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PAYING FOR CROSSRAIL: THE BUSINESS CASE

Michael Schabas

A new railway is being planned across London. Incremental fares revenue will only pay about a quarter of the £10 billion¹ expected cost, so the Greater London Assembly (GLA) is considering 'alternative funding mechanisms'. These include new taxes on businesses that are presumed to benefit from the scheme. Taxes would deter the very investment Crossrail is supposed to support. The GLA would do better to change the scheme to reduce the need for subsidy and strengthen the business case.

Introduction

Nobody expects a new railway to pay its own way, at least not entirely. Railways are 'natural monopolies' with high fixed costs. Like parks and the police, it is not possible or efficient to capture all benefits through user charges. Many of the benefits accrue to people who do not even use the trains, including motorists on less congested roads, and employers who can access a larger labour market.

However, the presumption that all railways lose money, and so fares income is irrelevant, is false. In spite of strict development controls, London continues to grow. With little new road construction, this growth has increased demand for rail transport, and several commuter rail routes now earn revenue well in excess of costs.

Nor is it true that the only way to fund new railways is from taxes. Crossrail will be London's fourth major new railway in four decades.² They have been funded with a mix of revenues and negotiated developer contributions, with the exchequer usually only paying about half of total costs. Rather than impose new taxes, which will only deter the very investment Crossrail is supposed to support, the GLA would do better to revisit the Crossrail scheme to see if the business case can be strengthened. This might include adding longer branches serving high growth corridors, which can generate higher revenue. It might also gradually raise fares, to fund both the Crossrail scheme and other improvements to the network. This could be done within the context of a new London Regional Rail Authority.

Unless passengers are willing to pay a significant proportion of total costs (as they were historically: see Box 1), one must question whether any rail scheme is worth the price.

Nationalisation and 'modernisation'

During the Second World War, the railways were forbidden to make capital improvements. After the war, they were condemned for failing to invest, and nationalised in 1947 essentially for ideological reasons.³ British Rail (BR) embarked on a 'modernisation' programme, often driven more by engineering ideals of what was 'modern' than any rigorous business analysis.

Main lines were electrified, with diesel traction replacing steam on other routes. The economic case for electric or diesel traction is often unclear, depending upon the characteristics of a route but also assumptions about the future costs of oil and electricity. Politicians have had a bias towards electrification, which is seen as more 'modern'. In the 1950s, Britain was an oil importer, electricity was generated by the same coal that was used to power steam trains, and the coal, electricity and rail industries were all nationalised. BR was forced to buy inferior diesels made by local manufacturers, rather than the more reliable and powerful locomotives that had been developed since the 1930s in America.⁴

The appointment of Richard Beeching as BR Chairman in 1961 began a shift towards managing BR as a commercial, competitive enterprise. Henceforth, freight would be carried at market rates, mostly in whole trainloads or standardised containers. BR would charge what the market would bear, attempting to recover the high fixed costs of the network from those customers who were most able to, and most likely to pay.

The passenger railway moved away from mileage-based fares towards market pricing. The captive business passenger would be charged more than the politically-important commuter or the discretionary leisure traveller. BR was restructured

Box 1: Historical background

From 1830 to 1947, private companies built 20,000 miles of railways across Britain, including underground and elevated lines in London, Liverpool and Glasgow. Private 'promoters' conceived and designed the routes, responding to market demand. With minor exceptions, they were financed^a and operated by private investors, and funded by passenger and freight revenues.^b Government involvement was limited to passing legislation granting powers for compulsory purchase of land, enforcing charges and providing immunity from liability and nuisance claims. Although there was some regulation, fares and freight rates were mostly set by the market. This *laissez-faire* approach gave Britain the best railways in the world.

On major routes there were often two railways competing on service quality and price. However, on local routes the railways were usually monopolists, and tended to invest less than if they were in a fully competitive industry.^c The Victorians used the new railways with awe and excitement. However, by the turn of the century the railways came to be taken for granted, and then gradually became the subject of criticism and abuse. The economics of railways depend on local circumstances, and passengers on branch lines often wondered why 'their' service did not get the best trains. People began to demand better services than their owners could profitably deliver.

