

William Mackenzie and Railways in France

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His Early Career

William Mackenzie, civil engineer and contractor, was born on 20 March 1794 near Nelson, Lancashire, the son of Alexander Mackenzie, a small contractor on the Leeds & Liverpool Canal. During an apprenticeship and early career in applied civil engineering, he worked under some of the leaders of his profession on a wide variety of schemes, including the Edinburgh & Glasgow Union and Gloucester & Berkeley canals and the extensive improvements carried out on the Birmingham Canal in the late 1820s¹. In later life during a disagreement over financial matters with Joseph Locke, he commented on the extent of his service in the field of public works:

*"In matters of this kind," he said, "I have had a 20 years' longer experience than Mr. Locke when I was in the employ of the greatest men in this Kingdom - I was 6 years with [Hugh] MacIntosh - with Telford constantly about 10 years directly under him In short, I am among the oldest practical contractors & living Engineers. I could easily shew that I have had more experience in public works than ... even old George Stephenson"*²

Mackenzie first encountered Locke in the early 1830s when, having decided to transfer his skills and experience into railway work, he obtained the contract for the construction of Lime Street Tunnel, Liverpool, for the Liverpool & Manchester Company. In later years in Britain and France, the two men, along with Thomas Brassey, worked together in a spirit of mutual respect though Locke never forgot that his responsibility was principally to railway companies and his "cutting and carving" of the contractors' claims for payment was on more than one occasion a source of friction³. A satisfactory professional relationship also developed in the 1830s with Thomas J. Woodhouse, Resident Engineer on the Midland Counties Railway, under whom Mackenzie was a contractor on sections of line between Leicester and Derby and Nottingham; this rapport laid the foundations for their close co-operation in the following decade during the completion of the Orléans, Tours & Bordeaux line. In contrast, a dispute over accounts on the North Union Railway (Wigan - Preston) gave Mackenzie an abiding detestation of its Engineer, C.B. Vignoles.

The State of Railway Construction in France

In 1840, during the final stages of their contribution to the construction of the Glasgow, Paisley & Greenock Railway, Mackenzie and Brassey were approached by Locke with the suggestion that they should jointly tender for a line between Paris and Rouen as the first stage in the establishment of railway communications between the French capital and Channel ports. For several years the French had been considering the many issues associated with the construction of a national railway network. Debate finally came to fruition with the Railway Law of July 1842 which, as might have been predicted, decreed that lines were to radiate from Paris to the major cities and frontiers of the nation. It was a rational and carefully conceived plan in which the State

had a leading role as a financier and, through the expertise of the Corps des Ponts et Chaussées engineers of the Public Works administration, constructor of lines. The initial pattern of railway growth in France was thus to be in striking contrast to that which haphazardly occurred in Britain⁴.

By the end of 1839, although France had acquired approximately 320 kilometres of line⁵, much of this was solely for industrial purposes, tributary to other forms of transport, such as rivers, or for horse-drawn traffic. The first locomotive-powered passenger railway in France, the Paris to St Germain (20 kilometres), opened in 1837; but this event was immediately followed, for one reason or another, by a collapse in the financing of lines by haute banque, such as Rothschild⁶. In the background, there were still in France "many who questioned the future of railways and more who ignored them altogether."⁷ What the situation required in the interval before the Law of 1842 arrived with its massive and predictable State support was a new source of finance for a demonstration of the potential of the railway through the construction of a steam-powered trunk line designed to carry both people and goods at speed. Two such lines, with different solutions for the problem of finance, soon appeared.

