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Strategic Planning Studies Within British Rail

Norman Ashford, Department of Transportation Technology, Loughborough University, Leicestershire, England

Over a period of 3 years, British Rail has been carrying out a long-term strategic planning exercise that has looked at the role rail transport is likely to play in the overall transport scene in the United Kingdom. This paper describes in broad outline the nature and scope of the strategic studies and deals with the overall philosophy of strategic planning at the level of a national network. Some of the major study findings are briefly presented.

For over 3 years, beginning at the start of 1974, the staff of British Rail in conjunction with Loughborough University and Cranfield Institute of Technology were engaged in a series of studies that examined the long-term position of rail transport, both passenger and freight, within the United Kingdom. This overall study, which set out to examine the scale of operations the railways could expect in the period around the year 2000, was approached from the viewpoint of strategic planning, examining the long-term issues and factors that will affect rail travel in Britain. An attempt is made here to outline the underlying rationale of the project and to describe in the broadest terms the interrelated structure of the individual substudies that as a whole comprise the strategic studies.

In previous work discussing the overall assessment process, I have discussed the difficulties associated with assessment in the strategic sense. In the short term, the assessment process is a fairly clearly defined procedure of formulating the level of supply and demand associated with the innovation, specifying the scale of impacts (including those that are economic), and selecting from the available solutions by an appropriate evaluation procedure. Assessment procedures used in the past seem to have maximum validity where the process is used in the short term, where the technologies being compared are essentially similar, where the scale and nature of impacts are essentially similar, and where the planning horizon is limited. The more simple the assessment procedure, the more difficult it becomes to relax these constraints.

In much work that relates to long-term planning, the assessment has related to the introduction of new technology. Frequently, where new transport technology has been considered, the overall assessment procedure has been rudimentary, largely neglecting nonfinancial impacts. In seeking examples of such evaluations one might cite the assessment of Concorde and the Report of the Interdepartmental Committee on Intercity Travel in the United Kingdom. Experience and discussions with a number of planners and technologists have previously led to the identification of six criteria areas that appear to be considered in the evaluation of long-term transport commitments. These criteria or factor areas have been stated to be the following:

1. The availability of the technology or its potential for development.
2. Estimation of demand for travel at a fairly rudimentary level of consideration, taking cognizance of such variables as money cost, travel time and a limited number of socio-economic factors including comfort and convenience.
3. The optimality of financial resource allocation.
4. Environmental effects in the areas of: amenity, noise pollution, air pollution, safety, water pollution and solid waste pollution.
5. Socio-political impacts on the various levels of the national and local community.
6. Constraints on solutions imposed by the limited availability of natural resources.

STRATEGIC PLANNING VERSUS SHORT-TERM PLANNING

In approaching the problem of strategic planning for the railways, the British Rail Strategic Studies team was aware that any methodology developed or used

should reflect the needs of long-term planning rather than conform to the more conventional wisdom of many studies, the methodology of which has grown out of the planning procedures developed for urban transportation in the 1960s and 1970s.

From the outset it was realized that the conventional form of benefit-cost studies was likely to be an unsuitable and unusable evaluation procedure for planning with the time horizons envisaged. It should be remembered that the strategic studies were oriented to an examination of rail transport in the year 2000, 25 years ahead, rather than to developments over the next 25 years. In the context of long-term planning, it is worthwhile briefly examining the difficulties associated with conventional economic analysis.

The mechanics of discounting require the use of interest rates that must be projected forward, in this case for a quarter of a century. An examination of the historical movement of discount rates over the last 50 years would indicate that a planner is being optimistic if he or she feels that he or she can estimate discount rates for 5 or 10 years ahead with any degree of accuracy. Only the most daring would care to project interest rates 25 years ahead. Logically it would appear to be unwise to predicate decisions on a basic parameter that could well have an inbuilt error of over 100 percent in its assumed value.

Possibly even more important is the fact that this form of analysis is by its very nature a short-term tool clearly unsuitable for strategic studies. This becomes quite apparent when one considers the condition of a long-term analysis with high interest rates. Long-term benefits and disbenefits of even large magnitudes are discounted to insignificantly small amounts in strategic analysis. Another problem arises from the fact that cost-benefit analysis works on the Hicks-Kaldor principle that we can justify penalizing one individual by the greater gain of another individual or group.

