3,460

The capital and maintenance costs were not included in the Shenfield electrification scheme (completed in 1949). Most of the work was undertaken during 1933 and, according to LNER 1933 and 1934 Accounts, cost about £600,000.

Development (Loan Guarantees and Grants) Act, 1929

The 1929 Act authorised the Treasury to subsidize interest on loans to the railway companies for development works made under the Act.[43] The group railways had to certify schemes in their submissions would not normally have been undertaken for at least three years, and, if carried out with government assistance, make every reasonable effort to complete the work within the period specified. Additionally, companies were required to guarantee that no part of their normal expenditure on development would be postponed by undertaking the grant-aided scheme.

All LNER works proposed to the government were approved and work commenced immediately. The total estimated cost of LNER schemes submitted to the Treasury 1930/31 was £3,479,728 (excluding interest during construction), whilst the amount ranking for grant (capital expenditure on works excluding land) was £2,725,947.

Schemes included widened lines between York and Northallerton and between Romford and Shenfield, together with improved freight facilities at Whitemoor, Temple Mills, Ferme Park and improvements at Parkeston Quay Ferry Terminal.

Widening between York and Northallerton, 1931 to 1933 (scheme 20)

18 miles of new running lines were constructed between York and Northallerton by widening the line in three sections:

- Skelton Bridge to Beningbrough, where widening, was undertaken on both sides. Length 3½ miles.
- Alne to Pilmoor- widening of down side only. Length 5 miles.
- Otterton to Northallerton, widened on both side. Length 3 miles.

The work also involved the construction of the grade separated Longlands Junction south of Northallerton.

As the same time colour light signalling was introduced from Skelton Junction (where the route to Harrogate diverges) to Northallerton. Semaphore signalling was abolished and a new box built at Thirsk, operated by switches.[44]

Returns of savings realised on new works completed under the 1929 Act were reported by Wedgwood to the Works and Traffic Committees held on 27 April 1933.

Table 5.4: Quarterly returns of savings realised on new works at 31 March 1933 (54 schemes)

Estimated Expenditure (£)	Actual Expenditure (£)	Total Estimated Savings (£)	Actual Savings and Additional Net Revenue (£)
122,857	114,617	29,041	31,637*
* Actual savings £29,182 plus actual additional net revenue £2,455 per annum, equal to 27.6% on actual expenditure. Source: TNA, RAIL 390/759			

As one of the key operating points in the Eastern Section, details for Bishop's Stortford were shown separately, although estimated and actual numbers were included in the return.

The scheme (No. 15) was accepted for a grant of 4½% for five years on a capital expenditure of £11,936. The savings in train delays exceeded the estimate by 1,065 hours, but although a rate of 15s (75p) per hour was adopted in the estimate, revised rates of 10/8d (53p) and 7/8d (38p) for delays up to 15 minutes and over 15 minutes, respectively, were applied to savings, resulting in a decrease of £67. The savings gave a return of 7.33% on the total expenditure, or 8% including the value of the government grant. The scheme was completed on 8 May 1931.

Table 5.5: Bishop's Stortford: Additional Sidings and Reconstruction of Signal Boxes

	£	£
Estimated expenditure	16,776	
Actual	17,619	(843)
Estimated savings	1,519	
Actual	1,291	(228)
Source: RAIL 390/942		

The LNER claimed that the remission of Rail Passenger Duty, government assistance under the 1929 Act and net earnings from the new works would provide sufficient revenue to cover the interest payable on new debenture stock that was issued.

New Works Programme

Details of the NWP were given in two announcements: on 5 June 1935 by Neville Chamberlain, Chancellor of the Exchequer, in a statement to the House of Commons (the London Passenger Transport Area) and 5 November 1935 to the press (the main line companies). Railway schemes under the New Works Programme fell into two categories: those to be financed by the Railway Finance Corporation Ltd (£26.5 million, 1935 prices) and proposals, confined

Table 5.6: Amount and Nature of Savings per annum for Bishop's Stortford

	Estimate		Actual	
	(£)	(£)	(£)	(£)
Train delays		1,745		1,678
Less				
Extra maintenance	226		342	
Increased classification*	0	226	45	387
		1,519		1,291
Add				
Interest @ 5 pa on payment value of grant receivable from government		119		119
		1,638		1,410
Source: RAIL 390/942 * Signal box				

to the London Passenger Transport Area (some joint with the LNER and Great Western Railway), to be financed by the London Electric Transport Finance Corporation Ltd (£40 million, 1935 prices). A large part of the government guaranteed loan available to the LPTB was for the Board to expand and improve the existing transport network.

On 5 November 1935 the government announced details of an agreement with the four main line railway companies enabling them to put in hand a programme of modernisation and improvements estimated to cost £29,500,000. The proposed works were additional to the ordinary railway programmes and could not have been undertaken at the time without the financial facilities arranged.

The Railways (Agreement) Act, 1935 empowered the Treasury to guarantee the principal and interest of a loan not exceeding £26,500,000 raised from a public issue of Guaranteed Debenture Stock by the Railway Finance Corporation Ltd (a company incorporated by HM Treasury). The proceeds were loaned to the railway companies. The balance required to complete the works would be provided by the railway companies from their own resources. The works were to be completed by the 1 January 1941.

The railway companies were required to apply to Parliament for the necessary statutory powers. In the case of the LNER this was the London and North Eastern Railway (General Powers) Act, 1936.

The Railway Finance Corporation Loan Act, 1935 provided the support for the NWP 1935–40 (the only source of new money in any amount), authorised by the Railways (Agreement) Act, 1935.[45] The Programme was intended to give the LNER substantial efficiency benefits, but most of the work ceased at the outbreak of World War 2.

£6,000,000 of 4% Debenture Stock was created by the LNER Act. As the LNER took down money from the Railway Finance Corporation Ltd it was required to charge the equivalent amount of debenture stock to the Corporation as collateral. An annual sum was set aside and invested and the securities (whether or not 4% Debenture Stock) arising from the investment charged in favour of the Railway Finance Corporation Ltd.

The main benefit of the Government Assistance Works Offer (Main Line Railways) to the LNER was that it was able to obtain debenture powers that might not otherwise have been available. The aim was that the Government Assistance Works would give an estimated return in excess of the interest to be paid on the money advanced.[46]

The level of Treasury finance was not dependent on whether the LNER charged the amount to capital or revenue and was advanced at approximately 3%, repayable in 20 years or at the option of the company 15 years.

The LNER capital expenditure would be met at the repayment date by an issue of stock at the best possible rate, whilst the revenue expenditure would be met by setting aside annually a sufficient amount to provide for the full cost in not more than 15 years (Sinking Fund).

Under the Government Assistance Works (Main Line Railways) scheme (New Works Programme) the LNER was awarded £5,929,811, repayable in 1951/52. The Board sanctioned works for estimated expenditure of £5,823,083. Its Programme was divided into two parts, which were considered separately. Electrification of the Manchester–Sheffield–Wath Lines (the Woodhead route) was by far the largest scheme (see Electrification). Much of the work ceased at the outbreak of World War 2.

Table 5.7: LNER New Works Programme 1935–40: LNER Memorandum 29 September 1937 Initial Numbers

Manchester – Sheffield Electrification		£	£
Estimated cost	Gross		2,568,945
	Net (Capital)	1,671,424	
Remaining items. Estimated cost			3,254,138
Total			5,823,083
Source: TNA, RAIL 390/979			

The LNER submitted the company's proposals to the Treasury for the NWP: these were approved in October 1935.

The Special Committee divided the schemes into eight categories:

1. Improving the movement of traffic: Schemes 7, 8, 9, 11, 14, 20 and 22.
2. Installation of up-to-date colour light signalling: Schemes 16 and 19.
3. Extensions of stations at York and Doncaster: Schemes 10 and 15.
4. Rolling stock: Scheme 1 and locomotives: Scheme 1 and 2.
5. Manchester- Sheffield Electrification: Scheme 6.
6. Fishing industry: Schemes 12 and 17.
7. King's Cross Frontage: Scheme 13.
8. Safety Arrangements- Track circuits, Automatic Train Control and converting lighting in bogie stock to electric: Schemes 3, 4 and 5.

Source: TNA, RAIL 390/1039

There were many schemes which Wedgwood decided not to put forward to the Special Committee.

Once tenders had been received for electrification works, it was clear these would considerably exceed the preliminary estimate. As the electrification scheme was still considered justified, other works were recommended by the LNER Special Committee to be either cancelled or modified amounting to £356,000. The revised estimates at 29 September 1937 together with progress and an indication of any changes to the proposals are given in the scheme descriptions.

Table 5.8: LNER New Works Programme 1935–40: LNER Memorandum 29 September 1937 Revised Numbers

	£
Manchester- Sheffield Electrification, say	3,000,000
Other works	3,366,000
	6,366,000
Money available	5,929,811
Excess of estimated expenditure over money available	436,189
Less works cancelled or postponed	356,000
Adverse balance remaining	80,189
Source: RAIL 390/979	

An estimate of the savings on the electrification scheme was made.

Table 5.9: Estimate of Savings on Electrification Scheme

Original estimate	£111, 011 pa, 6.64% on capital cost
Revised estimate—saving	£124,351 pa, 7% on capital cost as adjusted
Source: TNA, RAIL 390/979	

The savings take no account of the possible additional revenue arising from an increase in passenger traffic resulting from electrification of the Manchester–Sheffield route. The larger estimate of savings resulted from increases in the cost of coal and wages which inflated the cost of steam operation in comparison with electric operation.

Apart from electrification, other schemes included improvements to the fish docks at Hull and Grimsby, improvements to the ECML, the conversion of rolling stock from gas lighting, 162 new coaches and the replacement of 43 locomotives The latest estimated costs (in a few instances they are uncertain as available information is difficult to follow), amendments and cancellations are as reported in a memorandum dated 29 September 1937 (TNA RAIL 390/979), whilst earlier details are as given in the report and attached spread sheet dated 23 October 1935 (RAIL 390/1039).

Scheme 1. Additional carriage stock. Latest estimate £500,820 – completed

The proposal involved:	(£)
6 vestibule train sets each of 14 vehicles for East Coast services and 13 miscellaneous vehicles	296,660
35 open thirds and 30 other vehicles for general traffic in the three Areas 204,160	204,160
	500,820

This would all be additional stock and charged to capital. In 1935 there was a shortage of modern passenger rolling stock and passenger traffic was being refused.

Scheme 2. Replacement of Uneconomic Types of Locomotives. Latest estimate £288,500 – nearing completion (see Chapter 8. LNER Locomotive Investment, page 22)

Additional Scheme. Detonator Placers. Latest estimate £10,000 – machines ordered**.**

Scheme 3. Conversion of Gas-Lit Stock to Electric Lighting

Latest estimate £152,000 – completed.

Proposal was to convert all 593 gas-lit bogie vehicles (under 35 years old) to electric lighting. At 31 December 1934 the LNER had a larger proportion of gas-lit stock than any other company. The Ministry of Transport was pressing the LNER to convert stock from gas to electric lighting more quickly.

Scheme 4. Extension of Track Circuiting

Consideration had been given to the extension of track circuiting, particularly at more important and complicated junctions. The average speed and density of main line traffic was continually increasing and as a consequence there were a large number of junctions where track circuiting should be considered, although no report had been prepared.