In June 1840, the State awarded concessions to promoters of the Paris & Orléans (121 kilometres) and Paris & Rouen (137 kilometres) railway companies⁸. Bankers for the Orléans persuaded the Government to guarantee a minimum rate of interest on its shares⁹. In contrast, the Rouen looked principally to the railway investors of Liverpool and London for assistance. The time was propitious for seeking English support since the railways of the first "Railway Mania" were making or about to make a satisfactory return for their shareholders. Nevertheless, it was also essential for English investors to have the assurance that schemes outside the country were in the hands of engineers and contractors of proven merit. As a previous example of this process, Mackenzie, Brassey and Locke had gone to Scotland to build the majority of the Glasgow, Paisley & Greenock Railway, not because the Scots were incapable of doing the job themselves but because it was vital to attract English finance. For shareholders of the London & Southampton Railway, the Rouen line, in association with an obvious subsequent extension to Havre, was of outstanding interest since it would make their line part of the fastest route between the two capitals.

Thus English investment began to flow into France and it continued to do so until 1848 brought revolutions in France and the end of the second British "Railway Mania". Approximately 50 per cent of the shares of the Paris & Rouen, Rouen & Havre and Orléans, Tours & Bordeaux railways were held in Britain and about 70 per cent of those in the Amiens & Boulogne, which attracted strong support from the shareholders of the South Eastern Railway¹⁰.

The Contribution of Mackenzie & Brassey to the Development of French Railways

Despite their great traditions and achievements in the field of civil engineering, the French had much to learn about railway construction and Mackenzie & Brassey provided a demonstration of the best British methods. The former visited France for the first time in August 1840 and was immediately fascinated by Paris. After touring the city and seeing some of its monuments, he commented, "all tend to astonish and bewilder[.] France is truly a Great Nation"¹¹ He finally established his home in the Avenue Lord Byron and, alimentary matters having a prominent place in his life, became an habitué of its best restaurants. Thereafter, he spent much time in France: the equivalent, for example, of ten months in 1842, and, nine in both 1843 and 1844. Not until the 1848 revolutions did he, in effect, leave the country (Fig. 1).

During 1841, Mackenzie & Brassey obtained contracts for a line along the Seine Valley, via Poissy, Mantes, and Vernon, largely by negotiation with Locke and the Paris & Rouen Railway Company. The contracts on this line were advertised and put out to tender but, since it was

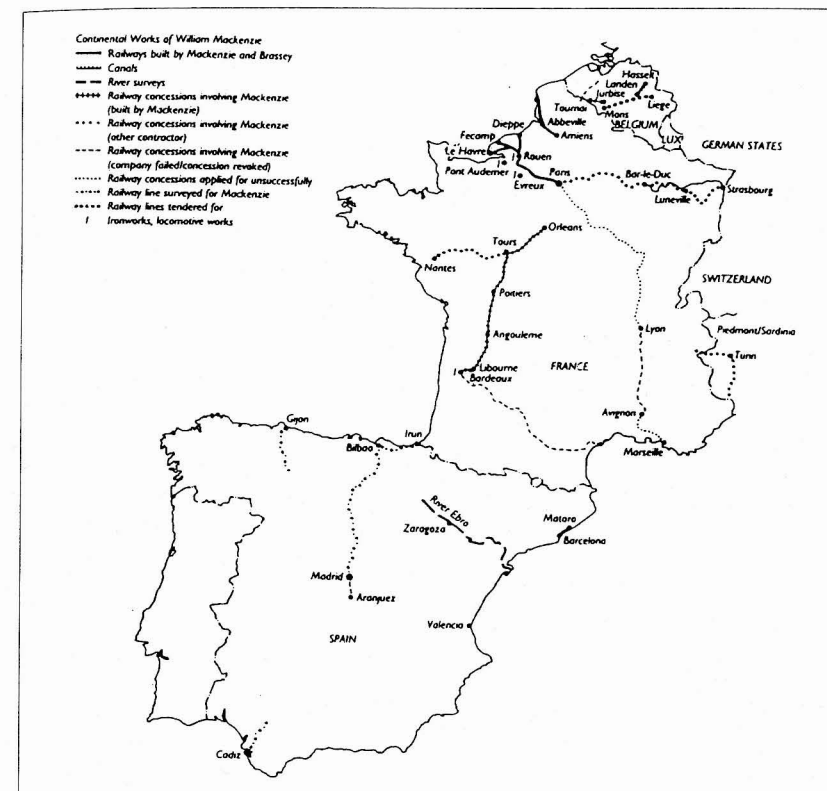


Fig.1 Railways and Canals in France associated with William Mackenzie (by kind permission of The Institution of Civil Engineers).