After the First World War, construction of new lines slowed but investment continued. Main lines were upgraded with faster services. Commuter lines were electrified, because lower costs and better service made this worthwhile even for monopolists. In an attempt to create jobs, and perhaps win votes from the suburbs, government provided funding guarantees for extensions and electrification schemes, but a commercial return was still expected.

Within central London, the effects of bus competition were severe. Three new 'tube' lines opened in 1906, but buses took enough of the short-distance traffic to make them unprofitable. To avert bankruptcy, government allowed a monopoly 'combine' to be formed comprising the tubes, buses and trams. Routes and fares were set to maximise overall revenues, avoiding direct competition. Revenues were pooled and shared among the owners. The Metropolitan Railway, which earned its money from longer distance commuter markets where buses could not compete, did not see the need to join the combine. It remained profitable and independent until it was nationalised, together with the bus and underground combine, in 1933. The new London Passenger Transport Board (LT) was government-appointed, but expected to cover its costs from fare revenues.^d

^aFunding refers to the ultimate source of income, either passenger fares or tax revenues, while 'finance' refers to the arrangements to raise money for capital investment.

^bAlthough some railways engaged in property development around train stations, in Britain this was merely a parallel and essentially speculative activity. In contrast with America, where it was common to grant government land as a form of subsidy, British railways were usually only allowed to use their statutory powers to acquire land for the operational railway.

^cRailways are not unique in this respect – unregulated local monopolies survive to this day in the provision of all sorts of goods and services, ranging from neighbourhood video rental shops to ready-mixed concrete suppliers.

^dSee Barker and Robbins (1974).

into market-focused 'InterCity', regional and freight units. Although the roads continue to improve, congestion in a crowded country means that rail is the preferred mode for most journeys into central London.

The Metropolitan Green Belt, established in 1938, had unexpected but ultimately beneficial effects.⁵ New development was forbidden in a broad band around London, but permitted around towns outside the green belt, roughly 20 miles or more from the capital. In an era when people still heated their homes with coal, big cities were dirty places. The utopian ideal was for people to live and work in the new towns.

It did not happen according to plan. The new towns were built, but the jobs did not follow. While industrial employment declined, it was replaced by office jobs as London renewed its position as a world business centre. Since development was, at least in

theory, prohibited, supply was constrained and house prices in London rose at a rate well above inflation. More and more people found it worthwhile to travel across the green belt to homes beyond it.

Through the 1970s and 1980s BR continued to upgrade commuter routes with electrification, resignalling and new rolling stock. These schemes were mostly self-funding, with increased revenues paying a respectable surplus over costs. Without the green belt, commuters would not have had to travel so far and pay so much, nor would they have had to concentrate around towns with railway stations. Arguably, BR hijacked the new towns strategy as the improved services meant commuters could outbid local residents for homes.

With costs being reduced and revenues increasing, the financial health of the railways gradually improved. By the end of the twentieth

century, about 300,000 people were commuting daily by rail from homes in and beyond the green belt into central London. Rail commuting had become a business worth almost £2 billion per year.⁶

New railways in London from 1950

In the postwar years, London Transport was a poor cousin to BR. Several schemes to extend tube lines, partially completed before the war, were abandoned because the areas they would serve were located in the green belt. In 1947, government declared that it accepted 'the principles' of the Greater London Plan,⁷ which included proposals for new railways that would eventually become the Victoria and Jubilee lines, and Crossrail. However, government showed no appetite to provide any funding. Growth within London was contrary to the green belt policy and ridership on the Underground was gradually declining.

London Transport (LT) obtained powers to build the Victoria Line in 1955. It would connect existing tube and surface lines, bringing a substantial increase in capacity and relieving severe congestion.⁸ In particular, it was necessary to distribute the growing numbers of commuters from the BR terminals. The Victoria Line was not expected to pay for itself with fare revenues, but passengers would benefit from shorter journey times. For the first time, a line was proposed on the basis of 'cost-benefit' analysis. Government reluctantly accepted this rationale. The go-ahead was finally given in 1962, and the line opened in stages after 1968. It was a popular success and heavily used from the day it opened. 'Cross-platform' interchanges at many stations allow passengers to change between lines without climbing stairs.