In much short-term transport planning this principle has been used to justify the undesirable externalities of transport schemes that can impinge on certain sections of the community only. These externalities, it has been argued, must be borne by the few for the greater good to the whole community. Applied to long-term planning, this argument, which even in the short term is at its best debatable, is highly contentious. Clearly it could result in the approval of a course of action that optimizes the economic conditions of one generation while leading to economic disaster for a later generation, provided that it is suitably separated by a gulf of time and interest rate levels. Even in the private sphere, analysis procedures that led to such conclusions could well be considered unacceptable; in the public sphere, where the government must be considered to be working in the interest of not only the current generation but also for posterity, the implications would be totally unacceptable.

Even at the mechanical level of the calculation, the long term predicates against the use of this form of analysis, which traditionally relies on cost and time differentials and the costing of externalities. Over the long term, the estimation of cost differentials is remarkably difficult. Experience of the variations in road, rail, and air costs in the last 4 years since the studies started bears strong witness to this. Estimates of the level of cost differentials by the year 2000 would justifiably be open to substantial uncertainty and would be difficult to sustain.

More predictable are future modal performance levels that can give estimates of modal time differentials, but the utility of the reliability of these figures is lost in attempting to convert time differentials to any form of generalized cost. There is little general agreement on the value of saved travel time for the present day; to attempt to estimate that value 25 years ahead would appear to be futile.

Equally important in any economic analysis is the costing of the external benefits and disbenefits. In terms of some of the externalities that arise from transport, such as noise, pollution, community severance, land take, mobility levels, institutional impacts, and resource depletion, it is clearly impossible to cost these successfully in terms of either current or future monetary terms. The cost of an externality is so intricately bound to living standards that any estimated costs would necessarily be computed in a way that at least once removed them from current estimates, about which there is anyway little agreement and much debate.

Long-term forecasting and the techniques necessary to achieve it are a much neglected area; planning efforts have largely centered on producing short-term forecasts or at least forecasts based on short-term methodology. There has been a healthy (or perhaps unhealthy) disrespect among planners for the projections of a number of "futures" organizations. Yet most planners would agree that long-term planning can really be effective only if backward-seeking rather than forward-seeking models are used in conjunction with analysis of fiscal and other resource use. The unsuitability of forward-seeking models is perhaps emphasized by the eventual abandonment of the transport recommendations based on a number of rather elaborate conventional land-use and transport models. Some planners and decision makers have claimed with some justification that a forward-seeking model is simply another term for extrapolation, a procedure that can lead to the perpetuation of unsatisfactory trends.

In long-term transport planning, the principal considerations should be related to the overall scale of operations and the infrastructure requirements contingent upon the findings. Consequently, the degree of precision required is far less accurate than for the 5-year forecast of traffic for planning wagon or coach replacement, street widening, or container purchasing. It is in this contextual framework that the forecasting procedure was developed for the strategic studies.

MODELING AND THE LEVEL OF UNCERTAINTY

The level of certainty that any forecaster places on his forecasts must relate to the certainty that can be placed on the underlying model variables. Ideally, model variables are of a causal rather than of an associative nature. In truth, even the best causal variables are tightly bound into the social structure. Stability of social structure gives the best conditions for confidence in forecasting models.

Under conditions of substantial social change, models become unreliable and, under radical change, they become useless. The structural changes over the last few years in income distribution in Britain that were accompanied by substantial changes in real costs of transport and other goods and services have meant that many predictions developed 10 years ago are already substantially incorrect. As these structural social changes harden, their effects will become even more apparent. For example, earlier forecasts developed on car ownership levels and annual travel predictions have already substantially overpredicted observed values, and the difference between those predictions and observed figures can be expected to worsen.