already known that Mackenzie & Brassey could build more cheaply than could French contractors at this time in railway construction, there was little doubt as to who would obtain them. Work on the route from the St Germain Railway in the Colombes district of Paris to the left bank of the river opposite Rouen entailed making four river bridges and several tunnels but it required little in the way of excavation. Building went forward at speed and, as a feat that was rarely equalled in Britain, reached completion in a little over two years. But it should be noted that the French also acted expeditiously and were able to open the Orléans line in the same month (May 1843) as that to Rouen came into use. The continuation of the latter railway to Havre was an altogether more challenging matter since it necessitated a long (Eauplet) bridge over the Seine at Rouen, a series of tunnels under the old town of Rouen, three long viaducts at Malaunay, Barentin and Mirville and a substantial tunnel at Pissy-Pôville.

The most dramatic event of Mackenzie & Brassey's time in France occurred during the construction of this line. On the morning of 10 January 1846, all 27 arches of Barentin Viaduct collapsed. Investigations undertaken by the company and the Ponts et Chaussées into the cause of this failure, and subsequent engineering opinion, indicate that defective mortar and the use of stone of inadequate strength in the base of the piers may have been the crucial factors¹².

Mackenzie's agents rebuilt Barentin at speed and the other viaducts were strengthened but the partnership lost about £30,000 despite receiving £20,000 compensation from the company (Fig. 2).

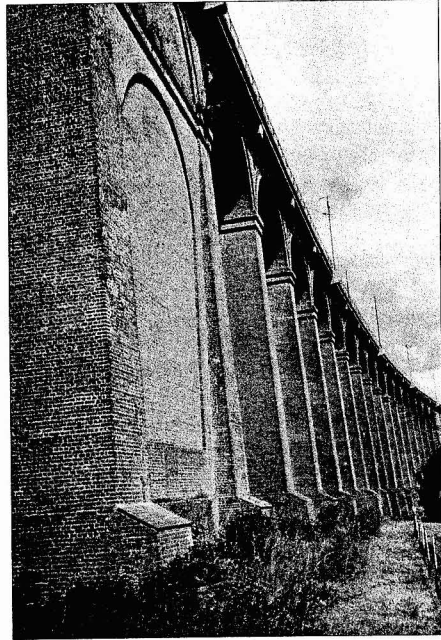


Fig. 2 The Mirville Viaduct on the Rouen and Havre Railway. This view shows evidence of the reinforcement introduced following the fall of the Barentin Viaduct in 1846 – a filled-in arch and buttressed piers.

The lines to Rouen and Havre, including the latter's branches to Fécamp and Dieppe, and the Amiens & Boulogne Railway attracted some State assistance but to a major extent followed the British pattern of private finance and contracting. The Fécamp and Dieppe branches were built entirely by Mackenzie & Brassey but their contribution to the Amiens & Boulogne was largely confined to earthworks and track laying from Abbeville to Boulogne, via Étaples; a French company, Ganneron, won the contract for the masonry, bridges and other 'works of art'. Other lines which followed the Law of 1842, as befitted the French conviction that railways were part of the national patrimony, received more substantial State finance. Thus the Ponts et Chaussées, backed by Government capital, supervised the building of the track bed, viaducts, bridges, stations, etc., of the line from Orléans to Bordeaux, via Tours, Poitiers and Angoulême, without cost to the company. Mackenzie & Brassey ballasted and laid the rails only; these operations and the provision of motive power and rolling stock were the principal charges on the company.

The lines of the 1840s from Paris to the Channel ports produced outstanding improvements for travellers between Britain and France. In 1849, with the completion of the Amiens & Boulogne, it was possible to go between London and Paris, via Folkestone and Boulogne on the new steam ferries, in eight and a half hours. In the rhetoric of the editor of the "Railway Record": "In eight hours and a half was the space which separates the two capitals of England and France devoured by the 'chariot of fire' by land and by sea." Four years before, it had taken Mackenzie – with no untoward events and ignoring periods of rest – 20 hours to go simply from Boulogne to Paris, and this included the use of the railway from Rouen¹³.