Government also approved an extension to Heathrow, which opened in 1977. This attracted new riders, paying high fares for long single journeys, and mostly filling empty off-peak and contra-peak seats. Although commuters do not mix well with tourists hauling suitcases, serving Heathrow has been a good business for the Underground.

The Jubilee Line was also planned to relieve congestion on existing routes, and was justified on the basis of cost-benefit analysis. The first stage, to Charing Cross, opened in 1977.⁹ While it relieved the parallel Bakerloo Line, it attracted few new riders. LT found itself operating two lines each just over half full, with adverse effects on its finances. Compared with the Victoria Line, the design left much to be desired, with 'tortuous and awkward' interchanges.¹⁰

However, the new tube lines did not reverse the long-term decline in overall ridership. By 1982, peak hour trips on the expanded Underground system were down by about one-third.¹¹

A second stage of the Jubilee Line was to run east through the docklands to the massive housing estate at Thamesmead.¹² It would cross under the Thames five times. Although parliamentary powers had been

obtained, government refused to fund the scheme. LT and the Greater London Council (GLC) eventually proposed a much cheaper light rail system (Docklands Light Railway, DLR) that would make use of abandoned railway viaducts. This won funding from the new London Docklands Development Corporation to attract investment and jobs into the area. The strategy succeeded beyond all expectations when Canadian developers Olympia & York (O&Y) decided to build Canary Wharf. O&Y agreed to contribute £70 million, half the estimated cost to extend the DLR to Bank, and to upgrade it for longer and more frequent trains. O&Y spent a further £30 million building a larger DLR station to serve its development.

O&Y soon learned that a single rail link was too tenuous to convince major companies to relocate, no matter how attractive the buildings and rents. In the summer of 1988, O&Y proposed a 'Second Docklands Railway', to run initially from Waterloo via Canary Wharf to Stratford. O&Y even prepared a Parliamentary Bill. But despite O&Y offering to pay most, and potentially all, costs of the new line, LT refused to co-operate and government did not allow the Bill to be deposited.¹³ Instead, LT agreed to promote an extension of the Jubilee Line (Jubilee Line Extension - JLE), following the route suggested by O&Y. After obtaining a contribution from British Gas, newly privatised owner of the derelict gasworks on the Greenwich Peninsula, the route was swung south to serve that site. The line then turns north to intercept the eastern commuter lines at Stratford. Provision was made for a future branch to Thamesmead, but loadings on the route to Stratford are high and it seems unlikely that this will ever be built.

LT promoted several further extensions of the DLR. The Beckton and Lewisham branches are in service. The City Airport branch is under construction and work on the Woolwich Extension will commence some time in 2005.

At the time the JLE and each of the DLR extensions were approved, incremental operating margins together with negotiated developer contributions were projected to cover at least half of the capital costs. The DLR Bank Extension and JLE both had severe cost overruns, but traffic and revenues on both lines and on the Lewisham extension also exceeded expectations. Only the Beckton Branch has failed to achieve promised usage and benefits.¹⁴

Also in the late 1980s, the privatised British Airports Authority (BAA) began developing plans for a fifth terminal at Heathrow. BAA recognised that it was unlikely to get permission for the new terminal if it could not offer a credible story as to how surface access would be managed without overcrowding the road network. The solution was Heathrow Express, a non-stop service to Paddington. This operates mostly over existing tracks, but BAA built and owns the

tunnels and stations under the airport. It also paid to electrify the line into Paddington. Although BAA initially saw the project as risky, Heathrow Express has turned out to be a profitable business, with revenues paying a respectable return on capital. And BAA did get permission to build Terminal 5.