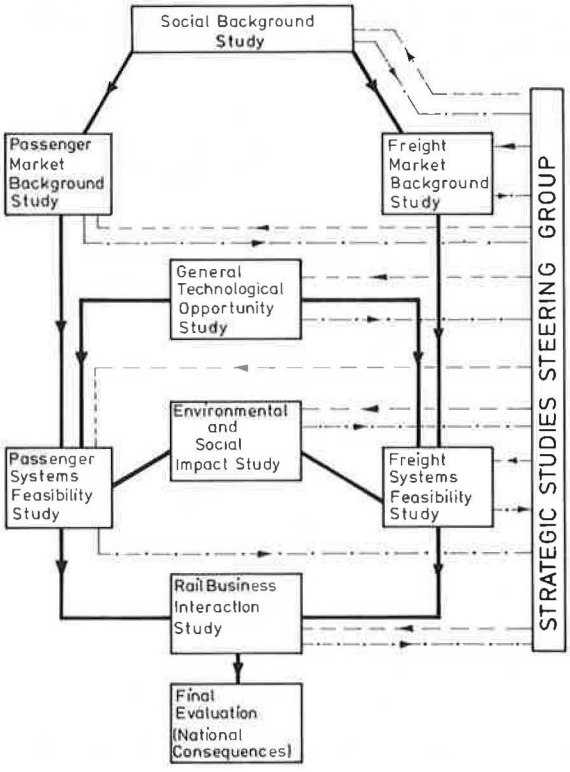
Referring back to the six areas of evaluation criteria discussed earlier, we can see that these factors, as

well as being the criteria by which a scheme is evaluated, are also to a large degree the underlying factors for which the causal model variables are surrogates. Over time we can expect the level of importance of these variables to change, possibly substantially. Under these conditions, a model built from a number of surrogate variables is likely to be substantially more important in society's view. For example, if real per capita income in Britain continues to grow over the next 25 years, environmental considerations could become of paramount importance. Faced on the other hand with major economic problems and the approach of the much predicted exhaustion of fossil energy resources, economic survival could reverse the order of consideration of resources and environment, with the latter possibly becoming insignificant.

Given this level of uncertainty, conventional modeling in terms of regression analysis was considered to be an unjustifiable method for predicting the status of transport in the United Kingdom in the year 2000. Regression implied a level of certainty about the future that the study team could not sustain. Furthermore, the technique could assign to a few statistically significant variables the implication of causal relationships that might be neither provable nor even defensible. It was therefore decided to use the technique of scenario building in conjunction with category analysis to attempt to structure a range of futures for the United Kingdom depending on some fundamental variations in assumptions about the economic state and the level of environmental concern.

In the opinion of the team, the models are robust and cover a range of futures sufficient for decisions to be made so that the implications of alternative decisions are clear. On the other hand the forecasts are not precise, nor are they expected to be wholly accurate. The forecasting procedure and the modeling techniques are, however, integrated into the total structure of the studies, so that at each stage of the planning process each study could be related to the scale of envisaged futures in terms of individual scenarios.

Figure 1. Structure of British Rail strategic studies.



STRUCTURE OF THE BRITISH RAIL STRATEGIC STUDIES

It was envisaged at the beginning of the overall project that the strategic studies should be divided into nine separate subareas as shown in Figure 1. Each study is briefly summarized in what follows.

Social Background Study

Based on the opinions and advice of 27 respondents in business, academic, and government circles, a Delphi survey was carried out to explore how the demand for transport would change over the next 25 years and how rail would contribute to satisfying that demand. The area explored in the course of the survey was the broad field of the social changes that would determine the nature of the British economy and consequent life style in the years up to the year 2000. Some of the areas examined included

1. The economy: economic growth, prices and incomes, real income, income distribution, employment sectors, and occupations;
2. Life style: demographic variables, class structure and class consciousness, developments in family structure, leisure patterns, geographical mobility, environmental considerations, environmental legislation, urban structure, and regional policies;
3. Travel: expenditures, mobility deprivation, valuation of time, and journey to work; and
4. Work-related issues: attributes of the working population, including education, school-leaving age, retirement age, sex split, working hours, vacations, and unemployment; size and structure of organizations, pressure groups, social accountability, and human rights; attitudes to work, worker participation, and automation in shift working.

The Delphi study was supplemented by a confidential survey of major industries, whereby the individual industrial forecasts could be compared and related to the findings of the Delphi work. Some of the principal findings of the social background study are shown below.

1. Gross domestic product up and real income to increase 50 percent;
2. Switch to be made from manufacturing to service industries;
3. Total population to grow only slightly from 50 million, but with regional distributions;
4. Income distribution remarkably stable;
5. Pressure for environmental improvement to be great;
6. Geographical mobility to increase especially for middle classes;
7. Travel expenditure to grow rapidly with increased income;
8. Power of occupational pressure groups and trade unions to increase;
9. School leaving and retirement to be a more gradual process than now;
10. Working hours to be more flexible;
11. Statutory holidays and annual holidays to increase;
12. Greater demand for shift work and greater resistance to it to be made;

13. Worker participation at board and plant level to increase; and
14. Automation expected to increase markedly in the 1980s.