Construction Methods and the Organisation of the Work

In their work in France, Mackenzie & Brassey in principle applied the methods of construction that had already succeeded in Britain. The challenge was to adapt these to foreign circumstances. Both at home and abroad, Mackenzie first toured the route of a proposed line, usually in the company of one of its engineers. He then assessed the ability of the area around the line to supply him with the materials that would be required in great volume and, if obtained outside that area, would incur severe transport costs. The accounts for the construction of Lime Street Tunnel¹⁴

show that his policy had been to order materials, such as rails, candles, gunpowder and coal, in small quantities from as many local suppliers as possible. This stimulated competition for his business and reduced the problem of storage and its concomitant, theft. In France he gradually built up groups of reliable suppliers. Thus by 1844 the Rouen and Barentin Contract of the Havre line was receiving timber from at least 18 French dealers. His inspection of the routes of the Rouen and Havre lines revealed that the district contained only limited quantities of suitable stone. Therefore, much was built in brick and Mackenzie & Brassey set up six brickyards between Rouen and Barentin to cater for requirements on that 14 miles alone. Above all, they were especially careful to establish control over a wide and expensive range of products in iron in order to remedy the inability of French industry at this time to supply some of their requirements and also to ensure that any profit remained with themselves. So they took over and expanded ironworks at Evreux and Pontaudemer¹⁵, and set up a foundry in Eauplet, Rouen. These establishments supplied them with waggon wheels and pedestals, turntables, points, rail spikes, chairs, etc. A most valuable asset was their partnership in the works run by Allcard and Buddicom at Chartreux and Sotteville in Rouen. Here, in addition to routine railway equipment, locomotives were manufactured.

In their methods of railway construction, Mackenzie & Brassey gave much responsibility to Agents who, it appears¹⁶, sometimes went for months without supervision by or advice from either of the partners. One or two of these men, including John Milroy and Alexander Ogilvie, were already or eventually became respected figures in their profession. Others, such as George Goodfellow, who built Eauplet Bridge and strengthened Malaunay Viaduct, and John Jones, a valued employee of Mackenzie over many years, are virtually unknown. In accordance with the already well-established procedures of the industry, part of the work on every section of a line went to sub-contractors. Mackenzie sometimes provided them with materials – presumably to ensure that it was of a proper quality – and lent them horses and waggons. It was left to them to make a profit or loss. Work could commence on a sub-contract after a simple verbal exchange. When Edward Mackenzie, William's brother, wanted additional work done on Roule Tunnel on the Rouen line in 1845, he

".....walked through Rolleboise Tunnel saw Beaver and arranged with him to do the Mining, and brickwork for the underpinning Roule Tunnel for 2.20 francs the superficial Metre including all labor finding his own lights, sharpening picks etc."¹⁷

More onerous assignments had to be accompanied by a signed agreement¹⁸.

Below the sub-contractor in status and financial hazards and rewards was the ganger whose primary duty was to organise his team. At the end of a period of time, it could be a day or a month, the work was measured and the ganger received recompense in keeping with performance for distribution amongst his men. But, as Edward Mackenzie discovered in March 1846, this procedure could lead to dishonesty:

"This morning early I received intelligence of a Ganger the name of Simcox having left Blois without paying his Men I sent at once to the railway Orleans and there he was with the first dilligence on his way to Paris but La Marie our time keeper met him and brought him to our house where he gave up all the money 1300 francs and off he went."¹⁹

The Mackenzies now began to hand wages to gangers in front of their assembled men. Depending on circumstances of time and work, an interchange of rôle could occur between gangers and sub-contractors, as it did between engineers and contractors.

