AN ECONOMIC COMPARISON OF URBAN RAILWAYS AND EXPRESS BUS SERVICES

A Comment

By P. R. White*

Although a case clearly exists for express busways in certain circumstances, Mr. Smith's\(^1\) selection of data and means of assigning costs are misleading.

In taking existing urban railways and buses as a base of calculation, two problems arise:

1. Institutional and unique historical factors affect costs, whereas a comparison should be based on the costing of factor inputs for a specific new facility. For example, London Underground Railways are unusual in being of the "tube" rather than "subway" variety, with associated higher costs. There is normally a minimum of five staff to each London Underground station, although in principle a rapid transit station can be operated with no staff present (as on the Lindenwold line in Philadelphia, which uses closed-circuit TV and automatic ticket barriers).

2. In almost any large city, the peak work journey load is thrown on to the railways rather than buses. Thus in London some 72 per cent of all trips on the Underground are to and from work, but only 53 per cent of bus trips (London Traffic Study, Vol. I, table 6–27). Higher average costs for rail thus reflect the phenomenon of costs associated with peak demand as well as characteristics of rail per se.

In considering a segregated track system, the costs associated with route alignment should be considered separately from those of the mode (rapid transit or bus) utilised on that track (assuming that the same width and height apply). Thus a segregated busway in central or inner areas of London would follow an underground alignment, the depth of which would be determined by existing underground railways, sewers, etc., as for tube railways. The cost of escalators is thus attributable to any segregated mode (and also fixed; Mr. Smith's practice of assigning this cost not only to rail but also on a basis of cars in peak service adds further confusion). The assumption that elevated structures would be acceptable does not appear reasonable in the light of public reaction to Westway in London, nor is the cost estimate for a busway (obtained by dividing the cost of Westway, some six lanes wide, by six to give cost for a single lane) reasonable. The cost of structures is not directly proportional to size, and some understatement thus occurs. Since the construction of Westway, provision has also been made for greater compensation to those adversely affected by urban motorways, considerably increasing costs.

Assumptions are also made about the cost and practicability of a signalling system which would permit other traffic to use busways even in the peak without affecting bus operations. These have yet to be justified.

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ECONOMICS OF URBAN RAILWAYS AND EXPRESS BUSES

O. B. Coles

Data for energy consumption reflects the high weight of present urban railway rolling stock, and suggests the need for redesign. However, Mr. Smith makes no reference to light rapid transit systems, either in terms of energy consumption or operating costs. In many respects these are closer to the busway in peak traffic levels and would form a fairer basis for comparison. Cost of power is also more relevant than MJ/Car-Km. This is indicated in Table 2, but if we are concerned with the future the likely rise in fuel oil costs should be considered.

The above comments do not rule out the case for busways, but suggest more limited circumstances in which it would apply. Many existing urban railways either have underground sections, or share track with intercity and/or freight traffic. At the suburban end of the trip, the busway would undoubtedly have advantages in permitting through trips to points otherwise served by feeder bus. However, so far as new development is concerned, either private development at low densities (making conventional bus operation very costly, and based on either dial-a-ride or park-and-ride, i.e. interchange) or public development at relatively high densities (permitting nucleated development within walking distance of railway stations, as in Stockholm), would present different conditions from those now applying in many medium-density suburbs.

A Comment

By O. B. Coles*

Edward Smith's article suffers from ambiguities about (1) policy objectives and (2) economic criteria for project appraisal. In addition, certain factual assumptions may be queried.

(1) It is stated that the use of urban busways will allow passengers to travel without interchange, and that this is an improvement on urban railways. It is also claimed that the busways could be used by private cars. If buses are to be run in a manner which eliminates charging vehicle, they must run into the centre of the city to the areas where existing streets are narrow, and the very high cost rules out the possibility of building new busways. The solution is to use priority bus lanes, and even priority bus roads, in the city centre. It follows that the improved urban motoring corridors arising from the construction or conversion of busways will generate additional car traffic which the centre roads, having an even smaller car capacity than before, will be unable to carry. Thus there will probably be both accentuated city centre road congestion and a shift in the suburban areas from public to private transport, as a result of improved roads.

Cross-city journeys are likely to be slower than by underground railway. Since buses will perform the functions of both feeder and line-haul vehicles, the punctuality

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of the services on both sections is liable to suffer in peak hours because the buses will be delayed by local congestion on the feeder routes.

It is not clear what railway routes are considered to be candidates for conversion into roads. In the context of London, deep underground railways are excluded. Other routes carrying freight, and express and outer-suburban passenger trains, are implicitly excluded.