British Rail also electrified the line north to Luton and Bedford, and re-opened an old tunnel so it could operate through passenger services across central London from north to south. The Thameslink scheme was funded from operational savings and revenues. Cross-London services commenced in 1987, and traffic doubled over the next decade. With four central London stations, Thameslink is very attractive for commuters. It also serves Gatwick and Luton airports, attracting off-peak traffic that fills seats during the day. Thameslink now generates a surplus¹⁵ of about £30 million per year, with passenger revenues of about £150 million.¹⁶

Since 1994, first Railtrack and then the Strategic Rail Authority (SRA) have been seeking to upgrade the Thameslink route, to run longer and more frequent trains and connect into more routes. The 'Thameslink 2000' scheme would cost something in excess of £1 billion but much of this could be offset by fares revenue and operational savings. An application to obtain statutory powers was commenced in 2000 but is delayed because of objections mostly relating to details of the proposed designs in the London Bridge area.

Crossrail versus the Jubilee Line Extension

During the Thatcher years, London's economy flourished and by 1988 traffic on the Underground increased by a third, back to the level of 1970. There was severe crowding, and government asked BR and LT to complete a joint Central London Rail Study (CLRS).¹⁷ While the study was given a broad remit to 'develop a strategy for improving services for passengers on the British Rail and Underground Networks' it was also told to make 'particular reference to passenger congestion in the area bounded by the major rail terminals and approaches'. Government also stated that it expected schemes to 'earn a commercial return'.¹⁸ If revenues and contributions from developers are not enough to pay for a scheme, it might consider grant finance if justified by *non-user* benefits, mostly reductions in road decongestion. However, benefits to rail users should be captured through fares.

CLRS focused almost entirely on the latter part of the brief, testing various schemes to relieve congestion. They considered various new tube and BR lines across central London. While the CLRS schemes would relieve tube congestion, they were very expensive and generated little additional rail revenue. Like the Victoria Line, it seemed that a new railway could only be justified on an economic cost-benefit

basis. Perhaps because it gave something for both organisations, CLRS recommended 'East-West Crossrail', essentially the proposal that survives to this day. A tunnel large enough for BR trains would run from Paddington to Liverpool Street, with five large stations under the City and West End. East of Liverpool Street and west of Paddington the existing tracks would be used, with some lengthening of platforms but otherwise no increase in capacity. Trains from LT's Metropolitan Line would connect into Crossrail west of Paddington.

CLRS did not look at building new railways outside central London, and took little account of growth at airports or in Docklands. The DLR had been recently opened, Heathrow Express was under development and construction had only just commenced at Canary Wharf. The CLRS team was staffed by operators who faced daily criticism about overcrowded trains, and this was what they tried to address.

Olympia & York argued that the Jubilee Line Extension, together with the shift of jobs to Canary Wharf, could also relieve congestion. Government commissioned a separate East London Rail Study (ELRS), led by consultants who it was hoped would be independent of BR and LT. They concluded that JLE would indeed relieve key parts of the network. The degree of relief would depend on how many jobs were shifted to Docklands, and how many were 'new' jobs that would otherwise not be created in London at all.

While Crossrail had a higher benefit-cost ratio and greater net benefits (table 1), it also had a much larger 'funding gap'. Within a few weeks of publication of ELRS, Canary Wharf agreed to contribute about £150 million (NPV), or about 20% of the expected out-turn cost of the JLE scheme. This reduced the funding gap further, to about £300 million, about one-third that of the Crossrail. O&Y had already been working with LT to prepare a Bill for the JLE, and this was deposited in October 1989. The Jubilee Line had jumped ahead of Crossrail in the project 'queue', and construction started in 1993.