Labour

The decline in the volume of railway construction being undertaken in Britain in the early 1840s meant that, especially on the lines closest to the Continent, such as the London & South Western (or London & Southampton), men became available for work in France. Even further afield at home, there were, according to Mackenzie's secretarial staff in Liverpool, many who wished to go to France but could not meet the expenses of the sea journey²⁰. William Reed, a Director of the Paris & Rouen Railway, in evidence to the Select Committee on Railway Labourers of 1846 estimated that at one time about 5,000 British navvies worked on that project²¹. Once abroad and in the Seine Valley, the men enjoyed not only the availability of cheap wine and an abundance of types of accommodation for their leisure hours but also the system of compensation for injuries which Edwin Chadwick emphatically recommended to the 1846 committee for adoption on British contracts²². This compensated the victims of accidents whether they had contributed through irresponsibility to their own suffering or not. Such a concept in the treatment of workers was wholly alien to the practice of British contractors but, as Mackenzie was advised by his solicitor, it was better to pay up immediately than face the award of a tribunal which was augmented by the costs of its proceedings²³. Men who were injured could receive 250 francs compensation, and widows, a gratuity of 300 francs²⁴. In the area of routine ill health and for those who practised self-help, a sick club on the Dieppe line paid 10 francs per week²⁵.

A feature of the railway construction scene in France throughout the 1840s was the differential in wages in favour of British labourers; this reflected their initial advantages in experience and stamina, and the requirement for rates which would keep them in France, especially when business in Britain picked up. Thus British labourers on the Poissy Contract of the Paris & Rouen Railway in 1842 received 4-5 francs for a ten-hour day and Frenchmen, 2.50-3 francs²⁶. Five years later the contrast had narrowed to 4.50 and 3 francs for English and French labourers, respectively, but amongst the tunnel miners employed by Edward Hatfield at Hardelot near Boulogne a conspicuous difference of 7 and 4 francs still existed²⁷.

By the time of Mackenzie's death in 1851, the mass of British workers had gone home leaving the Agents of the partnership and their assistants who were supervising the laying of the track between Poitiers and Bordeaux as the remnant of this once formidable force in railway building.

Mechanical Equipment

A notable feature of Mackenzie's methods was his spirit of innovation in the field of mechanical equipment. He was an early, though not the first, contractor to use locomotives²⁸. On his entry into railway work, he purchased two celebrated early locomotives, "Comet" and "North Star", from the Liverpool & Manchester Railway and employed them in moving spoil from Lime Street Tunnel. In France, locomotives from Potts & Jones of Newton-le-Willows, Hawthorns, Newcastle, Hicks, Bolton, and Kitsons, Leeds, made a major contribution to construction and, when no longer required by Mackenzie & Brassey, were sometimes sold to French railway companies. These engines with their tenders weighed c.15 tons and cost c.£1,500. In the early 1840s, before the French themselves became efficient manufacturers, more British locomotives would have been imported into France if freight, insurance, unloading and Customs duties and permits had not added c.37 per cent to their cost²⁹. And there were other problems associated with exporting locomotives to France. They had sometimes to be dismantled because French ports did not always have the equipment to handle such loads; suitable cranes existed at Rouen, Nantes and Boulogne but not at Dieppe and Bordeaux³⁰. Thus fitters had to be sent to France by manufacturers to reassemble them. The locos of Allcard & Buddicom, of course, escaped these charges and problems.