"Valid... reasons for preferring a new railway" (p. 31), although not "non-economic" ones, include the following:

Railways can provide a higher quality of service than buses. Comfort and punctuality are less likely to be affected by poor weather, human error of the driver, and the poor riding of high-mileage, lightly constructed vehicles. There is a marked speed advantage, particularly in the central zone of the city. Luggage can be carried with comparative ease. Non-travellers benefit from the complete absence of fumes and the far less noise and disruption on railways than on urban motorways. New railways result in less scarce urban land being allocated to transport. For these last two reasons, the construction of a new railway is likely to require the payment of considerably less compensation than a new road.

(2) In recommending a transport policy, it is rash to ignore the extent to which subsidies are entailed. This is irrespective of one's attitude to subsidies. Smith rather blurs the picture by giving inadequate consideration to subsidies, yet stating—without evidence—that "the construction of a new urban railway is not likely to be economically justified in typical circumstances" (p. 31). A social cost-benefit assessment was the justification for the construction of the Victoria Line (as is well known), and may also have prompted the current construction of the London Fleet Line. Cost-benefit analysis tends to emphasise in this context that bus and train are by no means perfect substitutes for each other, and that buses tend to create greater externalities (see above). In addition, in taking $Q$ to refer to "practical bus capacity" rather than (as in the case of railways) "maximum traffic flow in cars/track-km" (p. 27), a positive monetary value is set on off-peak road space for private cars, something which is allocated free of charge. This is of particular importance because it constitutes a justification for building the busways with capacity to accommodate the flow of vehicles required within the height of the "peak".

Research into urban bus operation suggests that the size of the fleet employed in the peak largely determines total labour costs and capital expenditure. Undertakings which provide sufficient vehicles to satisfy the demand for standing room in the peak often find it difficult to break even financially. Smith's proposal of employing sufficient buses to provide seating for all peak passengers would, on the basis of this evidence, entail considerable operating deficits and much larger capital stock (of buses). It is not clear whether the improved service quality at the peak would allow considerably higher fares to be charged without significant loss of custom. It is at least arguable that city bus transport could be drastically improved in quality without any of the heavy capital expenditure envisaged by Smith, simply by restricting—by means of the price mechanism or otherwise—the number of private cars in use. In any event, subsidies cannot simply be ignored.

It is because road space is provided as a free good to motorists, and because externalities are ignored by Smith, that it is impossible ex post to confirm or deny
that London's Westway is valued by the community at £1.3 million per lane-kilometer. Since it generates little revenue and has capital and maintenance costs, one could reasonably contend that Westway has a substantial opportunity cost, since it could be converted into a railway. In addition, certain non-transport uses of the land might impose high opportunity costs on whichever type of track was chosen.

**Factual Assumptions**

Much emphasis is placed by Smith on the high running costs, labour-intensity and in flexibility of railways relative to buses.

It is arguably false, when assessing the costs of future railway operation, to treat the past operating practices of London Transport as representing the best attainable. The scope for labour-saving equipment appears to be large. London Transport already possesses driverless trains, and much ticket issue and collection can be and has been mechanised. Underground railway stations and trains are places where fare collection should be simpler than on buses. One may expect the wages of London bus drivers to be higher than those of men doing basically simpler work on the railways. With labour costs constituting so large a share of total working expenses of public transport services, future reliance on a large quantity of highly skilled labour is likely to narrow the gulf between bus and rail average operating costs.

A future railway is not bound to employ trains as short, or track layouts as restrictive, as those currently in use underground. Both the maximum peak passenger capacity and the average cost per car-kilometer might compare more favourably with the bus counterparts on a new railway, if the objective of meeting peak demand were allowed to override the requirement of covering operating costs, as Smith allows in the case of busways. This objective itself may not require costly investment in new roads or other travel capacity, if certain long-term socio-economic trends—such as towards flexible hours of work, prohibitively high office rents in central London, and automation—become powerful enough to reduce significantly the peak demand for passenger travel.

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**A Rejoinder**

By Edward Smith

Messrs. P. R. White and O. B. Coles both suppose that a new facility free of "institutional and unique historical" lumber would have lower operating costs. Their theory is not supported by available data. The Montreal Metro, built in the 1960s as an all-new system, is even more labour-intensive than the London Transport railways. BARTD, with all its "advanced" technology, promises to remain much more labour-intensive than either the AC Transit buses or the elderly but well-managed Hamburger Hochbahn railways.

Subsidies, to the extent that they affect travel choices and management decisions, are very much a concern of transport planners. The purpose of this study, however,
was to assume a fixed level of demand and compare the quantifiable cost to the
community of satisfying the travel demand by different means. But it is interesting
to note that subsidies to railway passengers are often greater than subsidies per
passenger-km necessary for fare-free bus services.