Crossrail was allowed to follow, and government made warm noises that it would pay the price, now expected to be about £1.7 billion.¹⁹ By the time the Crossrail Bill made it to a Parliamentary Committee, the economy was in recession. After hearing evidence about the general case for the scheme, the Committee rejected the Bill. Government made a good show of being disappointed, but did not try to revive it. It did agree to 'safeguard' the route.²⁰

Crossrail Mark II

Crossrail was revived in 1999 by the City of London. They suggested that the scheme, now estimated to cost £3.1 billion, could be funded 'without any direct impact on the public sector borrowing requirement'.²¹ The City proposed creation of a TunnelCo, with government-guaranteed financing,

Table 1: Comparison of Jubilee Line Extension and Crossrail proposals in 1989

	Jubilee Line Extension ^a	East-west Crossrail
Costs (present value, including operations)	£780m	£1,210m
Incremental rail revenues	£290m	£310m
Incremental revenues : costs	37%	26%
Funding gap	£490m	£900m
Benefits to rail users	£730m	£1,550m ^b
Benefits to road users	£200m	£310m
Total benefits	£1,220m	£2,170m
Net benefits	£440m	£960m
Benefit : cost ratio	£1.56 : 1	£1.79 : 1

^a*East London Rail Study*, Halcrow Fox, & Associates for Department of Transport, September 1989. This included forecasts on a comparable basis for the Jubilee Line Extension via Canary Wharf, and East West Crossrail. CLRS provided slightly different figures for Crossrail and forecasts for a Jubilee Line Extension via Ilford, not serving Canary Wharf. Apparently to strengthen the government's hand in negotiation with O&Y, forecasts of rail and road user benefits were not published in the public version of the report. These were included in a separate report which was released later.

^bELRS published estimates of costs and revenues for both lines, as present values, but not rail and road user benefits for Crossrail. Annual figures, as presented in CLRS, have been increased pro rata with revenues to give present values for the project life.

which would sell paths to franchised train operators. The economics of the scheme had not changed much, and government would still need to pay the lion's share of the costs, albeit indirectly through subsidies to operators.

During 2000 the SRA carried out 'a review of the issues relating to rail travel on an East-West axis across London'.²² It considered 'regional metro' routes, serving mostly Greater London, as well as 'regional express' schemes, which would extend beyond the green belt. It also looked at northeast-southwest routes, including a new tunnel from Liverpool Street to Wimbledon. The SRA recommended against serving Heathrow, because mixing commuters and airport passengers would jeopardise service quality. They also saw no need to serve Docklands. This attitude met with quiet support from the City of London Corporation, which itself has large property holdings and sees Canary Wharf as a rival. The SRA claimed a benefit-cost ratio of 3.2 : 1 for an east-west Crossrail scheme that would cost £2.8 billion. Again, the case rested on rail and road user benefits, with taxpayers expected to pay the costs. The report did not even mention passenger revenues.

Canary Wharf turned on its lobbying machine again, arguing that it was now a business centre as comparable with the City and West End. It made vague offers to contribute to the scheme. For Canary Wharf, the link to Heathrow was seen as essential. Ken Livingstone, London's newly elected Mayor, agreed that both Canary Wharf and Heathrow must be served.

Attempting to repeat its promotion of the JLE, Canary Wharf produced its own 'Supermetro' proposal.²³ This extended Crossrail from Liverpool Street through to Canary Wharf and Barking. There would be surface branches extending to Stansted, Southend and north Kent, the latter crossing the Thames through the tunnel being built as part of the Channel Tunnel Rail Link. There was no attempt at economic or financial analysis, and little evidence that any workable strategy had been developed to operate

the trains which would need to share congested surface lines with existing services.

In 2001 SRA and Transport for London (TfL: successor to LT) established Cross London Rail Links Limited (CLRLL) with £154 million to develop the scheme. CLRLL's chairman declared that, 'All potential route options for Crossrail are subject to detailed evaluation and appraisal in consultation with major stakeholders and no single option to the east or west of central London is a given at this stage'.²⁴

CLRLL's subsequent analysis of alternatives shows every indication that they had no clear idea as to what they were trying to achieve, let alone how they might achieve it. They added and dropped branches from month to month. CLRLL eventually produced a 'Benchmark Business Case' in 2003.²⁵ This used the safeguarded alignment through central London, extended east to Whitechapel. The line would then split, with one branch via Stratford to Shenfield. A second branch would run to Canary Wharf, then cross the Thames to the Royal Docks, then cross the river again to Woolwich before joining the existing North Kent Line and running through to Ebbsfleet.