Amongst the other mechanical equipment that could be found on Mackenzie & Brassey's contracts were brickmaking machines and, above all, steam excavators. In September 1843, the partners saw an Otis excavator at work on the Eastern Counties Railway near Brentford and in March of the following year Mackenzie agreed with the American, Captain Cochrane, to purchase a number of his excavators; these were, almost certainly, similar if not identical in design to those of W.S. Otis³¹. Favourable reports concerning their performance reached Mackenzie from the North of France Railway where they were in use between Paris and Creil. Cochrane excavators, as manufactured by Varrall, Middleton & Elwell in Paris, cost approximately £1,000 and were thus a relatively major addition to the partnership's fixed capital costs - especially so in comparison with the tried and tested locomotive. The comparative expense can be gauged from the fact that the fire insurance policy for the heavily capitalised section of track between Pissy-Pôville and Malaunay valued the stables, harness, fodder, forges, carpenters' shops, tools, houses, huts, offices, 33 navvies' houses and 105 horses at a little over £6,000³². Regrettably, little information exists concerning the performance of these machines. One of an unspecified number which went to the Rouen and Barentin Contract of the Havre line at Maromme broke down within 10 days; the four which Mackenzie stationed in gravel pits (for ballast) between Orléans and Tours probably did the most useful work. In the 1840s, the steam excavator was in the same state of mechanical imperfection as was the pneumatic drill.

Profits and Other Activities

Mackenzie & Brassey made a handsome profit on their French contracts and share dealing. In July 1848 this was calculated at £374,000 with a further £265,200 still under negotiation. If the final balance gave them only half of the latter sum, their joint return in today's values exceeded £28 million³³. On the debit side, heavy losses had been made on the ironworks at Evreux and Pontaudemer. This most unexpected setback was attributed by Mackenzie to the incompetence and duplicity of their manager, J.O. York. The partnership's assets also suffered from the deceleration in railway building in both Britain and France in the late 1840s and the French revolutions of February and June 1848. A striking example of this process occurred in relation to the shares and bonds received as payment for contracts on the Eastern Union Railway; these were originally worth £63,200, but by 1850 had fallen by almost 2/3rds in value³⁴.

The above account by no means covers all Mackenzie's activities in France. The returns from share dealing, including in ten French companies, accounted for approximately 15 per cent of the partnership's established profits in July 1848. Mackenzie was also a Director of three French companies. Outside France, he promoted, surveyed or built lines in Spain and Belgium.

The Curtailment of their Work in France

Throughout their time in France, Mackenzie & Brassey were careful to cultivate friends in business circles and the aristocracy. But the tensions generated by nationalism lay just beneath the surface. To many Britons, France was still the country of Bonaparte and there was even talk of war in 1840. For the French, national pride and an awareness of France's achievements in civil engineering decreed that British influence had to be reduced as soon as was practical. The Revolution of February 1848 saw hundreds of British construction workers and locomotive drivers and fitters employed by French companies flee the country because of violence or its possibility. Almost as serious, and totally irrational in Mackenzie's view, the timber arches of some of the bridges which he had built over the Seine were destroyed by fire, the equipment used by his maintenance crews on the Rouen line stolen and Buddicom's factory at Sotteville attacked by a mob. Both Mackenzie and Brassey now removed personal property from Paris and left the

management of their affairs in the capital in the hands of their secretarial agent, Francois Favrin. Writing to him in March 1848, Mackenzie revealed his bitterness and suspicions:

the French "... hate us so detestably and have driven lots of our own countrymen home and shown their true colours France is made for french[sic] only – except John Bulls who have overflowing purses and get in the shops of the Boulivarts"³⁵

Mackenzie and Brassey worked in close co-operation as supervisors of the construction of the Paris to Rouen line and, with less commitment in time by both men, on the extension to Havre (Fig. 3). By 1844, however, French affairs, including the machinations of railway politics, were largely the province of Mackenzie while Brassey spent much time in England on their Trent Valley, Great Northern and North Staffordshire contracts. But it is not easy to generalise about this division of responsibilities since Mackenzie also made a major contribution to the Chester & Holyhead and Liverpool, Ormskirk & Preston lines. The partnership with Brassey was dissolved in 1850 and their assets divided. The only disagreement arose over the disposal of profits from the construction of the Great Northern line between King's Cross and Peterborough. Robert Stephenson, acting as an adjudicator, decided that they should be shared between the two men and were not exclusively Brassey's. It is evidence of the harmonious relationship and trust which existed between the two men that a formal deed of partnership was signed only a few months before its dissolution.