Passenger Market Background Study

The passenger market study modeled by category the total market for passenger travel in the United Kingdom in both the urban and interurban areas for trip purposes designated into the categories of to-and-from work, education, and in the course of work and leisure. These figures are constructed in the context of social scenarios.

Freight Market Background Study

Based on the future development of industry and commerce and the future location of population, a forecast was made of the total demand for freight transport in the United Kingdom in the year 2000. The forecast was generated in terms of origin, destination, and commodity type. Base data principally came from British Rail traffic statistics, the 1967 Road Goods survey updated to 1972 by British Rail, the National Ports Council statistics, and the IMEG Consultants report, National Pipeline Network Study. A forecast of the future total freight market was generated from a number of growth rates determined from the social background study (most likely, least likely, etc.) and a derived relationship linking freight ton-kilometers to the index of industrial production.

General Technological Opportunity Study

This study was a state-of-the-art review of both freight and passenger aspects of transport technology (both developed and in development). From the viewpoint of operating characteristics and likelihood of change in these characteristics due to technological innovation, the study examined rail and competing technologies.

Within the passenger area, innovations in interurban rail technology were examined, as were changes in conventional rail, light rail, and light guideway systems, in the suburban and urban areas. Competitive technologies were similarly analyzed. In the interurban area it was expected that technological changes in the motor car, the long-distance bus, and the short-haul aircraft would provide the major areas of competitive changes. Within the urban-surburban context, the areas of technological change examined were the motor car, the bus and its infrastructure, and dual-mode systems.

The technological changes in freight movement systems concentrated on improvements to conventional rail freight technology, major innovations such as the trailer-rail and speed link shown below, to bring about major changes in the general merchandise market and anticipated changes in the major competing freight mode, road transport.

System	Innovations
Modified freightliner	Increased number of terminals, train turn-around at 2-h intervals at terminal, trains formed from 30 standard wagons, 120-km/h operation
Trailer-rail	Road trailer with detachable rail bogie
Speed link	Small container system with automatic loading and unloading at minor depots, trains formed at major depots only

Environmental and Social Impact Study

The Environmental and Social Impact Study (ENOSIS) was carried out not as an integrated unit, but in such a way that, using the results, the impact of one scheme could be designated at level X while a second scheme would have an impact level Y. Clearly, to be able to set definite and quantitative impacts would necessitate the ability to define a socioeconomic trade-off matrix. Recognizing that these trade-offs are not currently definable and possibly never will be, the study treats a number of separate areas within the context of the scenarios developed from the social background study. The topic areas selected are safety, accessibility and mobility, land take and building loss, and pollution and noise. Some of the principal findings are noted below.

In the safety study, the road carried 4 times as much freight and 15 times as much passenger traffic as rail. The costs of 1973 casualties at 1975 prices by two costing procedures (1£ = $2.30) were

	Accident			
Mode	Type	No.	TRRL Cost (£000 000)	Melinck Cost (£000 000)
Road	Fatal	7 406	229.9	1457.5
	Serious	108 333	182.1	1154.3
	Slight	347 426	18.1	114.1
Rail	Fatal	78	2.4	15.4
	Serious	145	0.2	1.5
	Slight	2 810	0.1	0.9

The accessibility study indicated that the following conclusions can be drawn:

1. Journeys to and from work are longer for wealthier people;
2. Longer interurban journeys are made mainly by car for higher income groups;
3. Travel for shorter personal business and leisure by both car and public transport is biased to wealthier people; and
4. Three regions, East Anglia, the North, and Wales, have high per capita expenditure on transport due to poor public transport and need for high car ownership.

The pollution study, which was carried out in two customary units—emissions per passenger-mile in milligrams and per ton-mile in milligrams—provided the following levels.

	Emissions per Passenger-Mile (mg)			
Pollutant	Road Gasoline	Road Diesel	Rail Diesel	Rail Electric
Carbon monoxide	28 420	775	630	0
Hydrocarbons	1 440	155	130	0
Aldehydes	45	25	20	0
Nitrogen oxides	990	465	380	Trace
Sulfur oxides	110	710	250	0
Lead	40	0	0	0

	Emissions per Ton-Mile (mg)			
Pollutant	Road Gasoline	Road Diesel	Rail Diesel	Rail Electric
Carbon monoxide	370 910	1720	760	0
Hydrocarbons	18 830	350	150	0
Aldehydes	590	50	25	0
Nitrogen oxides	12 980	1032	460	Trace
Sulfur oxides	1 470	680	695	0
Lead	500	0	0	0

The noise study revealed that the total numbers of

people dissatisfied with existing transport systems were 4.84 million with roads, 3.37 million with airports, and 0.105 million with rail.