In the west, some trains would run through to Heathrow, but on the 'slow' lines and making intermediate stops. It would not replace Heathrow Express. A second branch would leave the Great Western Line around Acton, then run south via a new tunnel to Chiswick and over existing lines to Kingston.

CLRLL claimed a benefit-cost ratio of 1.99 : 1 for a scheme costing about £11 billion. The 'Benchmark Business Case' lists 'increased fares revenue' as one of its economic benefits,²⁶ but no figure is quoted.

Canary Wharf and the City, as well as business groups such as London First, continue to lobby government to pay for the scheme. It is described as 'the single most important issue for London', with warnings that 'without Crossrail millions of people in this region may have to face life in worse jobs or without work, living in substandard housing or without homes of their own'.²⁷ In response, the

government appointed Adrian Montague, a merchant banker, to chair a task force to review the scheme and recommend whether or how it might be funded.

In parallel, London's business community began to look seriously at how it could contribute to the cost.²⁸ Central London is already served by more underground and commuter rail lines than any city in the world.²⁹ Crossrail might add about 7% to capacity into central London,³⁰ and even less for long-distance commuting. So the benefit to property owners of one more line will be modest.³¹ In Docklands, it was possible to threaten to move or omit stations to extract contributions; however, in central London the Crossrail route was picked about 15 years ago, and ownership around stations is fragmented. So some form of tax is seen as the only practical option. Representatives of major London businesses have offered, in principle, to support a special levy to raise about £2 billion in present-value terms. It remains to be seen whether businesses will accept that a 'tax' of, on average, about £100 per worker per year has commensurate benefits.³²

The Montague Report was released in July 2004. He gave lukewarm endorsement to the scheme, which 'appears to deliver value for money'.³³ However, he notes 'significant uncertainty' and 'cannot be satisfied that CLRL's Business Case fully meets the tests in the Terms of Reference'. He also raised basic technical questions which one would have expected would have been resolved by this point, including the capacity of the central section, performance risks of integrating the line with existing congested suburban railways, proposals for signalling and power supply, and the interface with the Heathrow Express.³⁴

Montague revealed that incremental revenues were forecast as £2.2 billion in present-value terms in the 'Benchmark Business Case'. He suggested these might be underestimated by about 50%, 'based on analysis of the markets served by Crossrail'.³⁵ He also noted 'London's business interests appear ready to contribute significant amounts, in the range of £2,000 million to perhaps £3,000 million NPV'. This leaves a 'funding gap' at £7-£8 billion.³⁶

Montague considered whether the scheme had been optimised, and considered various configurations of branches. He recommended the Kingston branch be dropped, with the line to Maidenhead (which had been in the original 1991 scheme) taking its place. He also suggested the line beyond Canary Wharf to Ebbsfleet might be built later.³⁷ Curiously, Montague does not appear to have considered dropping the Shenfield branch, although like the Kingston branch the costs to build it are high and the benefits probably very modest.

Montague considered premium fares, but noted that it would be difficult to introduce and enforce premium fares within London's integrated zonal fare system. There is also no good equity case for charging Crossrail passengers more than passengers on other

routes who may also benefit indirectly from less crowded trains or, indeed, from other investment on their line.

Montague concluded that Crossrail 'presents a significant funding challenge' and although 'a direct contribution from the Exchequer would be appropriate', 'direct funding of the whole cost would be unrealistic'.³⁸

The government responded skilfully to the report, repeating its 'support' and inviting CLRL to prepare a Hybrid Bill for deposit in Parliament.³⁹ However, it gave no hint as to how the large funding gap would be bridged. In this key respect, nothing had changed since the ill-fated 1991 Bill.

A better Crossrail?