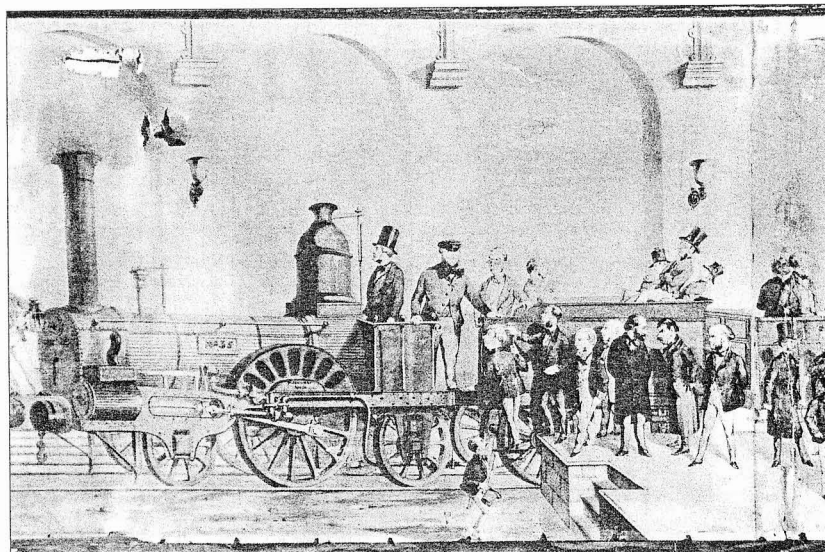


Fig. 3 The Scene at the Opening of the Rouen and Havre Railway in 1847 (by kind permission of the Flintshire Record Office).

His Personal Characteristics and Achievements

Mackenzie remained in touch with affairs in France to the end of his life and especially with the track laying being carried out by his brother on the Bordeaux line. The last important public event he attended was the opening of the section of this line between Tours and Poitiers in July

1851. For several years before his death, Mackenzie suffered from sepsis in several parts of his body and this, allied to a general deterioration in his health, brought about his death in his house in Liverpool on 29 October 1851³⁶. He had been given no time in which to relax on the three Scottish estates which he had recently purchased.

The picture of Mackenzie that emerges from his diaries and papers is of a man with immense energy (Fig 4). The conduct of his business required incessant travel, much of which could still not be carried out by rail. Although the bulk of the work in England, Wales and Scotland was left to Brassey and John Stephenson, their partner from 1844 in British affairs, Mackenzie toured the routes of the Lancaster & Carlisle and Caledonian railways and paid close attention to the progress of their contracts on the Chester & Holyhead. Also in the British Isles, work on behalf of the Shannon Improvement Commission meant that he stayed the equivalent of two months in Ireland in the years 1842 to 1845 alone. Travel outside the sphere of the railway sometimes proved exceedingly exhausting and even dangerous. A trip to eastern France during January 1843 in order to assess possibilities for work on the Marne-Rhine Canal was brought to a halt when he broke an ankle, and a journey in April 1845 between the Franco-Spanish frontier at Bayonne and Madrid, returning by Barcelona and Perpignan, became one of the most arduous and least rewarding excursions of his time on the Continent.



Fig. 4 William Mackenzie in 1845: a detail from the portrait by T. H. Illidge (by kind permission of the Institution of Civil Engineers).

Mackenzie's diaries reveal a volatile but sociable person with an acute sense of family loyalty, though even this had its limits. When pestered by a clutch of young nephews who expected rich Uncle William to launch their careers in civil engineering, his tart rejoinder to one supplicant was: "I received no help in life; no-one supported me." Disagreement in financial matters could bring out the very worst in his nature down to a very petty level. Thus he was prepared to haggle with cabmen over minor fares and was highly offended when refused admission during an attempt to take two of Brassey's sons into the Paris Opera on a single ticket. Navvies who complained about their wages got short shrift: in 1842 during a visit to the Rouen line "19 Scotch

came and were dissatisfied with wages I told them to go home again they went away grunting....”³⁷ Yet he met the hospital fees of injured men and paid the fares of some back to England³⁸.