Scheme 5. Automatic Train Control (ATC)

Costs of ATC were not as heavy as for track circuiting. It was estimated ATC could be adopted between Darlington and York for:

	(£)
Permanent way	13,000
Equipment for express locomotives, say	5,000
	18,000

It was considered that safety should be increased by a policy of introducing track circuiting and ATC over a period; a provisional allocation was proposed:

	(£)
Track circuiting	50,000
ATC (experimental)	50,000

Scheme 6. Electrification of Manchester–Sheffield–Wath Lines
The Manchester–Sheffield route was considered particularly suitable for electric working owing to the density of traffic.

Original/initial estimated Gross Cost	£2,500,000
Original/initial estimated Net Cost	£1,600,000

Financial case: The Special Committee estimated there would be a minimum saving in operating costs of £121,000 and further probable savings of £45,000, per annum, making a total of £166,000 per annum. This is a return of over 10% on the capital cost of £1,600,000.

Scheme 7. Modernisation of Colchester–Clacton–Walton Branch
Latest estimate £183,427 – work in hand. The work included: remodelling of Colchester Station, doubling about 4½ miles of single line between Thorpe-le-Soken and Clacton, provision of a crossing loop and new down platform at Frinton, together with additional sidings at Walton and extension of platform at Hythe, together with a run-round at Brightlingsea. There had been considerable traffic growth on the Clacton Branch and this seemed likely to continue if capacity was increased. Existing facilities were working to capacity during the summer and more capacity was needed.

Scheme 8. Modernisation of Shenfield–Southend Branch
Latest estimate £107,046 – work proceeding. The scheme included: remodelling of station, lengthening of platforms, additional carriage sidings, modernisation of locomotive depot and colour light signalling from Billericay to Prittlewell. Traffic on the Southend Branch was growing rapidly and increased capacity was needed. The provision of colour light signalling would reduce signalling costs by over £3,500 per annum.

Scheme 9. Modernisation of Felixstowe Branch
Latest estimate £126,536 – doubling postponed; station work completed. The branch was a single line of 14½ miles. The work proposed included: doubling the line between Westerfield and Felixstowe Town, provision of a new halt between Derby Road and Orwell, lengthening platforms and additional carriage sidings. Traffic was growing on the branch and increased capacity was necessary to accommodate the heavy holiday traffic available.

Scheme 10. Doncaster Station Improvements
Latest estimate £207,970 – work proceeding. Doncaster was the most congested point in the western section of the Southern Area, with 522 trains, in both directions, passing the Frenchgate Junction Box daily in summer. The scheme included additional platform accommodation, two additional running lines from the north end of the station through Frenchgate Junction to Marshgate and the complete remodelling of the signalling at and on each side of the station.

Scheme 11. Running Loops Grantham to Doncaster
Latest estimate £128,891 – Five loops postponed: work proceeding on 11 loops. Between Grantham and Doncaster, over 50 miles, there were just two running loops in each direction, at Dukeries Junction and Retford on the down line and Retford and Barkston on the up. These limitations caused considerable delays and additionally freight trains were restricted to 52 wagons. It was proposed to provide: new up and/or down independents, with associated changes to 10 points and colour light signalling between Grantham and Barkstone. It was predicted that the running loops would lead to net saving in train delays and mileage of about £7,000 per annum, the colour light signalling to net savings in operating and maintenance costs of £256 per annum: totalling £7,256 per annum or a return of 5.5% on expenditure.

Scheme 12. Grimsby: Additional Fish Quay Accommodation
Latest estimate £141,884 – work proceeding (see Appendix 4: Grimsby No. 3 Fish Dock, page 34).

Scheme 13. King's Cross Platform Barriers
Latest estimate £870 – completed. Remainder of scheme abandoned: improvements to frontage and extension of platform space. Original estimated cost £85,000. The London Passenger Transport Board proposed improvements to the frontage of the station. This was an opportunity to secure additional platform circulating space adjoining the mainline platforms and improve the appearance of the station in connection with the LPTB's extensions.

Scheme 14. Ely–Newmarket widening
Latest estimate £50,112 – work proceeding. The line was an important link, for passenger and freight traffic, between the midland and eastern counties. It was single line and this had hindered through traffic for many years. Passing loops were extended in 1927 at a cost of £13,000. Owing to traffic growth, delays continued and doubling was considered necessary. This would speed traffic and increase capacity.

Scheme 15. York Station Remodelling
Latest estimate £152,733 – work proceeding. Considerable delays were experienced at York during the summer months and these were felt throughout the system. The main problem was the shortage of through platform lines: there were only three, normally used as two down and one up. The scheme proposed included: an additional island platform with two through platform lines, the lengthening of Nos. 7 and 14 platforms, additional sidings with stage for fruit traffic, concentration of signalling into two power boxes and alterations to the station and locomotive yard. These improvements would also improve connections and allow for future development in passenger traffic.

Scheme 16. Colour Light Signalling Challoners Whin to Darlington
Latest estimate £356,643 – work proceeding. The remodelling of York Station provided the opportunity to upgrade signalling on this section of the ECML. Improved signalling would make possible the acceleration of trains and reduce the need for fog men.

Scheme 17. Hull. Additional Accommodation for the Fish Trade at Hull
Latest estimate £687,000 – Change of plan, involving diminished expenditure: no contract let, large amount of work by company's staff completed.

Scheme 18. Tyne Dock–Bede Quay High Level: Bunkering Appliance
Original estimated cost £75,000 – scheme cancelled.

Scheme 19. Newcastle Central Station: Signalling
Latest estimate £95,140 (included revenue expenditure) – scheme postponed. The proposal was to adopt full colour signalling for the station area. Two out of the five signal boxes between King Edward Bridge and Manor Junction would close, producing a saving of £4,800 per annum, equivalent to about 10% on capital expenditure.

Scheme 20. Additional Running Loops – Berwick to Edinburgh
Latest estimate £63,156 – work not commenced. The proposal was to convert refuge sidings to loops at four points and provide automatic colour light signalling between Berwick and Preston Pans. The intention was to increase track capacity to accommodate the rising number of express and excursion trains, particularly during the summer months, and avoid delay to freight train services.

Scheme 21. Improved Signalling: Waverley East End and Cowlairs
Latest estimated cost £82,665 – the Cowlairs project cancelled. It was proposed to replace mechanical boxes at the east end of Edinburgh Waverley Station and Abbeyhill Junction with one power box at the east end of station. A power box for the west end of the station had already been approved. It would be an advantage to have a uniform signalling system throughout the station. An annual saving of £692 in operating costs was expected.

Scheme 22. Increased Carriage Cleaning and Storing Facilities at Craigentinny, Cowairs and Craigendoran and Extension of Refuge Sidings at Bathgate Junction and Broxburn
Latest estimate £30,761 – completed. Increased Carriage Cleaning and Storing Facilities £16,640. The increasing number of toilet fitted vehicles, sleeping and restaurant cars being used had added to demands on carriage sidings and depots, meaning that the stock was delayed or inadequately cleaned and unnecessary empty carriage mileage was involved. This part of the scheme will increase annual costs by £161.

Bathgate Junction and Broxburn Loops £10,000. The short refuge sidings and lack of facilities at these locations caused delays in handling goods and mineral trains. At Bathgate the proposal was to extend the loop and one siding in the yard, and also install two crossover roads: this would improve both freight and passenger train working. At Broxburn the intension was to extend the down refuge siding which would improve working and also allow Broxburn West Signal Box to be closed and two crossover roads removed. The result of this part of the scheme was a net annual saving of £658 or a return of 6.5%.

Taking the two schemes together earns net annual savings of £497, equivalent to a return of 1.8 per cent on total expenditure of £26,735.

There was an addition to capital receipts in 1937 when Tyne Dock was sold to the Tyne Improvement Commissioners for £807,812.[47] Money could also have been raised by disposing of other unprofitable assets, including further marine facilities. City centre land not required for operational purposes was another possible source of cash.

Apart from the public concern to reduce unemployment, the rationale behind the 1929 and 1935 Acts (NWP) was that railways would be enabled to implement projects more quickly, and would be compensated for the loss of interest suffered in the interval before the investment became fully remunerative. Government assistance had only ameliorated, not eliminated, serious difficulties in raising capital.[24]

All the Group Railways had a declining rate of return on their aggregate capital expenditure over the period 1929 to 1938. The LNER suffered the largest fall, from 4.3% to 2.1%.

Table 5.10: Returns of Railway Companies on Aggregate Railway Capital Expenditure

	LNER	LMS	GWR	SR
	(%)	(%)	(%)	(%)
1927	4.3	4.2	4.95	3.5
1937	3.3	5.5	4.2	3.3
1938	2.1	2.8	3.0	2.9
Source: Annual Report and Accounts				

Investment in Road transport
Dividends from investments in road transport companies were to form an increasing source of income from 1930 onwards: investment by the LNER amounted to £3.1 million in 1938. Only these investments showed an increasing return: the company receiving dividends of £1.94 million between 1929 and 1938.[48]

In 1928 the LNER, with the other group companies, obtained parliamentary powers by the passage of a Private Act "to provide, own, work and use road vehicles to be drawn or moved by animal, electrical or mechanical power in any district to which access is afforded by the system of the Company".[49] These powers were used chiefly to enter the bus industry. There had been some buses operated without specific authority prior to 1924: the LNER acquired a number from its constituent companies. There was uncertainty about the legal position of the LNER. This

Table 5.11: LNER Return on Aggregate Capital Expenditure

	1932	1933	1934	1936	1937
Railways					
Capital expenditure (£)	288,309,508	288,514,840	288,891,002	289,553,375	291,682,410
Net receipts (£)	7,014,973	7,476,183	7,981,531	8,728,492	9,546,215
Net receipts as percentage of capital expenditure (%)	2.43	2.59	2.76	3.01	3.27
Collection & Delivery, Road Transport and Garages					
Capital expenditure (£)	1,474,048	1,657,957	1,804,137	1,927,064	2,022,073
Net receipts (£)	-328,864	-255,818	-295,917	-285,966	-364,945
Net receipts as percentage of capital expenditure (%)	-22.31	-15.43	-16.40	-14.84	-18.05
Steamboats					
Capital expenditure (£)	2,872,303	2,967,405	2,965,431	2,932,116	2,896,864
Net receipts (£)	-75,841	-95,314	-97,538	20,718	49,027
Net receipts as percentage of capital expenditure (%)	-2.64	-3.21	-3.29	0.71	1.69
Canals					
Capital expenditure (£)	1,311,174	1,310,368	1,310,204	1,303,153	1,302,761
Net receipts (£)	-12,538	-13,210	-9,655	-13,253	-12,522
Net receipts as percentage of capital expenditure (%)	-0.96	-1.01	-0.74	-1.02	-0.96
Docks					
Capital expenditure (£)	25,187,097	25,447,025	25,949,002	26,009,039	24,968,309
Net receipts (£)	52,212	95,589	151,342	183,646	247,851
Net receipts as percentage of capital expenditure (%)	0.21	0.38	0.58	0.71	0.99
Hotels					
Capital expenditure (£)	2,650,526	2,672,763	2,697,753	2,732,616	2,765,451
Net receipts (£)	49,595	85,680	125,325	164,146	165,459
Net receipts as percentage of capital expenditure (%)	1.87	3.21	4.65	6.01	5.98
Sum of capital expenditure listed above (£)	321,804,656	322,570,358	323,617,529	324,457,363	325,637,868
Sum of net receipts (£)	6,699,537	7,293,110	7,855,088	8,797,783	9,631,085
Joint lines, non-railway land and miscellaneous: capital expenditure (£)	27,544,986	27,506,433	27,716,212	27,279,244	26,951,644
Whole Undertaking					
Capital expenditure (£)	349,349,642	350,076,791	351,333,741	351,736,607	352,589,512
Net receipts (£) *	6,699,537	7,293,100	7,855,088	8,797,783	9,631,085
Net receipts as percentage of capital expenditure (%)	1.92	2.08	2.24	2.5	2.73

Source*:* Annual Report and Accounts
* Does not include Joint lines, non-railway land and miscellaneous.

was resolved by the London and North Eastern Railway (Road Traffic) Act, 1928 which enabled substantial investment through the purchase of bus company shares, mainly ordinary, but some preference shares were also held. The railways agreed not to acquire a controlling interest, nor operate road passenger services in their own name. Some interests were taken jointly with the LMS.