New railways can be worthwhile. A recent review of the JLE⁴⁰ concluded that, despite cost overruns, the 'out-turn' benefit : cost ratio was 1.75. The JLE became one of London's most heavily used lines from the day it opened. Travel on the Underground, measured in passenger-miles, increased 15% from 1999 to 2004.⁴¹ This implies an operating margin of about £130 million per year, at current fare levels. Allowing for future growth, this is enough to repay about half the capital cost.⁴² Without the JLE, many of the jobs at Canary Wharf would certainly have gone to other cities such as Paris or Frankfurt.

While the rail network overall loses money, many parts are actually profitable. At the time Montague was completing his report, government awarded a franchise for the Liverpool Street commuter services that will pay premiums averaging £50 million per year, a margin of about 20%. Thameslink, discussed above, which is already offering a north-south 'Crossrail' service, generates even higher margins.

Commuter fares are set by politics, not free markets. Although higher in London than in most other cities, fares are well below the level that a profit-maximising monopolist would choose. When the railways were privatised in 1996, the Conservative government fixed key fares to inflation until 1999, and thereafter reducing them to cut by 1% per year in real terms. This was a classic case of one government spending the next government's money. Tube fares, however, were not covered by this policy and have overall been increased slightly above inflation. TfL has successfully masked real fare increases by changing the fare structure. In 2003 the Labour government finally changed its policy and regulated rail fares now increase by 1% per year, after inflation. This is still below the 2% rate of increase of average earnings.

Increasing regulated fares is a good way to raise money because they apply where the railway has 'market power'. Train operators are still free to offer discounted fares where this will attract more passengers and generate more revenues.

There is money to be made carrying longer-distance commuters into London, especially from areas with major new housing construction and serving airports. While existing tracks are full on the approaches to the London terminals, on many routes there is spare capacity further out. The Channel Tunnel Rail Link has shown that it is possible to build new railways through open country, at relatively low cost. Yet Cross London Rail Links has never considered building new tracks beyond Paddington and Canary Wharf. Over the next decade almost 1 million new homes will be built in the southeast region, outside London's green belt. These homes will generate a million additional commuters. Stansted and Heathrow airports will each roughly double in size. Without additional rail capacity new commuters will travel by road, to jobs that will locate outside London on the motorway network.

London's Mayor has put forward proposals to create a London Regional Rail Authority, which would extend far beyond the green belt. The London commuter rail market is now worth £2 billion per year. A policy of increasing fares at a rate above inflation, in line with incomes, and addition of some longer routes to carry additional passengers from across the green belt, could generate the revenues to fund construction of Crossrail, Thameslink 2000 and many other projects.