Mackenzie’s experience and talent made him a master of the materials and operations of his profession, whether it was in an evaluation of preservatives for sleepers or in ordering a locomotive which contained the latest mechanical advances, such as Stephenson’s valve motion. Engineers who attempted to sneak additional work into a contract after it had been signed rarely succeeded. If he had been asked to list his skills he would have given a high place to his knowledge of the manufacture and uses of cast iron. In the 1820’s, when working under Thomas Telford, he supervised the installation of the cast iron arches of the elegant bridge over the Severn at Tewkesbury which exists today. Inferior production methods did not pass unnoticed and so an attempt by a Paris foundry to sell him “soft”, i.e., inadequately chilled, cast iron waggon wheels led to direct action: “Beaumont and I went to Davidsons Foundry at 7 o’Clock and broke up all the Wheels 42 - returned home took breakfast”³⁹

In conclusion, he would have been delighted to know that his profession accepted as fair appraisal the modest self-assessment which appears in a letter written in 1833 to Henry Booth of the Liverpool & Manchester:

*“It must be well known to you that in works of this description men require strict and rigid looking after, but I never yet knowingly put bad work through my hands, I have been under some of the most eminent Engineers and the most extensive Contractors in this Kingdom and always ... had the gratification of turning out my work in such a manner that ... they have been admired by all practical men who have seen them....”*⁴⁰

The French were above all impressed by the speed at which Mackenzie & Brassey worked and their ability to take on assignments extending over an entire line. They would not have quarrelled with the claim that Mackenzie was the senior partner in “the first conspicuous effort of British [railway] construction enterprise abroad.”⁴¹

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27. Mackenzie Papers, I.C.E., B4R1/2/3, Payments on the Boulogne Division of the Amiens & Boulogne Railway, Oct. 1847.
28. The first contractor to use locomotive power is almost certainly John Tredwell who had an engine on the Kenyon & Leigh Railway which opened in January 1831. Evidence of John Tredwell to the House of Lords’ Committee on the London & Southampton Railway Bill, 2 June 1834, pp.73-6. I am indebted to Mike Chrimes of the Institution of Civil Engineers for bringing this reference to my notice.
29. Based on the charges listed in a Customs Certificate for a Hawthorn-built locomotive imported in February 1846, Mackenzie Papers, I.C.E., *Mackenzie & Brassey Ledger, 1845-6*.

30. As contained in a "Droite d'Entrée" issued by the Douane at Rouen in August 1845, Mackenzie Papers, I.C.E., A5L4 and A5L5, *Box 2, Paris & Rouen*.
31. Mackenzie Papers, I.C.E., Diary of William Mackenzie, 14 Sept. 1843 and 28 March 1844.
32. Mackenzie Papers, I.C.E., A5L6:17, Fire Insurance Policy with the "Eagle Insurance Company", Sept. 1844.
33. Mackenzie Papers, I.C.E., letter of F.Favrin to William Mackenzie, 20 July 1848, *Private Letter Book, 1848*. Favrin was the partnership's secretary in Paris. Taking an exchange rate of 25fr/£1. The comparison with today's values is based on the calculation £1,000 in 1996 = £55,300 in 1845.
34. Mackenzie Papers, I.C.E., letter of William Mackenzie to Thomas Brassey, 17 January 1850, *Private Letter Book, 1848-50*.
35. Mackenzie Papers, I.C.E., letter of William Mackenzie to F. Favrin, 9 March 1850, *Thomas Brassey Correspondence, 1848-50*.
36. The date of death given in "Memoirs" is incorrect.
37. Mackenzie Papers, I.C.E., Diary of William Mackenzie, 16 April 1842.
38. *ibid.*, 24 Jan. 1844.
39. *ibid.*, 28 Nov. 1842.
40. Mackenzie Papers, I.C.E., letter of William Mackenzie to Henry Booth, 2 April 1833, *Letter Book of William Mackenzie, October 1829-December 1840*.
41. L.H. Jenks, *The Migration of British Capital to 1875* (1971), p.142.