The LNER road investment in 1931 exceeded £2.2 million and was earning 6.4% on the capital expenditure; a significantly higher return than the railway business. Standing Joint Committees of the railway and bus companies were formed which were expected to promote rail and bus service coordination and interchangeability of tickets.[50]

The Royal Commission on Transport, in its Final Report of 1931, did not support the railways' decision to invest in bus companies and considered the money might have been better used on improving rail services, electrification for instance. The comment made no reference to relative rates of return, and no notice of it was taken by the LNER.

The main justification for large investment by the four railway companies in bus companies was to protect them from road competition.

The railways undertaking not to operate road passenger services in their own name did not apply to the transport of goods: the LNER operatedg both under its own name and indirectly through cartage companies.[51]

A major development took place in 1933, when the four group companies jointly purchased the large carriers Carter Paterson and Hay's Wharf Cartage Company, a subsidiary of which was Pickford's. The LNER share cost £545,740.[52]

There was, however, no major move into road haulage; investment was much smaller than in bus companies. The LNER continued to think of itself as a railway rather than a transport company: some commentators consider that this was perhaps a mistake.

Table 5.12: Road companies in which the LNER held investments, 1938

Company	Value of holding (£)
Alexander and Sons Ltd.	225, 000
Carter Paterson and Co. Ltd.	335, 749
Currie and Co. (Newcastle) Ltd.	84, 808
East Midland Motor Services Ltd.	120, 411
East Yorkshire Motor Services Ltd.	41, 606
Eastern Counties Omnibus Co. Ltd.	231, 068
Eastern National Omnibus Co. Ltd.	199, 743
Hay's Wharf Cartage Co. Ltd.	209, 991
Hebble Motor Services Ltd.	12, 500
Lincolnshire Road Car Co. Ltd.	68, 357
North Western Road Car Co. Ltd.	123, 078
Northern General Transport Co. Ltd.	349, 440
J W Petrie Ltd.	17, 000
Scottish Motor Traction Co. Ltd.	241, 209
Trent Motor Traction Co. Ltd.	74, 664
United Automobile Services Ltd.	514, 054
West Yorkshire Road Car Co. Ltd.	125, 592
Yorkshire Traction Co. Ltd.	65, 070
Yorkshire Woollen District Transport Co. Ltd.	44, 428
Total	3,083,768
Source: Annual Report and Accounts, 1938	

Table 5.13: Road Company Investment and Returns

Year	Capital Investment (£)	Dividends (£)	Return on Investment* (%)
1929	489,718	2,278	0. 5
1930	2,160,011	86,940	4.0
1931	2,251,801	144,495	6.4
1932	2,451,795	151,547	6.2
1933	2,471,597	167,646	6.8
1934	3,064,769	215,841	7.0
1935	2,960,276	227,582	7.7
1936	2,984,015	259,779	8.7
1937	3,028,759	311,559	10.3
1938	3,083,768	377,157	12.2
*In the years in which heavy investment took place in mid-year, these end year percentages are misleadingly low. Source: Annual Reports and Accounts.			

6. Electrification

ONLY THE SOUTHERN Railway (SR) adopted electrification generally. The railway started a major third rail electrification of its suburban lines and main lines in the south and south east.

Elsewhere there were only a few self-contained electric systems on the LMS and LNER. A consideration for the other companies was freight, which was a much more important part of their business and the benefits of electrification appeared less obvious.

North Eastern Railway (NER) Electrification Schemes

The Newcastle electric tramway system opened in 1902, and within two years the NER lost four million passengers – 40% of the 1901 total. The NER directors foresaw this loss and in 1902 decided to electrify the suburban lines on the north bank of the Tyne. The North Tyneside loop services operated from Newcastle through Wallsend, Tynemouth and Benton to terminate at New Bridge Street.

600 V DC was supplied using the collector ("third") rail system. Partial opening between New Bridge Street and Benton, took place on 29 March 1904. This was only the second electric passenger service operated by a British main line railway company, with the Lancashire & Yorkshire starting its first Liverpool services one week earlier.

The Tyneside system was fully operational on 25 July 1904, and quickly regained the lost traffic. Passenger ridership figures again topped 10 million in 1913. In 1909 the electrification was extended into new platforms at Manors station and eventually full loop services started to operate in 1917.

In 1914 work began on electrification of the 18 mile route from Shildon Yard to Newport Yard, near Newcastle, using the 1500 V DC overhead system, which was to become the standard in much of Europe before World War 2. The project, proposed by Vincent Raven, Chief Mechanical Engineer (CME), NER (who later became Technical Adviser to LNER), was approved by the NER Board of Directors in 1913. The completed work was opened in two stages on 1 July 1915 and 10 January 1916. The route was chosen because it carried a large quantity of mineral traffic.

Even in the opening years, there was insufficient traffic for the ten 1,100 horsepower Bo-Bo locomotives built. Initially this was due to restrictions on coal shipments in World War 1, but it lasted into the 1920s when the coal trade continued to be depressed. Traffic levels reduced further during the Depression. By the mid-1930s, it was necessary to replace much of the overhead equipment. The much reduced traffic levels could not warrant the expenditure, and it was decided to dismantle the overhead lines and revert to steam haulage.[53] The Shildon yards closed on 7th January 1935, and all ten locomotives entered storage at Darlington.

In 1919 Raven had proposed to electrify from York to Newcastle (and possibly through to Edinburgh), building a prototype 4-6-4 electric locomotive in 1922, although no corresponding infrastructure was installed.

Weir Committee

Three official committees were set up in the 1920s to consider railway electrification. The most important was the committee formed by the government in 1929 under Lord Weir, which reported in March 1931 (Wedgwood was a member of the Committee). A conclusion was that all main lines could be electrified for £261 million net, giving a gross return of 6.7% (2% after interest). This represented the position in 21 years, when electrification was complete.

The Weir report failed to stimulate electrification, partly because of the unfavourable timing of its publication and partly because of the unrealistic assumptions on which its cost–benefit calculations were based.[24]

The Weir Committee commissioned Merz & McLellan to conduct two investigations into sections of British railway systems.[54] The first scheme was from Kings Cross to Doncaster and Leeds. The second was on the LMS, from Crewe to Liverpool and Carlisle. In both cases, the return on capital was derived entirely from predicted savings in working expenses.

Table 6.1: Summary of the Merz & McLellan Reports

	LNER	LMS
Total route mileage	492	193
Total track mileage	1,944	843
	(£)	(£)
Net capital outlay	8,646,000	5,123,000
Savings in working expenses	624,600	127,800
	(%)	(%)
Percentage returns on net capital	7.22	2.5

The Weir Committee concluded that the electrification of small sections of a main line system were unlikely to be justified on financial grounds, and that to secure the fullest advantage of railway electrification schemes must be more comprehensive; a view supported by a Royal Commission on Transport report, which advocated the electrification of all suburban lines.[55] The Cabinet was anxious to progress suburban electrification to relieve unemployment but no reference was made to government cash.[56]

Watson argued that "the electrification of suburban lines can rarely be regarded as a means to secure any worthwhile economy, but must be justified by attracting additional revenue".[57] Wedgwood stated that only lines with dense traffic could justify electrification. These were generally located where they possessed competitive advantage: most notably in urban areas. Electrification would not give

protection against passengers transferring to other modes if rail's competitive position was weak.[58]

Manchester–Sheffield–Wath

Under the NWP, the LNER borrowed about £2.6 million for electrification of the Woodhead route.[59]

Table 6.2: 1936 Estimate for the Manchester–Sheffield–Wath Scheme

	LNER Manchester–Sheffield–Wath scheme
Total route mileage	68
Total track mileage	300
	(£)
Net capital outlay	2,570,000
Savings in working expenses	111,000
	(%)
Returns on net capital	6.64

The reason for the LNER selecting this route was its view that main line electrification could be financially justified only if it would substantially reduce steam traction costs, there being no concept of the "sparks effect" stimulating fares revenue. The work was started in 1936, but suspended on the outbreak of hostilities. The Woodhead route electrification eventually opened in 1952.

Great Northern suburban lines

In 1931 the company revived proposals for electrifying the GN London Suburban lines; the LNER Board had first considered the question in 1923. A report was submitted to the Board, Nigel Gresley, CME, being one of the joint authors, supported by Merz & McLellan. There were 50¾ route miles in total. The capital cost of the scheme was £4,386,700.[60]

The depressed estimated return on the capital cost made the project unattractive. Despite the prospect of government financial assistance, it was predicted that it would be 15 years before an annual profit (£84,000) was achieved.[61]

Great Eastern suburban lines

Great Eastern electrification from Liverpool Street to Shenfield (route mileage 49.85) was eventually addressed by the Standing Joint Committee of the London Passenger Transport Board (LPTB) and main line railways.

The Standing Joint Committee was set up by the London Passenger Transport Board Act, 1933. There were eight members of the Committee, four representatives of the Board and one representative from each of the four group companies. The Committee's function was to co-ordinate LPTB services with the suburban passenger services of the four group companies.

It became part of the NWP (civil engineering work started before the World War 2) with 100 three-car 1500 V DC electric multiple units being ordered by the LNER in 1938, but building of these was delayed by the war.[62] The scheme was not inaugurated until September 1949.