On a passenger-mile basis, land take for rail, the study revealed, is less than one-half that for road-based schemes.

Passenger Systems Feasibility Study

Taking the forecasts of the passenger market background study for the year 2000 and the general appraisal of the technology likely to be available at that time, this study was designed within a range of scenarios to develop forecasts using models developed in the passenger and freight market studies. The scenarios such as the passenger scenario shown below enabled the team to identify the range of options to be evaluated for guided and nonguided systems in terms of the possible scenarios of policy and legislation and energy and resources availability. They could also determine the characteristics of the available passenger transport systems in the year 2000 and the likely level of the total passenger travel market and the modal split at levels within the range of option. They were also able to evaluate the options in terms of their financial, environmental, and social effects and, where appropriate, in terms of net social benefit or loss.

Scenario Mode	No.	Characteristics
Nonrail (No change in rail cost or quality)	1	Little change in car/bus cost and quality
	2	Increased car costs but no changes with average car speeds; some restrictions in town
	3	As for scenario 2 but changes assumed greater
Rail (Scenario 2 used as a starting base)	4	Reductions in journey time for rail travel
	5	Creation of a combined public transport network with great coordination
	6	As for scenario 5 but with rail price changes to spread demand

Freight Systems Feasibility Study

The remit of the Freight Systems Feasibility Study team was to examine the output of the freight market study in terms of size of market and quality of service requirements and to

1. Devise candidate rail-based guided transport systems for the various market groupings and determine their potential market penetration at various potential performance-characteristic levels (costs, receipts, volumes);
2. Identify the likely nature of competing systems, and evaluate their performance on the same basis, and their likely level of market penetration; and
3. Summarize the overall effect of selected candidate systems on the national freight transport situation in financial, environmental, and social costs and benefits at (a) the commercial modal split level and (b) a range of higher levels of market penetration. The most likely forecast is listed below in millions of customary tons.

Freight	Forecast (000 000 tons) 1972	2000
Total market	1963	2500
Bulk market	1090	1300
Rail bulk market	190	260-300
General merchandise	590	900
General merchandise > 80 km	–	200
General merchandise rail potential	–	20

Rail Business Interaction Study and Final Evaluation

The business interaction study recognizes that passenger and freight traffic share the railway's infrastructure and that, although the level of demand of freight and passengers may be to a very large extent independent, the two businesses interact significantly on the supply side. The study takes the outputs of the individual freight and passenger studies according to the various scenarios of social and environmental control and converts the individual forecast traffic flows into trains on the peak average working day.

This level of train demand is related to the existing route network and compared to network and route capacity. From this comparison the study derives a measure of the additional route infrastructure in terms of trackage and location needed to accommodate the total combined traffic.

Other areas within the realm of this study were an estimate of the costs of provision of additional infrastructure, methods of constraining demand so that existing facilities can cope without the construction of additional infrastructure, and various strategies to optimize service levels, such as the segregation of high-speed intercity passenger services.

VALUE OF STRATEGIC PLANNING

Having described the study structure and the philosophy behind the strategic studies as they are to date and in their final form when completed, it is worth attempting to evaluate strategic planning both as it might be and as it is exemplified by the studies reported here.

The results of the studies obviously cannot be assumed to be definitive and accurate projections of the future. These could be attained only if all the temporal and local deviations from the generalized assumptions of growth were known. In the long term, political and technological discontinuities are likely, and, as Drucker has pointed out, there is no way of forecasting across a technological jump. This is equally true for political discontinuities, as 1973 would indicate.

However, the studies must be regarded as useful in that they indicate the nature of the effects of different policies. Given that the overall methodology is acceptable, the scale of differential outcomes is likely to be similar to those projected. The methodologies chosen in our forecasting techniques have purposely been simple and robust, for it is our opinion that sophisticated techniques are unwarranted in this type of long-term planning.

The outcome of strategic studies should be an indication of the scale of real investment and identifiable impacts with respect to different policy options. We are confident that these studies have achieved this goal.

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