There is no assumption that viaducts will always be acceptable in town centres,
although a recent example of viaduct—built for BARTD—is in Oakland, California.
A subsurface road to accommodate buses would probably have stops at the surface.
As well as eliminating escalators this design would allow the gradients of the ramps
to assist buses decelerating and accelerating, and would provide connexions with
surface streets for both buses and other traffic sharing the subsurface road. Surface
stops are not feasible on subsurface railways because gradients on railways are
generally limited to two per cent.

If “light rapid transit” is to be interpreted as trams, Mr. White is wrong to
suppose that tramcars are light. A tramcar weighs as much as an urban railway car
of similar length and uses as much electricity. It costs between £40,000 and £100,000,
and is an expensive substitute for a £12,000 bus. Like buses, trams can share road
space, but track maintenance for trams is costly and disruptive to other traffic. On the
basis of long experience countless undertakings around the world have replaced
trams with buses. Those operators with tramways through long tunnels, such as the
Twin Peaks Tunnel in San Francisco, ought to consider buses with electronic
lateral guidance when their rolling stock becomes due for replacement.

Mr. White’s point that existing bus services in London have a lower peak-hour
factor than London railways is irrelevant. In this study standing costs and running
costs are distinguished, and all comparisons of costs are based on equal peak-hour
factors.

Mr. Coles is mistaken when he says that “a positive monetary value is set on off-
peak road space for private cars”. The formula used assigns to other traffic only the
cost of road capacity not needed by buses during the peak. Road capacity used by
buses during the peak but not the off-peak may in practice be valuable to delivery
vans and other off-peak road users, in which case this formula overestimates the
track cost attributable to buses.

The value of ramp metering as a means of preventing congestion on a limited-
access road has been proved at many sites in Germany, the United States, and
Japan [1].

Estimators find that the construction cost of elevated roads on viaduct is very
closely related to the surface area, and for this reason an extra allowance was made
for bus-bays. It is pointless to worry whether the road will cost £1M or £2M per
lane-km. For the assumptions made, the capital cost of a bus service sharing a new
road will be less than the capital cost of another Victoria Line as long as the road
costs less than £12M per lane-km, a figure far beyond the cost of any conceivable
road.

Indeed, new roads in existing cities are costly and should be built only when
essential. And recent experience with London’s Oxford Street, for example, shows
that the reservation for buses of even major streets in the existing network can be
acceptable. But, where new construction is necessary, a road designed to be of
maximum use to express buses is sure to offer the community better value for money
than would a new urban railway.
ECONOMICS OF URBAN RAILWAYS AND EXPRESS BUSES

Edward Smith

Any railway physically suitable, generally any railway not in deep tunnel, should be considered for conversion to a road. The criterion should be simply whether the railway is of greater value to the community continuing as a railway or converted to a road, with existing traffic either transferred to buses and lorries or diverted to other railways.

Mr. Coles draws attention to the possibility of new radial roads generating more private car journeys to a city centre unable to accommodate more traffic. But is there a city anywhere that has not already sufficient radial road capacity to create traffic congestion in the centre? With or without new radial roads, the usage of private cars in the centre of large cities must be restrained. One means that has proved effective is to limit the supply of non-residential parking and to set an hourly charge sufficiently high to deter car commuters and restrict demand. A reduction in traffic on existing streets, rather than the generation of new private car journeys, may often be the principal objective in allowing private vehicles to use the spare capacity on a converted railway or new bus road.

There was no assumption in this study that bus passengers would be all seated in the peak. To compare like with like, the same seating standard should be applied to both modes if the vehicle journey times are similar. However, if costs are as in Table 5 it will be cheaper to have passengers sitting in buses rather than standing in crush conditions on trains.

Most of the supposed advantages Mr. Coles lists for railways are very doubtful, and the genuine deficiencies of present buses can be remedied. Most buses in Great Britain have leaf-spring suspension. However, the Greenline Routemaster, the Leyland National and the Metro-Scania are examples of buses with air suspension, giving a very smooth ride. A London Transport bus was observed emitting 99 dBA. A maximum noise level of 77 dBA is claimed for one new bus, and a noise limit of 80 dBA would be reasonable as a legal requirement in built-up areas for all new road vehicles. The Americans have proved that the exhaust of a Diesel bus can be much cleaner than is usual in the United Kingdom.

The social cost-benefit assessment of the Victoria Line, in so far as it was correct, merely proved that building the Victoria Line was more beneficial than doing nothing. It by no means demonstrated—or even suggested—that there was not a more economical means by which the community could achieve the same benefits. If an express bus service is likely to give greater benefit at less cost than a railway, the public interest requires that no plan to build or preserve a railway should be approved without a fair comparison with the best bus alternative.

REFERENCE