Great Eastern London Suburban Electrification scheme	£
Total estimated gross capital costs	7,101,322
Less:	
Replacement value of steam locomotives/coaches released	233,226
Total net capital costs	6,868,096

Table 6.3: Comparison of Estimated Annual Costs of Present Steam (1932) and Proposed Electric and Steam

	Cost per Train Mile (d)	Operating Costs (£)	Other Working Costs (£)	Total Costs (£)
Steam Traction				
Local Trains	34.08	281,517		
Main Line Trains	14.80 (a)	34,560		
Total		316,077	245,000	561,077
Electric Traction				
Electric Trains	29.12	389,629		
Main Line Steam Trains	14.80 (a)	36,630		
Total		426,259	250,000	676,259
Increases under Electrification		110,182	5,000	115,182

(a) Half of average cost per train mile.
Source: Great Eastern Railway Society (GERS) Information Sheet M 184[63]

Table 6.4: Estimated Increased Revenue and Return on Capital Investment (capex)

		Years after Electrification		
	Steam traction (1932)	5	10	15
	(£)	(£)	(£)	(£)
Receipts	882,000	1,184,000	1,273,000	1,363,000
Expenditure	561,000	676,000	676,000	676,000
Profit	321,000	508,000	597,000	687,000
Increase in profit as compared with steam traction		187,000	276,000	366,000
Return upon net capex of £6,868,000		2.70%	4.0%	5.30%
Source: LNER Annual Accounts, 1938				

Table 6.5: Capital Expenditure on London Suburban Lines Electrification for 1938

	(£)
Land and compensation	47,008
Construction of way and stations, engineering etc.	796,400
Law charge and Parliamentary expenses	2,259
Total	845,667
Source: LNER Annual Accounts, 1938	

Hughes maintains that the main reason for the LNER Board's unwillingness to commit the capital needed for further electrification was the worsening state of the company's finances.[64] [65] Others cited the reluctance to adopt new techniques and innovate as further factors.[66]

Inward-looking traditionalism was a characteristic of the railway industry and management's commitment and confidence in steam traction was part of this.[67] Aldcroft believes that this partly explains the long delay in the application of electric and diesel traction to Britain's Railways.[68] It is worth pointing out, however, that commentators at the time were not critical of general traction policy, only those deciding to comment many years later.[69]

7. London Transport Area

Under the provisions of the London Passenger Transport Board Act, 1933, from 1 July 1934 all underground, tramway and bus services within the London Traffic Area were acquired by the LPTB (a statutory corporation).

The London Passenger Transport (Agreement) Act, 1935 established the London Electric Transport Finance Corporation Ltd and authorised the NWP for the LPTB area. It allowed borrowing of not exceeding £40 million (1935 prices) by the LPTB, LNER and GWR through the issue of 2½% debenture stock guaranteed by the Treasury, to be repaid in 1951–52.[70]

As part of the NWP proposals various London suburban services managed by the LNER and GWR became joint operations with the LPTB and were integrated with the LPTB existing network. The divestment of some of the GN and GE suburban services to the LPTB helped the LNER to make more productive use of its assets.[71]

The LNER GN suburban service was operating at capacity and the LNER lacked the capital for the radical improvement needed. The NWP therefore provided for the LNER north London (Northern Heights) branches to Alexandra Palace, High Barnet and Edgware to be transferred to the LPTB. Removal of local services from the King's Cross to Finsbury Park congested section made available capacity for improved main line services to outer suburban stations and justified the LNER investment.

The LPTB Northern Line Extensions over LNER suburban routes were estimated to cost £6.7 million, with the LPTB share costing £4.6 million and the LNER's share £2.1 million. The LNER part included electrification of these lines but the benefits of the parts of the scheme eventually completed accrued to the LPTB rather than the LNER.[72] [73]

Some of the proposed Northern Line Extensions were abandoned in February 1954. The main cause was the restrictions on housing development by the implementation of Green Belt policies, meaning that there was no point in further extension of the railway. In any event, there was little money available for large capital works.

Capital expenditure written off in cancelling the extensions amounted to £560,000, at pre-war prices.[74]

8. LNER Locomotive Investment

Introduction to Locomotive Policy

Many factors effected traction policy, chiefly the financial crises of the 1920s; the low estimated return on capital investment in electrification; the problem of defining the best electric system for general use; and the lack of a successful, powerful oil–electric locomotive. At a time when British industry lacked expertise in electric and oil-engine traction, the British steam railway was improved through imported American and French (André Chapelon and Alfred de Glehn) practice. It was therefore inevitable that the steam locomotive was retained down to the late 1930s, and owing to the World War 2, down to the 1950s. British mechanical engineers cannot be condemned for advocating the retention of steam traction. Henry Fowler, William Stanier, Charles Collett and Gresley had good reason for continuing with steam locomotives. The major error of steam locomotive engineers working on the LMS, LNER and GWR before the nationalisation in 1948 and on British Railways after nationalisation was the failure to develop expertise in oil-engine traction and main line electric traction when by 1930 there were signs that it would be required within 10 or 15 years.[75]

The section sets out to show financial and investment considerations were not the only factors significantly restricting LNER locomotive policy. Other constraints arose from technical and engineering shortcomings.

The Gresley Approach

Although it had been decided early in 1923 that the LNER would be organised for operating purposes on a basis of devolved authority, mechanical engineering was to be an "all-line" function, under a single CME, guided by the Locomotive Committee.[76] Gresley was appointed to this post on 24 February 1923 and served until his death on 5 April 1941. On his appointment, he moved office from Doncaster to the LNER headquarters at King's Cross, meaning that he was separated from the main design team at Doncaster Works. Each Friday Gresley, when design work demanded, would visit the drawing offices and discuss aspects of design with draughtsmen.

The senior management of the LNER were operating against a background of financial constraint, and the company experienced weak profitability and financial stringency throughout its existence.

It is not possible, however, to limit the constraints to LNER Locomotive Policy to examining the financial evidence and capital expenditure alone. Behind the financial considerations were the constraints of other factors, including serious technical differences between the personalities involved. It is necessary to consider the views of those who believed that some of his policies were flawed (Appendix 5: Key Members of Gresley's Team, page 35).[77]

There were significant differences between Gresley and Edward Thompson, for example. Thompson held a number of mechanical engineering positions in Gresley's department between the grouping and April 1941, when he was appointed Gresley's successor as CME. Thompson and Gresley disagreed on a number of issues.[78] A significant difference was that of the Gresley conjugated (or derived) valve gear for three-cylinder engines. Another was standardization and significantly, when he became CME in 1941, Thompson started a much needed programme of standardization.

Some Commentators believe that Gresley's insistence on certain policies cost the LNER unnecessary expense:

- Building locomotives with three cylinders, proportionately more expensive than using two, introduced the need to provide inside valve gear.[79] [80]
- Using the conjugated two-to-one valve gear in all three cylinder classes.
- Being a compulsive, but not always successful, experimenter, primarily with increased energy conversion in mind.[81]
- Declining to introduce a standardised fleet of locomotives to cover all traction requirements.[82]

For some, these issues prompt the question whether the Board's budget for the mechanical engineers department was responsibly spent.

One of the criticisms that can be made of Gresley was his failure to reduce locomotive build and maintenance costs, and the conjugated valve gear, which was very vulnerable to poor maintenance, was one reason for this.[83] That there were too many links and pins, subject to wear and flexing of levers, was a major criticism of the early form of conjugated gear. Another was his insistence on a three cylinder drive for all but the smallest types. Apart from the J38/39 0-6-0s, all his newly designed conventional types, including the 2-6-2Ts were three cylinder locomotives with some form of derived drive**.** Gresley was reluctant to accept that the derived gear was not working effectively, despite the evidence.[84]

Atkins describes the derived valve gear as having "various functional shortcomings".[85] Many commentators believe that the Gresley conjugated valve gear was technically seriously flawed. In 1941 the Board agreed to an independent examination of this valve gear being undertaken. The report dated 8 June 1942 was prepared by William Stanier and Ernest Cox, with Cox writing the report. It concluded:

"The '2 to 1' valve gear although theoretically correct is, in practice, incapable of being made into a sound mechanical job … In view of its inherent defects and the discontinuance of its use throughout the world, a good case can be made for not perpetuating it in any future design."

Significantly, both Thompson and Arthur Peppercorn agreed with this view and developed post-war locomotive designs with three separate sets of Walschaerts valve-gear in place of Gresley's preference for two outside sets of Walschaerts working the valve motion for the middle

cylinder. Thompson, after he became CME, decided to rebuild many of the Gresley three-cylinder engines with two-cylinders, thereby obviating the conjugated valve gear. For example, from 1945 ten B17s were rebuilt with two cylinders, to the similar design of the earlier B1.

The A4 and A3 inside cylinder had a tendency to give more power than the other two as speed increased, leading to the overloading of the inside connecting rod bearings, especially the big-end which was liable to overheat and fail. Improvements which mitigated the problem were introduced by Kenneth Cook, Chief Mechanical & Electrical Engineer, Eastern & North Eastern Region, British Railways (formerly Locomotive Works Manager, Swindon) by fitting a Churchward type big end with an accurately machined bearing to the Gresley Pacifics in the early 1950s.[86]

The final batch of ten B12 locomotives was ordered from Beyer, Peacock & Co. Ltd in 1927. In mid-contract Gresley stipulated they should be fitted with Lentz poppet valves. This led to acrimonious correspondence between Gresley and Sam Fay (Chairman of Beyer, Peacock). The locomotives were delivered between August and October 1928.

The Lentz valve gear was not a success. Improvement in coal and water economy, compared with piston valve engines, was marginal and serious faults developed with twisted cam shafts and cracking Monobloc cylinder castings, necessitating early and expensive replacements.

All of the B12s fitted with Lentz valves were rebuilt as piston valve engines between November 1931 and January 1934.[87] Bert Spencer was not in total agreement with Lentz valve gear being fitted to the final batch of B12s, nor with other experiments where the CME seemed too innovative.

Many of the B12s also participated in Gresley's Feed Water Heater experiments. These involved a number of systems, by far the most extensively used being the French ACFI system. The cost was put at £300 per engine, and the annual savings £77, but even in the short run no measurable benefits accrued; the unsightly apparatus (its main components included two large cylinders strapped to the top of the boiler) was removed between 1934 and 1941.[88]

Another example of an unsuccessful experiment was the twin-head superheater fitted to the N2s. This heat exchanger consisted of two completely separate heads which leaked very badly from the outset.[89]

Martin argues he could find no evidence at the TNA or NRM for the frequently expressed view that Thompson had attempted to erase Gresley's achievements. His work on standardization of locomotives and parts showed no bias against Gresley's designs.[90] There was still, however, Thompson's opposition to Gresley's three cylinder conjugated valve gear and other issues on technical grounds. As regards Thompson's new designs when CME, his B1 was one of the most successful LNER locomotives, but Thompson's L1 class tank on the other hand was not successful. The 5 ft 2 in. wheels were too small for the fast outer suburban services.

Standardization

Chief Mechanical Engineers of the other main line railway companies made use of standardization for steam traction. Between 1903 and 1911 George Churchward (CME, Great Western Railway 1902–1922), widely regarded as Britain's best locomotive engineer, introduced a series of nine standard locomotive types (using standardised boilers, wheels, cylinders, motion and tenders), of which over 1,100 were built by 1921. He was succeeded by Collett (CME 1922 to 1941) who achieved a completely integrated series of locomotive designs covering the whole traffic range.

Fowler (CME, LMS 1925–1933) was able to implement a policy of wholesale scrapping of pre-grouping engines and their replacement by standard types, a policy continued by Stanier (CME 1932–1944).He again achieved a completely integrated series of locomotive designs covering the whole traffic range.

Richard Maunsell (CME, SR 1923–1937) inherited a fleet of 2,285 steam locomotives of 107 different types, with little standardization**.** The SR had a wide range of track types and loading gauges. In 1924 Maunsell started to design a standardized range of locomotives that was suitable to operate on all three of the SR's sections. He also attempted to design as few types as possible. Reflecting the high level of passenger traffic on the SR, most of Maunsell's designs were for passenger locomotives.