1. See *Crossrail Review*, July 2004, prepared for the Department for Transport under the Chairmanship of Adrian Montague available at <http://www.dft.gov.uk>. Whole-life costs including additional contingency and operations were estimated at £11.2 billion in net present-value terms; however, the proposed branch to Kingston has now been dropped, replaced with a less expensive and probably more profitable branch to Maidenhead.
2. The Victoria Line opened in 1968, the Jubilee Line to Charing Cross in 1979, and the extension to Canary Wharf in 2000. The Docklands Light Railway opened in stages from 1988 to 1999. Although mostly above ground, DLR includes two underground sections and has cost about £1 billion in total. The high-speed Channel Tunnel Rail Link will be completed in 2007. Also, short extensions have linked existing lines into Heathrow and Stansted airports, and a tramway system has been built in the suburb of Croydon.
3. For an excellent account see Bonavia (1980).
4. Eventually, BR developed the most successful high-speed diesel passenger train in the world, the HST. These are still in service on the Midland and Great Western routes, and on some East Coast services to Scotland.
5. For discussion of the green belt as perceived in 1963, see Hall (1963).
6. Total a.m. peak arrivals by national rail are about 460,000. See *London Travel Report 2003*, Transport for London available on www.tfl.gov.uk
7. For discussion of planning and development of the Victoria Line see Barker and Robbins, op. cit., p. 311.
8. For maps showing the tubes, and other London railways described in this paper, see www.tfl.gov.uk/map.asp
9. Due to delays during construction, it missed the Queen's Silver Jubilee, for which it was named, by two years.
10. See Croome and Jackson (1993). Ridership on the Bakerloo Line, formerly 18,500 in the peak hour, was now split with 9,500 left on the Bakerloo and about 9,000 on the Jubilee. There was growth in off-peak traffic of about 20% (p. 387).
11. *London Travel Report 2003*, Transport for London. See also figure 2.20 in *The Mayor's Transport Strategy*, Greater London Authority, 2001. The postwar peak was in 1963 but the decline accelerated after 1969.
12. This 'brutalist' high-rise development was immortalised in the film *Clockwork Orange*.
13. The author was employed during this period as Vice President, Transport by O&Y Canary Wharf Ltd. See Schabas (1994).
14. See *Reappraisal of the Jubilee Line Extension, Final Report*, Colin Buchanan & Partners for TfL, May 2004.
15. Excess of fares revenues over operating costs, rolling stock leases and track access charges.
16. See Strategic Rail Authority, *Annual Report and Accounts 2003*, available at www.sra.gov.uk
17. *Central London Rail Study*, London Transport and Network Southeast (British Rail) January 1989.
18. CLRS, *ibid.*, p. 22.
19. Cost of the Jubilee Line Extension also increased, and it was completed in 1999 for about £3.5 billion.
20. Essentially, safeguarding precludes new construction along the route that could make it difficult or more expensive to build it later. It also allows property owners to receive compensation for 'planning blight'.
21. *Crossrail, A Report by the Corporation of London*, November 1999.
22. See Strategic Rail Authority, *London East West Study*, 2000.
23. *SuperMetro – Crossrail for the 21st Century*, Canary Wharf Group PLC, September 2001.
24. Sir Christopher Benson, Chairman of Crossrail, at the Mayor's London Conference, 9 November 2002.
25. *The Crossrail Business Case – Summary*, Cross London Rail Links Ltd, September 2003. See www.crossrail.co.uk
26. In fact, increased fares revenue is not an 'economic benefit', but rather a financial benefit indicating that some of the benefit to passengers can be captured through fares.
27. Open letter organised by London First signed by 50 representatives of businesses, unions, rail industry groups, property developers and house builders in the *Evening Standard*, 30 July 2003. See <http://www.london-first.co.uk/>
28. See 'Business Leaders Offer Crossrail Funding', *Financial Times*, 18 May 2004, available at www.crossrail.co.uk
29. London has approximately 3,500 route-km and 1,500 stations with LT or BR commuter services.
30. Montague, op. cit., p. 6.
31. *Ibid.*, p. 183 suggests 6%.
32. It is likely that the 'tax' will be charged as an increment on business rates, essentially a tax on business property. See *ibid.*, para. 197. The magnitude can perhaps be best understood as the average cost per employee. There are about 1 million workers in central London, so a tax of £150 per worker per year could fund about £2 billion of debt. About 10% of London's workers will use Crossrail for some part of their journey, but most will only save a few minutes each day compared with using existing railways.
33. *Ibid.*, p. 2.
34. *Ibid.*, p. 9.
35. *Ibid.*, pp. 21–22.
36. *Ibid.*, para. 229.
37. *Ibid.*, para. 310. Since this article was written, the Ebbsfleet branch has indeed been cut back to Abbey Wood, because of perceived operational difficulties.
38. *Ibid.*, p. 77, Conclusion 11.
39. Ministerial statement, 20 July 2004, available on www.dft.gov.uk
40. *Reappraisal of the Jubilee Line Extension, Final Report*, Colin Buchanan & Partners for TfL, May 2004.
41. *London Travel Report 2003*, Transport for London available at www.tfl.gov.uk
42. Total revenues on the Underground are about £1.1 billion, so 15% is £170 million. Most, but not all, of this growth can be attributed to the JLE. The London economy was booming, and there were some improvements to services on other lines. Buchanan, op. cit., estimates the operating costs of the JLE at £40 million per year. Capacity on the JLE will be increased 46% by lengthening trains and increasing frequencies, while employment at Canary Wharf may double over the next decade.

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