Officially, LNER policy was to reduce the number and types of locomotive by introducing standard designs.[91] In 1929, Whitelaw reported on the benefits of locomotives of standard classes.[92] He had little data, however, as by that time only 397 engines, or 5.3% of the stock, had been built to Gresley's designs. These, however, were less inefficient as coal burners than most of their predecessors, and the provision of more powerful locomotives meant that some double heading was avoided.[93]

Gresley did not favour and had little interest in standardization, apart from interchangeable components between classes, preferring to introduce new designs for the specific tasks they were to undertake. LNER standardization was largely confined to such things as tenders, engine and boiler fittings, which were made as interchangeable as possible.[94]

The LNER all-line boiler classification was introduced in 1928. By nationalisation Boiler Diagram numbers reached 120.[95] This amounted to an average of a different boiler for every 80 locomotives running**.** The 100A boiler, however, was successfully used on the B17, B1 and a number of other classes.

A 4,200 gallon Group Standard tender was designed in 1924. Apart from detail alterations the 4,200 gallon tender continued to be built until 1952.[96] The LNER Group Standard tender represented the most wide ranging application of standardization in the LNER locomotive fleet. The Group Standard water gauge was also common to many LNER classes.

Braking systems were a prominent example of lack of standardisation. Vacuum brakes were used by the Great Central Railway (GCR) and Great Northern Railway

(GNR), and compressed air by the Great Eastern Railway (GER) and North Eastern Railway (NER), the North British Railway (NBR) being in the process of changing from compressed air to vacuum. After some debate, the vacuum system was adopted. This was despite the air brake being the more efficient. The expense of immediate conversion of all stock was out of the question, and a programme of gradual implementation was introduced. Under this, new stock was fitted with the vacuum brake, and some locomotives, both new and old, were dual fitted, so that they could operate with coaches of both types. The vacuum system was gradually standardised, but never took over completely. The switch to left hand-drive for locomotives was a further example of standardisation.

Benefits of standardization of locomotive design for new engines include savings resulting from the reduction of pattern and jig and tool costs. Tools required to build a new locomotive were very expensive, particularly when required for non-standard types of locomotive with, for instance, patterns for cylinders costing more than the casting process. There was also the benefit of higher route availability. For older engines they include the reduction of operating costs in the long term: running shed spares stocks reduced, less time out of service awaiting manufacture of spares, fewer large items stocked at works and a reduced range of knowledge required by staff. According to Cox, however, the value of economic benefits of standardization for steam traction was difficult to determine.[97]

The LNER inherited 7,383 locomotives (4,863 tender and 2,520 tank) in 249 different classes.[98] Many of the locomotives were obsolescent or out-of-date.[99] No less than 16 new locomotive types were introduced between 1925 and 1941, and Gresley made serious proposals for a further five new types,[100] whilst between 1927 and 1939 there were nine principal new designs resulting from rebuilding.[101] Summers argues that there was no strategic assessment of the overall needs of all traffic types or any systematic plan behind these new builds and rebuilds.[102]

Table 8.1: Principal new designs resulting from rebuilding under Gresley

4-6-2	A3	1927
4-6-2	A8	1931
4-4-2	C9	1931
4-6-0	B12/3	1932
2-8-0	O4/5	1932
4-4-0	D16/3	1933
0-6-0	J19	1934
4-6-0	B16/2	1937
2-8-0	O4/7	1939

Source: *Locomotives of the LNER. Part 1: Preliminary Survey*, RCTS (1963), page 19.

Starting from scratch, no more than a dozen would have been needed. Many of the locomotives had been in service for 40 years or more. Gresley, however, was in no hurry to implement a scheme of standardization; in fact, he had no mandate for a "scrap and replace" policy. Moreover, while expressing strong support for standardization in principle, he had, in 1918, indicated that he did not necessarily advocate locomotive standardization.[103] This may, however, have represented a defensive stance, to avoid his having to adopt other engineers' designs during a period when standard locomotives were a particular topic of discussion.[104]

By transferring locomotives elsewhere on the system, the LNER made the most of the varied fleet it had inherited, postponing the construction of new locomotives at the expense of higher maintenance costs in the workshops. For the first years of the grouping, Gresley not only built his own locomotive designs but continued about 10 of those of constituent companies.

There were still 164 classes in 1941, which according to Glover demonstrates the longevity of most railway assets and hence the long term effects of virtually any investment decision made.[105] This was itself an additional expense, both in terms of carrying spares for a fleet so diverse and the different knowledge needed.

Table 8.2: Prominent Express Locomotives of the Four Railways Compared 1923–37: GWR and LMS

Class	GWR King	GWR Castle	LMS Coronation†	LMS Princess
Type	4-6-0	4-6-0	4-6-2	4-6-2
Introduced	1927	1923	1937	1933
Designer	Collett	Collett	Stanier	Stanier
Cylinders	4	4	4	4
Boiler pressure (lb/in.²)	250	225	250	250
Driving wheel diameter	6 ft 6 in.	6 ft 8½ in.	6 ft 9 in.	6 ft 6 in.
Tractive effort (lb)*	40,285	31,625	40,000	40,285

Sources: *Railway Magazine*, February 1939, page 104; Wilson, Andrew, 'The 1948 Locomotive Exchanges: The Express Classes' *Steam Days,* November 2020, page 40; British *Railways Locomotives & Locoshed Book 1959*. London: Ian Allan Ltd.
* Tractive Effort was at 85% boiler pressure.
† Enlargement of Princess class.

Table 8.3 Prominent Express Locomotives of the Four Railways Compared 1923–37: LNER and SR

Class	LNER A4	LNER A3	SR V Schools	SR LN Lord Nelson
Type	4-6-2	4-6-2	4-4-0	04/06/2000
Introduced	1935	1927	1930	1926
Designer	Gresley	Gresley	Maunsell	Maunsell
Cylinders	3	3	3	4
Boiler pressure (lb/in.²)	250	250	220	220
Driving wheel diameter	6 ft 8 in.	6 ft 8 in.	6 ft 7 in.	6 ft 7 in.
Tractive effort (lb)*	35,455	32,910	25,125	33,510

Sources: *Railway Magazine*, February 1939, page 104; Wilson, Andrew, 'The 1948 Locomotive Exchanges: The Express Classes' *Steam Days,* November 2020, page 40; British *Railways Locomotives & Locoshed Book 1959*. London: Ian Allan Ltd.
* Tractive Effort was at 85% boiler pressure.

An Accounting Complication

The view is widely held that Gresley was severely constrained by the company's financial circumstances.[106] This precluded a wholesale restocking of the locomotive fleet. One commentator, however, interprets the numbers differently, understanding that new build locomotives could be charged either to renewal fund or capital. With this interpretation and quoting the numbers in "Abstract B: Maintenance and Renewal of Rolling Stock (1) Locomotives" of the LNER published Annual Accounts (prepared under provisions of the Railway Companies (Accounts and Returns) Act, 1911), this commentator feels that Gresley was not constrained by insufficient funds to introduce comprehensive standardization. That Gresley did not is a serious shortcoming.

Funding of new build locomotives was, in fact, mainly provided from the renewals account (built up from revenue), and only in exceptional cases was money appropriated from capital (see Chapter 7. LNER Investment Performance).[107] [108]

The accounting treatment of new build locomotives or whether funds were available for a "scrap and replace" policy was immaterial, Gresley did not want standardization for locomotive designs. He merely followed his own pattern of new and rebuild as funding became available.

Gresley's Locomotive Policy

See Tables 8.4 and 8.5.

Gresley had identified a need for large locomotives to haul the heaviest trains on the East Coast route, and for strong mixed traffic engines with a dual freight and passenger role. Forty new Class A1 engines were authorised and tenders were issued for supplying 20 locomotives. The

Table 8.4: LNER Annual Stock of Steam Locomotives 1923–1939

	Engines built	Bought Royal Ordnance Dept	Withdrawn	Total stock
1923	126		N/A	7,399
1924	132	125	171	7,485
1925	114	48	178	7.469
1926	104		150	7,423
1927	81	100	166	7,438
1928	116		115	7,439
1929	106		152	7,393
1930	74		136	7,331
1931	69		191	7,209
1932	34		136	7,107
1933	17		208	6,916
1934	60		115	6,861
1935	102		161	6,802
1936	88		157	6,733
1937	69		230	6,591
1938	91		149	6,533
1939	62		104	6.491

Total Stock numbers differ slightly from those in LNER Annual Report and Accounts.
Source: Locomotives of the LNER. Part 1: Preliminary Survey and LNER Annual Accounts

Table 8.5: LNER Tender Locomotives at end 1913 Compared with end 1938: showing the growing number of different wheel arrangement types

Type	1913	1938
4-6-4	–	1
4-6-2	–	114
4-6-0	127	338
2-6-2	–	44
2-6-0	22	274
2-8-2	–	8
2-8-0	114	483
0-8-0	244	287
Garratt	–	1
Total	507	1,550
Source: *Railway Magazine*, December 1939, page 427		

North British Locomotive Co. Ltd (NBL) quote was the lowest at £8,720 each.[109] In October 1923 Doncaster Works was authorised to build twenty A1 locomotives, for which they had estimated £7,500, or £1,220 less than North British. The actual Doncaster costs were later reported to have been £7,844, made up of materials, £5,413, and wages, including 57.5% overheads, £2,431.[110] On 17 December 1923 20 were also ordered from NBL.[111]

Table 8.6: Tenders for supplying 20 "Pacific" locomotives, 1924

Builder	Price quoted per locomotive (£)	Delivery period (weeks)
North British Locomotive Co.	8,720	34
Wm Beardmore	9,320	45
Armstrong Whitworth	9, 400	36
Kitson and Co.	9, 800	38
Beyer Peacock	10,800	52
Vulcan Foundry	11,204	31
R Stephenson and Co.	11,276	About 43
Source: Minutes of Locomotive Committee meeting, 13 December 1923		

The A1 locomotive order was not profitable for North British:
North British Locomotive Company Ltd.
20 4-6-2 express passenger locomotives.
Date of quotation 24 November 1923
Date of acceptance/order 17 December 1923
Delivery 2 locomotives in 20 weeks and 5 per month thereafter.
Contract completed 5 December 1924.
Cost of order £235,481
Invoiced price £177,067
Loss £ 58,414
Percentage loss 24.8 (loss as percentage of cost)
Source: University of Glasgow Archive Services

The original A1 was not an outstanding locomotive design. Following lessons learnt from the locomotive exchange trials with the GWR in April and May 1925, where the GWR locomotives outperformed the Gresley Pacifics on both networks, Gresley ordered that all A1s should be modified with long-travel valve gear; this took place between November 1927 and May 1931.[112] Five A1s were fitted with 220 lb/in.^{2} boilers between July 1927 and May 1928, but no further conversions were undertaken until 1939 (by 1947 all but one of the A1s were rebuilt).[113] New 4-6-2s combining long-travel valves with 220 lb/in.^{2} boilers began to appear in August 1928: these were classified A3. The final batch was constructed in 1934.[114] The A1/A3 Pacifics took over the majority of express services on the GN Section from older steam types (Ivatt "large" Atlantics and 4-4-0s).

During 1924–29 the LNER took delivery of 273 Robinson O4 2-8-0s from the Railway Operating Division. These locomotives were purchased on increasingly favourable terms and saved the company a considerable amount of money.

Table 8.7: Purchases of ex-Government heavy freight locomotives

Year	Number	Price paid per locomotive (£)
1923	125	2,000
1925	48	1,500
1927	100	340
Source: J W P Rowledge, Heavy Goods Engines of the War Department 1 (1977), page 21 and following		

From 1925 annual rolling stock programmes were drawn up and finalised in discussions at joint meetings of the Locomotive and Traffic Committees, and ratified by the Board.[115] Any weakness was not one of the system but in top management, in failing to override the CME. Normally, the CME did not attend full meetings of the Board, but Gresley did attend when matters of importance specific to his department were discussed, as for example the annual locomotive building programme. Before each Locomotive Committee meeting, Andrew K McCosh (LNER director 1923–1948) the chairman, met the CME to review the agenda and department's cash requirements.

The proposal for new locomotives forming part of the NWP was to scrap 43 uneconomic locomotives and replace with 43 new engines (estimated cost £288,500).[116] According to the report all this expenditure was charged to revenue.[116]

Table 8.9: Proposal for New Locomotives as part of the NWP 1935 (Scheme 2)

Class	Number	Estimated cost (£)
A4*	17	127,500
B17	11	66,000
K3	10	58,000
V2	5	37,000
Total	43	288,500
* Predictably substituted for A1		

In making investment decisions a company needs to consider the impact investment in a new project will have on working capital requirements. Whereas today this would be standard, it was not the case in the 1930s.[117]

Streamlined Trains

In 1935 the Board approved Wedgwood's recommendation for Gresley to design and build the A4 locomotives and stock for the *Silver Jubilee* streamlined train. Four locomotives were ordered in March 1935: the first was completed in September 1935. The *Silver Jubilee* entered passenger service on 30 September.

Justification for the *Silver Jubilee* was based on a forecast of fares revenue being sufficient to cover direct costs. Gresley, speaking to the Institution of Mechanical Engineers on 22 October 1936, claimed that the gross receipts from the running of the *Silver Jubilee* amounted to 13s 11d (69½p) per train mile, whilst the operating expenses were 2s 6d (12½p) per mile. These figures excluded profits on the dining car service and interest on capital cost. The seven coach train and one locomotive cost £34,500. On 14 September 1938 Wedgwood submitted the results for the *Silver Jubilee* to the Board covering the four weeks ended 9 July 1938.

Table 8.10: *Silver Jubilee* results for the four weeks ended 9 July 1938

	£
Gross receipts	8,261
Direct expenses	6,977
Net receipts	1,284

The first year of *Silver Jubilee* operation, with an 86% load factor, earned gross revenue (including supplementary fares) as much as six times the operating cost.[118]

Thirty-five A4s were built between September 1935 and July 1938; 17 were part of the NWP. The aggregate cost of building the engines and tenders amounted to about £310,000. Four streamlined service had been introduced by September 1937: all were withdrawn on 31 August 1939.[119] Robert Thom played a crucial role in developing the A4s.

Oliver Bulleid was highly critical of Gresley's enthusiasm for streamlining: possibly with some justification as commentators felt it to be of no value at speeds below 90 mph. The trains were criticised by other senior staff for diverting management attention from more important issues. Additionally, Michael Barrington-Ward, Superintendent, Southern Area, LNER emphasised, as the *Silver Jubilee* and *Coronation* streamlined trains operated under double block working for the whole route, the trains delayed other services. Others, however, considered them a public relations success with extensive media coverage and in the case of the *Silver Jubilee* averaged 90%, all at premium fares.[120]

Big Engine Policy

Gresley was not against ignoring Board policy. An example being his construction in 1929 of the W1 No. 10000 4-6-4 *Hush-Hush* experimental high pressure steam locomotive with water tube boiler, costing some £10,000, which turned out to be a failure and was admitted as such by Gresley.[121] The project received no formal approval, but it is inconceivable that the Board were in ignorance of it.[122]

Gresley in pursuing a big engine policy developed classes P1 2-8-2 for mineral traffic (two in 1925) and P2 2-8-2 for express passenger traffic on the Edinburgh to Aberdeen route to avoid double-heading (six between 1934 and 1936), together with the U1 Garratt 2-8-0+0-8-2 for banking (one in 1925). Bulleid was involved in the development of these projects.[123] He was also associated with the V2 class.

Gresley's attachment to three-cylinders included insisting that Beyer, Peacock & Co. Ltd fit three-cylinders to the LNER Beyer-Garratt articulated locomotive (Beyer, Peacock charged £14,395 for the engine), when the normal two-cylinders would have been far superior for a utility locomotive.[124]

Neither W1 No. 10000 nor the P2 had wide support and were seen by some as costly distractions. The W1 was a flawed design.[125] It was thought that Bulleid more than Gresley was instrumental in getting the P2 built: the first P2 was completed in May 1934. Overall the P2s proved costly to run and difficult to maintain in good running order.

The main issues with the engine were the valve gear, pony truck and crank axle designs.[126] According to Robert Riddles (appointed member of the Railway Executive for mechanical and electrical engineering in 1948), the P2s were "too elaborate and over engineered for the purpose required".[127]

The V2s were generally very successful engines but they had one serious defect. The cylinders, steam chests, and various passages were in one large Monobloc casting, which saved weight and reduced the number of potentially leaky flange joints used. Another advantage of the V2 Monobloc was that the steam passages were streamlined, unlike the complex steam passages in the A3 pacifics.

By the mid-1950s, however, maintenance of the Monobloc cylinder castings was proving difficult and expensive. If only one cylinder had cracked, then the entire Monobloc would need replacing. So, from May 1956 if a cylinder needed replacement, the opportunity was taken to replace the entire Monobloc casting with three separate cylinder castings.[128]

Oliver Bulleid was a man of sometimes controversially original thought who took no tradition for granted. At the start of his time with the LNER, Bulleid's design work was predominantly on carriages and wagons. It was not until the 1930s that he contributed significantly to locomotive development. The time Bulleid was CME, SR, following his period at the LNER, confirmed he was a brilliant locomotive engineer but, like Gresley, made some questionable decisions.[129]

One commentator feels that Gresley may have been too hasty to build a big engine for what he identified as a particular task without weighing economics sufficiently. A more detailed investigation and analysis of operational factors was needed. Savings no doubt were made in engine

crews, but it is unlikely a realistic view was taken of all costs projected over the life of the locomotives.[130] This illustrates the widely held approach to investment assessment at the time.

Electrification and Diesel Traction

The British rail industry showed little innovation between the wars overall: tradition and inertia were elements in the resistance to change. In fact the nature of many railway jobs changed little between 1914 and 1950 (as was also the case in other old industries: textile, mines and shipbuilding).[131]

Britain's railways were slow to exploit the potential of electrification and diesel traction.[132] Financial stringency was often cited as the reason in the case of electrification by the LNER.[133]

Nevertheless, over the years Gresley took considerable interest in electric traction schemes and also diesel traction. In 1933 Henry Richards, a LNER Electrical Engineer (later LNER Chief Electrical Engineer), published a comparative report *Primary Considerations Relating to Steam, Electric and Diesel-Electric Traction*. Richards was expressing his own views, but Wedgwood and Gresley both contributed to discussion of the paper.[134]

In July 1933 Sir W G Armstrong Whitworth & Co (Engineers) Ltd demonstrated its 1-Co-1 "Universal" main line diesel-electric locomotive, Britain's first, on the LNER. Gresley witnessed it on test with 17 coaches, but the company expressed little interest in the project, particularly after a crankcase explosion in June 1934.[135] Armstrong Whitworth continued with the development of diesel-electrics on the railways, though it had more success overseas than in the UK (as was the case with other UK manufacturers).[136]

By 1939 there had been a substantial advance in the technology of the diesel engine, prompting Gresley to initiate a study intended to produce a design specification for a medium power mixed traffic diesel–electric locomotive. World War 2 curtailed further progress.[137]

No viable diesel-electric locomotive sufficiently large to operate main line services was built in Britain until 1947 (main line diesel Nos. 10000/1 designed by George Ivatt and built by the LMS and English Electric Co. Ltd in 1947/8). The agreement between the LMS and English Electric had been signed in April 1937, but building of the locomotives was postponed by World War 2.[138] Large engine diesel-electric locomotives were first produced in the United States in the late 1930s, but further development was also delayed by the war. After the war, however, the US quickly adopted widespread use of diesel-electric locomotives on passenger services.

In late 1947, the LNER obtained quotations for the supply of 25 1,600 horsepower diesel-electric locomotives to be used in pairs on principal Anglo-Scottish passenger services.[139]

In 1946 the LNER published a booklet entitled "Forward the LNER Development Programme", containing details of a five year plan for the development of the company after World War.[140]

In August 1935, the LNER announced a scheme to electrify the line from Newcastle Central to South Shields. The original stock was in need of renewal at this time, so a system-wide assessment was undertaken. It was decided to move stock built in 1920–2 to the new South Tyneside electrification and for the 1904–5 stock to be replaced by new stock manufactured by the Metropolitan-Cammell Carriage & Wagon Company Ltd. With the exception of three Motor Parcels Vans, all of the original 1904–5 stock was withdrawn between August and December 1937.

Gresley was involved in this project. In 1936 he placed the contract with Metropolitan-Cammell for the new electric multiple unit stock. The 2-car articulated units had passenger operated sliding doors and entered traffic in 1937.

Gresley was also involved in the design of prototype 1500 V DC 1870 horsepower Class EM1 Bo-Bo locomotive No. 6701 for the Manchester, Sheffield and Wath electrification scheme. Final assembly of the prototype took place at Doncaster Works and the locomotive was completed in August 1940.

Conclusions

The *Locomotive Policy* section has set out to show financial and investment considerations were not the only factors significantly restricting LNER locomotive policy and other constraints arose from technical and engineering shortcomings. Gresley's approach to locomotive policy tended to reduce the efficiency of the CME's Department and resulted in financial implications for the company as a whole.

Gresley's capabilities were widely acknowledged. He did, for example, provide a good express passenger service on the principal main lines despite working under financial stringency. Gresley is remembered for a big engine policy (A3s, A4s), his mixed traffic V2s and his P2 2-8-2s for heavy passenger and freight.

Gresley gave directions, decided on points of detail design and approved final drawings. He had ultimate responsibility and alone was empowered to authorise any subsequent amendments.[141] He possessed an outstanding intellect, with a strong, dominating personality and was aware of the capabilities and limitations of his staff. "He didn't suffer fools gladly and, at times, disliked criticism."[142] Gresley was reluctant to address any shortcomings which became apparent after a new design had been introduced, such as the 4-6-2 derived valve gear.[143]

Although Gresley designed some outstanding locomotives, he did not, like Stanier, markedly reduce construction and maintenance costs (the LNER's costs of maintaining rolling stock was higher than those of the LMS) by developing a limited range of standard locomotives with consequent reductions in spares and works capacity.[144] Although Gresley's target was to reduce maintenance and running costs (in the interests of efficiency and economy), this appeared not always to be achieved in practice.

Gresley was an engineer of high standing, both within and outside the LNER, but was criticised for building locomotives to his own ideas, without taking sufficient account of the views of those concerned with traffic matters.[145]

In his memoirs Christian Hewison, who worked as a Shed Master in the 1920s, discusses how the design department, headed by Gresley, produced locomotives which in practice presented operational difficulties. Hewison notes that Gresley designed and built the engines which he then passed to the Running Superintendents on the principle that "it was up to them to make the engines work". Hewison says it was unwise to attribute locomotive failure to errors in design and a District Running Superintendent or Locomotive Running Superintendent who attempted to do so was likely to learn of Gresley's extreme displeasure; all failures resulted from the drivers mishandling or lack of shed maintenance.[146]

Some commentators argue his new build and re-build locomotive programmes lacked strategy. A number of design details increased company expenses unnecessarily, as did his compulsion, not always successfully, for experimentation, primarily with increased energy conversion in mind.

Over the years the view grew among some that Gresley's innovative or experimental designs for locomotives or components often seemed to take precedence over practical considerations: for instance his refusal to accept standardization of locomotive design and insistence on using three-cylinders for most locomotives.[147]

Given the company's difficult financial position, undue management attention was given to prestige passenger services, whilst there was a tendency to neglect other parts of the business, freight services (given that two-thirds of its business was in conveying freight and one third in passengers) for instance.[148]

The need to efficiently and economically deliver the traction needs of the company necessitated implementation of an effective traction investment policy. From the point of view of management control, "efficient and economical working" was the criterion by which the performance of the CME department (and indeed the LNER as a whole) should be judged. Some commentators feel by these measures Gresley probably failed.

9. Concluding Remarks

The document has reviewed reasons why the LNER made capital investment decisions. An examination of the company's struggle with financial stringency and necessary attempts to reduce costs forms part of the review. Also included are factors restricting locomotive policy.

In the long run, companies need to make normal profits both to cover the opportunity cost of capital and for an efficient allocation of resources across the economy. Failure to do this will threaten the availability of external finance and future viability of the business.[149]

The railway has a reputation for being long to plan and slow to change. Historians have mentioned "the weight of tradition" as a factor holding back railway management.[150] They have also been critical of railway management's failure to react to changing conditions. Conservative investment policy and a failure to calculate costs are frequently cited criticisms.[151]

The difficulty arose in classifying costs as variable or fixed.[153] There was little systematic analysis of how much a given traffic would cost to convey, and certainly no attempt to allocate fixed costs to traffic.[152] [153] The financial justification for new investment, was at best rudimentary. The LNER monitored investment in terms chiefly of cost savings, with sometimes a calculation for return on capital, and interest charges.[154]

Some commentators feel that if the LNER management did not have money to invest, one cannot criticise it for not investing. Did the LNER, however, undertake all that might reasonably have been expected of it to improve performance, generate higher profits and therefore the possibility of raising capital?[155] Glover asks whether certain of the analytical methods used by Beeching could have been applied in the 1930s.[16]

Given that freight traffic was such a high proportion of total revenue throughout the company's existence, it was poor judgement that more effort was not concentrated on this part of the business. Containerisation was introduced in the 1930s, but generally innovation in freight handling was limited. The LNER needed to fully or partly fit more freight trains with the vacuum brake to accelerate the movement of loads. There was a need to concentrate general merchandise traffic on fewer yards to reduce inefficient trip working and the company should also have concentrated depots for coal. The LNER was behind the LMS in the layout and mechanising of the more important depots for handling small traffic.

By the 1930s examination of the need for extensive remarshalling by the LNER led to a new system of direct routing of freight trains, cutting out marshalling yards. Opportunities for such trains were limited but they showed a saving in operations, and reduced the pressure on the yards. Major projects for new marshalling yards nevertheless continued to be authorised.

Closer attention should have been given to the problem of achieving control of conveyance operations. Whilst the LMS developed centralised Train Control which enabled a systematic analysis of information to be made, the LNER introduced localised Traffic Control which did not allow such systematic analysis.[156]

Table 9.1: Railway Revenue earned: freight compared with passenger (excluding parcels by passenger train)

	Total (£M)	Freight (£M)	Freight (%)	Passenger (£M)	Passenger (%)
1925	50.6	33.5	66	17.1	34
1928	48.8	34.0	70	14.8	30
1938	40.8	28.0	69	12.8	31
Source: Annual Reports and Accounts					

Stronger efforts might also have been made to lessen the cross subsidisation which existed as a matter of course. As the years passed, the more profitable traffic which provided the source of subsidy declined while the loss making part of the business became even more of a burden.[157]

The LNER downgraded the GCR Extension, as a duplicate main line, to secondary status, but maintained many passenger services even the unsophisticated accounting at the time showed were unprofitable.[158] Butterfield found the LNER did not give much time to branch lines and little was done to reduce costs.[159]

The company only closed about 18% by length of its branch lines to passenger traffic. In its defence, however, the pressure to act as a social service was unremitting. Opportunities to reduce or withdraw passenger facilities from some branch lines arose as a result of co-ordination arrangements made between railway companies and their bus associates.[160] Replacement road services by companies in which the LNER had substantial holdings would have brought the double advantage of savings on railway costs, and, in many cases, income from the road services.

The same point could be made about freight transport where little was done to extend the partnership with road companies by cutting back on loss-making rail freight services and substituting road transport feeding into fewer but larger railheads.

An instance of when the LNER attempted to reduce expenses and where a co-ordination arrangement existed with a bus associate was the Cambridge to Mildenhall Branch. This 19 mile single line was opened in 1884–5, with some elaborate station buildings, full signalling and no fewer than 70 level crossings. It served only a few substantial settlements, but goods traffic was important. There were two loops but these were not available to cross passenger trains. Mildenhall was provided with a turntable and pit, the latter located on the turntable road, but no other locomotive facilities.

Bus services were established from the early 1920s. These ran directly into Cambridge town centre, which the

railway did not. Cambridge railway station is over a mile from the city centre. By the late 1930s there were four passenger trains each way on weekdays, five on Saturdays. The standard formation on the branch after the LNER took over was a small tender engines plus two coaches.

The LNER made some economies. In 1935 two signal cabins were abolished, with the loops removed and remaining points unlocked by Annett's key operated by a porter/signalman when required. Tickets ceased to be issued at one station after June 1935, so like the halts on the branch its passengers were served by the conductor-guard. The LNER also saved expense by consolidating senior posts, so that one station master became responsible for a group of stations. Otherwise stations' staffing levels and signalling continued in excess of requirements, although this was partly justified by the occasional use of the branch as a diversionary route between Barnwell and Fordham.[161] The Mildenhall branch closed to passengers on and from Monday 18 June 1962. Other measures available to reduce branch line costs and combat competition from road transport included auto-trains (push-pull sets), steam railcars and one engine in steam operation with no intermediate signalling.

Steam railcars were introduced in an attempt to control costs. Eighty Sentinel steam railcars were purchased by the LNER from 1925 to 1932. They offered a service at half the running cost of a conventional auto-train.[162] Unfortunately, they were unreliable and withdrawals started in 1939: most of them had gone by the early 1940s. The purchase of steam railcars were regarded as a novel form of traction and therefore qualified as new capital stock.

Table 9.2: LNER Standard Gauge Branch Lines in England

Open at Grouping		Closed by LNER to passengers	
Number	Length (miles)	Number	Length (miles)
172	2450.50	42	432.0
Excludes: Northern Heights branches. Source: compiled by author from published information			

There was always the need to use assets more effectively. The LNER had more reason than most to watch its assets closely. Further rationalising of duplicate facilities was required by the company. Simplifying operating practices and infrastructure would have resulted in significant expense savings. For instance, the wide range of operating activities arising from train marshalling in stations required a large level of infrastructure capacity and resource provision.

The Board did not maintain sufficiently close scrutiny of major installations, such as construction and repair shops, and little was done to streamline clerical procedures. More collaboration with the Railway Clearing House may have produced simplified procedures. A strict control was not kept on staffing numbers. One might ask whether in view of inadequate profits the company maintained employment with the resulting overextended resources at the expense of the shareholders and further investment.

Table 9.3: Reduction in Traffic Receipts Compared with Employees

	1923 (£M)	1938 (£M)	Reduction (%)
Traffic receipts	61.3	46.6	24
Employees	202,232	177,236	12
Source: LNER Annual Accounts and staff numbers: 1923-1945, Ministry of Transport			

Appointments to senior positions were mainly from career railwaymen. Aldcroft contends the failure to recruit management staff from outside the industry meant the possibility for questioning traditional railway practice was limited.[163] Others believe many highly qualified managers from outside the industry would have struggled with the complex equipment, infrastructure, train control, Rule Book and staff supervision of the railway system.

The introduction of a traffic manager at the LNER, responsible for both the operating and commercial railway activities, would have produced somebody subordinate to the chief General Manager to focus on overall business performance.[164]

Was the Board structured in the best way to address its prime responsibility of promoting the success of the company? The conclusion must be that the Board was unduly conservative, the structure weak, and a smaller, more professional Board was needed. The 1921 Act provided for a statutory minimum of 16 Directors (at the first LNER Board meeting there were 26 Directors; in 1931 there were 21; and by the end of 1947 19: whereas probably no more than 10 were needed, mainly full-time). It has been suggested that the management of the company may have been more effective had the headquarters structure of permanent interlocking Board committees (there were seven) been largely abandoned and responsibilities for departments assigned to individual board members.

Hughes suggests the present day approach to the LNER head office organisation would be to appoint three or four Assistant General Managers, one of whom would be designated Deputy, to share the task of management between them. They would have provided a compact team, capable of concentrated thought and leadership, leaving the Chief General Manager to devote his time to the vital issues.[165] Robert Bell was the only LNER assistant general manager. In any event, what was needed in a competitive world was flexible management, rapid decisions, a keen sense of profitability and accurate knowledge of costs.[166]

It is argued the large new organisations established under the 1921 Act had to be managed by railwaymen quite inexperienced in conducting their business against the fierce competition they now faced. They assumed that the railways enjoyed monopolistic powers which in fact no longer existed.

Wedgwood transferred the Traffic Apprenticeship Scheme to the LNER from the NER. It was intended to

attract graduates and train young managers. Robert Bell, Assistant General Manager, managed the scheme. The LNER programme was centred on operating and overlooked the essential need to concentrate on net revenue, not just traffic volumes.[167] [168] This shortcoming continued into nationalization. [169]

According to Hughes, the limitations of the traffic apprentice's training highlights a significant weakness in many railwaymen's attitudes to their job. They were primarily concerned, quite rightly, with the safe operation of the railway. In addition to this, however, was every supervisor and manager motivated to seek economic working, particularly in efforts to eradicate waste?[170]

Bonavia, through his personal knowledge and interviews with some of the principal managers of the time, makes the case that the performance of railway managers of the era needs to take into account the handicaps that they had to work under, such as the imperfections of the Railways Act, 1921 and the economic forces over which they had no control.[171] He claims that some managers were forward looking and innovative.[172] Hughes states that it is easy to criticise directors and management with the benefit of hindsight, but nevertheless feels that the company would probably have benefited had certain alternative strategies been followed.[173]

Although judging railway profits poor, and their shareholders long-suffering, *The Economist* always acknowledged the competence of railway managers.[174]

A central argument of this paper has been that the LNER could have done more to exercise efficiency and economy in the management of the company, by better understanding and controlling costs, growing net revenue, improving capital investment decisions and thereby increasing the possibility of raising new capital on the market.

The LNER had to rely extensively upon government assisted finance, the main source during the 1930s, for investment, the largest being the loan to provide the NWP. There was limited incentive for the Board to compare the benefits of different investment options before making a decision when interest on borrowing was subsidized by the government and assistance for projects did not require precise financial justification.

10. Appendices

Appendix 1: Decline of LNER passenger business

Several urban steam train services were withdrawn in the early years of the 20th century. There were two main reasons: the substitution of motor buses and electric trams for the slow-moving horse-hauled vehicles and the introduction of underground railways. The outcome was that more frequent and, in most cases, more convenient means of travelling were available.

Apart from the negative impact of the General Strike of 1926 on passenger traffic, the railway companies interpreted the initial decline of their passenger business as resulting from road competition. The LNER's report of 1927 pointed out that, where direct competition with motorbus services existed, there was as much as a 90% reduction of traffic, and the diminished traffic inversely related to the increase in motorbus traffic.[175] Similarly, the Railway Companies Association stated that 15% of the total 17.3% decline in passenger receipts between 1923 and 1930 was due to road competition, from both the motorbus and the private car.[176] The car and roads built up rapidly in the interwar years: in the case of roads in the 1920s designed to reduce unemployment.[177]

The impact of road transport was the major cause of reduction in railway companies' revenue. From 1903 the electric street tram (and later the electric trolleybus) deprived the railways of much short distance traffic.

Trolleybuses developed in the 1920s and beyond. During the 1930s, the London system replaced all former tram routes north of the River Thames. If it were not for World War 2, trolleybuses would also have replaced the south side routes, but this was delayed until London's last traditional tram ran in 1952. Trolleybus operation in the UK peaked between 1949 and 1951. In 1954 the LPTB decided to withdraw the whole trolleybus system from 1959. The final trolleybus in London ran on 8 May 1962.

The motor bus grew rapidly in importance for longer journeys from the early 1920s.[178] Hibbs considered that the railway companies were ill prepared for bus competition.[179] Davies doubts this, however, maintaining that the railway companies were aware of the threat from road transport almost from the end of World War 1.[180]

As mentioned in Section 5, the LNER (and other railway companies) eventually invested in bus companies after 1928.

Appendix 2: Accounting

Accounts prepared by amalgamated companies constituted under the Railways Act, 1921 were regulated by the Railway Companies (Accounts and Returns) Act, 1911, as amended by the First Schedule to the Railway Companies (Accounts & Returns) Order, 1928, whilst non-railway companies incorporated generally were governed between the wars firstly by the Companies Act 1908, then the Companies Act, 1929.

The 1911 Act adopted the double account system and established a method for dealing with depreciation through the use of renewal funds in the balance sheet.[181] As part of the double account system, capital and revenue accounts are separated owing to a permanent distinction between capital raised and capital expended and the other liabilities and assets of the company. Fixed assets and fixed or long-term liabilities are recorded in Receipts and Expenditure on Capital Account. What today is called a profit and loss account is covered by Revenue Receipts and Expenditure of the Whole Undertaking and Proposed Appropriation of Net Income in the 1911 Act and 1928 Order.

The capital investment in most cases represented only the "betterment" element in the total outlay, in which the replacement cost of the original asset was deducted from the outlay and charged to a renewal fund, only the excess cost of the new asset being charged to capital as "betterment".[182] According to Newton, however, it could be charged to revenue.[183] Although the revenue account suffered, the company was relieved of overburdening a capital account already in deficit. Maintenance and renewals expenditure was a prime target for reductions. The railways were always more likely to make financial progress by cutting expenditure than by increasing gross revenue, and costs of all kinds were simultaneously targeted.[184]

Railway accounts, whilst very informative on many matters, did not readily permit calculation of new capital expenditure or depreciation. Bonavia emphasizes that the Act did not provide for the minimum information about original values and the annual loss of value requiring replacement, as would be the case where a company applies an appropriate rate of depreciation to correctly valued fixed assets. Under the double account system, there was provision for renewals on a replacement cost basis through renewal funds built up from annual revenue, but capital investment and capital receipts were recorded separately, only the balance by which capital investment exceeded capital receipts or vice versa being carried to the balance sheet.[185]

The Companies Act, 1907, made provision for the private company but more importantly made provision for including a balance sheet in the annual return to the Registrar of Companies.

Railway regulation had already addressed the subject of audit and balance sheet and was to go further than the 1907 Act in the Railway Companies (Accounts and Returns) Act, 1911. Apart from the 1928 Order, financial reporting by the railway companies remained broadly the same until Nationalisation.

The Companies Act, 1929 was the last major pierce of company law to be enacted before the Companies Act, 1948. It required for the first time a profit and loss account and balance sheet to be laid before the shareholders each year. Railway regulation had achieved this for railway companies much earlier.

In the period 1930–45 voluntary disclosures by non-railway Stock Exchange companies beyond the limited requirements of the 1929 Act were not common and in no case matched the level of disclosure by the railway companies in the period 1923–47.[186]

Appendix 3: Appraisal

Before World War 2, industry used the average return on investment criterion, developed by Du Pont and General Motors between 1920 and 1925, for limited assessments of capital investment. Research shows that ROI procedures were used to evaluate projects in place and management forecasting did not go much beyond one year.[187]

The lack of sophistication in investment appraisal for the railways and British industry generally continued into the 1950s and unwieldy business organisations were only improved in the early 1960s.[188]

Discounted cash flow methods were used less extensively in the United Kingdom before the 1960s than other techniques.[189]

Appendix 4: Grimsby No. 3 Fish Dock (NWP Scheme 12)

The first Grimsby fish dock ("No. 1") was built in 1857, and expanded southward in 1878 with the addition of a second ("No. 2"); both were built within the land reclaimed as part of the Royal Dock development. The railway grouping led to the docks coming under the control of the LNER, which appeared to lack the entrepreneurial dynamism of its 19th century forbears, the Manchester Sheffield & Lincolnshire Railway and, from 1897, the GCR.[190]

A need for an additional fish dock was recognized from the early 20th century: the GCR obtained an Act for a fish dock (Great Central Railway (Grimsby Fish Dock) Act, 1912). The proposal was to extend No. 1 Dock to the east onto land reclaimed from the Humber. The scheme was abandoned owing to World War 1, after which the cost of the scheme had increased from the initial estimate of £0.5 million to £1.2 million. As a result it was decided not to proceed with the work.

Later, the LNER proposed to the Grimsby Corporation that if the Corporation built a new dock, the LNER would pay rent for use of the dock, until such time as the cost of dock and loans were repaid, at which point it would take over the dock: this scheme was agreed and the Corporation obtained an Act (The Grimsby Corporation (Dock, etc.) Act, 1929).[191]

The estimated cost of the works was £1.418 million, of which the Corporation was enabled to raise £1.25 million, the remainder by the LNER. The dock was subsequently let to the LNER on a 30 year lease. Funding was aided by a government grant under the relief of unemployment provisions of the Development (Loan Guarantee & Grant) Act, 1929.[192]

The new No. 3 Fish Dock was opened in October 1934, substantially expanding the No. 1 Dock, and reclaimed additional land from the Humber. The dock was fitted with three electrically operated slipways which could handle trawlers up to 1,000 tons. Once pulled up the slipway the vessels, if required, could be "side slipped". It took about 20 minutes to hoist a trawler up the slipway. The fish docks and nearby estate were devoted to the landing of fish, and maintenance, supply and repair of the Grimsby fishing fleet, which grew into one of the largest in Britain.

To meet the requirements of the fishing industry a satisfactory understanding of and acceptance by the trade was needed. There were changes to the fishing grounds from the North Sea to more distant waters, which resulted in larger vessels, changes in fishing methods and greater time away from port.

The new No. 3 Fish Dock provided ample water space in Nos 1 and 2 Fish Docks, improved facilities for coaling, repairing and fitting out of vessels, but the accommodation for landing and distribution, particularly in No. 2 Dock, was inadequate.

The most pressing need was additional accommodation for deep sea vessels and it was therefore proposed, as part of the NWP, to construct a new quay and market along the south side of No. 2 Fish Dock and to widen the south-west quay. This would provide berthing accommodation for seven deep sea trawlers and adequate landing space for their catches. The estimated cost was £75,000.

Additionally, it was proposed to widen the South West Quay of No. 2 Dock and reconstruct sheds on the West Quay of No. 2 Dock, a section of which had burnt down in November 1934. The estimated cost was £22,000.

The fishing industry continued to make considerable demands on the resources of the LNER, but significant revenue was earned from the trade and associated industries. The demand for fish was rising in Britain and this would increase with the intensive advertising the industry was proposing.

Table 10.1: Grimsby: LNER works completed under the Development (Loan Guarantee and Grants) Act, 1929

No.		Total cost	Capex*	Scale of grant (%)		
		(£)	(£)	First 5 years	Second five years	Third five years
11	Fish Docks	60,493	41,605	5	3	1
12	East Quay	57,912	56,372	5	3	1
	Total	118,405	97,977			

Source: RAIL 390/759
* Qualifying for grant

Table 10.3: LNER NWP Submission October 1935 for Scheme 12: Grimsby Fish Dock, Additional Quay Accommodation

	Total (£)	Capital (£)	Revenue (£)	Annual interest on total cost (3%) (£)	Annual amount to repay revenue charge in 15 years (3%) (£)	Estimated savings or added net revenue (£)
A	75,500	68,590	6,910	2,285	372	Dr 1,076
B	23,235	16,466	6,769	697	364	Dr 192
Total (£)	98,735	85,056	13,679	2,982	736	Dr 1,268
Source: TNA, RAIL 390/1039						

Appendix 5: Key Members of the CME's Department in 1937/38

Bert Spencer
Technical Assistant locomotives.

Arthur Peppercorn
On the formation of the LNER Peppercorn became Carriage and Wagon Works Manager, Doncaster: in 1927 he was appointed to a similar position at York.

In 1933 he became Assistant Mechanical Engineer, Stratford and in 1937 Locomotive Running Superintendent, Southern Area. A year later Peppercorn was appointed Mechanical Engineer, North Eastern Area, Darlington.

In 1941 he was appointed to the dual post of Assistant Chief Mechanical Engineer, LNER and Mechanical Engineer, Doncaster. In 1945 Peppercorn relinquished the latter post to give closer assistance to Edward Thompson, whom he succeeded as Chief Mechanical Engineer in 1946.

Oliver Bulleid
In 1923 Bulleid became Gresley's assistant in Doncaster, a post he held until 1937, when he joined the SR as Chief Mechanical Engineer.

Robert Thom
Mechanical Engineer, Southern Area, Doncaster (retired 1938).

Edward Thompson
Thompson was appointed Assistant Mechanical Engineer, Stratford in 1927 and promoted three years later to the position of Mechanical Engineer. He became Mechanical Engineer, North Eastern Area in 1934 and in 1939 succeeded Robert Thom as Mechanical Engineer, Southern Area (Western Section). Thompson was appointed CME in April 1941 and retired in June 1946.

Thomas Street
Chief locomotive Draughtsman Doncaster.

Douglas Edge
Assistant to CME (Gresley), replacing Bulleid in 1937.

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