Transport Project Evaluation
Extending the Social Cost–Benefit Approach

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2. The boundaries of welfare economics: transport appraisal in the UK

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1. BACKGROUND AND INTRODUCTION

The methodology for transport appraisal in the UK has gone through a significant period of change in recent years. In this chapter we look at the extent to which the approach which has been used is based on the theoretical principles of welfare economics and how useful these principles can be in providing a justification for practical transport appraisal methods.

For a long period road projects have been appraised by the use of a formal computerized cost–benefit analysis model known as COBA (DMRB, 2002). We shall look at the elements of COBA in more detail in section 6 below, but in essence it is a conventional CBA analysis which deals only with those elements which can be both quantified and monetized (principally time and accident cost savings) in order to provide a consistent comparative treatment of all road projects. The key elements of this are that it does not deal with the environmental, social or wider economic impacts of a project and is confined to use in road projects.

Rail projects have largely been required to meet stricter financial viability criteria. One argument advanced to support this is that in rail the end user has to pay at the point of use and hence can be made to reveal his or her preferences directly. However, it is also the case that rail may be able to generate wider benefits which are not adequately accounted for in a situation where there is imperfect competition in the rail-using markets, such that the true value of benefits is not fully stated by the price paid.

Changes to the approaches adopted in appraising transport projects have been driven by three main forces. In the case of roads, the national road network is now largely complete, leading to an end to the general approach of 'predict and provide' which had dominated policy at least to the end of the 1980s. This meant that new projects were more about infilling, or the provision of bypasses to small towns, where time savings would be generally
smaller, but concern over the environmental and social consequences would often be greater. Secondly, the privatization of the national rail network required a more robust approach to the way that government dealt with the need to provide financial support to privatized operators, including the track authority, to cover the difference between costs and revenues. Thirdly, and most significantly, the Labour Government, elected in 1997, was committed to the development of an integrated transport system which required the evaluation of alternative approaches to transport problems rather than the traditional separation of all decisions by mode. This necessitated a consistent approach to appraisal for each mode as well as a planning system which allowed for a multi-modal approach to the solution of a perceived transport problem.

Here we develop three main issues. First, in sections 2 to 5, we deal with the theoretical basis for CBA in transport, showing how that needs to be developed from the simplified textbook example to deal with social, environmental and wider economic effects and how alternative approaches such as Multi-Criteria Decision Analysis (MCDA), Land Use Transport Interaction (LUTI) and Computable General Equilibrium (CGE) models have a role to play in this. Secondly, in section 6, we look in more detail at practical implementation of this in the UK through the development of COBA into the New Approach to Appraisal (NATA). Finally, in section 7, we assess the scope for a genuinely integrated approach to transport appraisal, including the capture of wider economic benefits.

2. THE STANDARD COST–BENEFIT CASE

It is worth recalling the standard textbook cost–benefit case as a reference point for the start of this discussion. Essentially this requires us to assess the change in consumer surplus resulting from a change in supply conditions. However, as we shall show, it is also necessary to allow for other changes such as general economic growth or the changing spatial distribution of economic activity, given the time period over which transport projects have to be evaluated due to both long gestation periods and long irreversible (at least costlessly) life spans.

In the most basic case (Figure 2.1), given known demand conditions (D0) and the cost conditions represented by the supply curve S0, the consumer surplus is shown as the light shaded area. The supply curve incorporates all the known generalized costs of making a trip. In particular, it includes any direct monetary outlays and estimated values of time and accident costs. The upward slope of S0 refers to the fact that as traffic flow increases on a section of road with given capacity, all of these costs will increase.
If generalized costs fall from $C_0$ to $C_1$, the volume of trips increases from $T_0$ to $T_1$ and the increase in consumer surplus, indicating user benefit, is the darker shaded area $C_0XYC_1$.

The key to successful evaluation is to identify the base case, that without the proposed intervention, and the supply conditions resulting from the intervention. The same principle applies to the evaluation of measures such as traffic restraint which are designed to increase the direct costs to users, where the supply curve for the with-scheme case will lie above the base case curve, and to those which increase road capacity or decrease costs, where the new supply curve will lie below the base case curve. The task is to evaluate the move in Figure 2.2 from the base case equilibrium point $A$ to the new equilibrium point $B$ or $B'$.

Over time, however, exogenous factors – changes in economic growth and income, changes in the price of car ownership and travel, and changes in the numbers and disposition of people, households, jobs and other activities – will shift the demand curve. The problem is that we need to forecast that shift in the demand curve and to find the new equilibrium point (Figure 2.3) $C$ which becomes the effective base case from which changes have to be evaluated. To appraise an intervention which will only take effect in the future, the task is to find the new equilibrium point $D$, where the new demand curve intersects the new supply curve (Figure 2.4). Transport
Figure 2.2  Base and with-scheme supply curves

Figure 2.3  Forecast year equilibrium
models thus need to forecast travel demands and costs for two situations: a base case or do-minimum case and a with-scheme case or do-something case. The transport benefits are given by the shaded area.

A conceptually correct transport CBA is thus very demanding: it requires a travel demand curve derived to incorporate the reorganization and output effects as travel costs change. This implies that it requires knowledge of the relevant conditions in all the markets likely to be affected by a transport scheme in order that the required demand curve can be correctly estimated and equilibrated with transport supply. In practice, simplifying assumptions are made, of which the most significant are that there is perfect competition in all transport-using markets, and that trip matrices are fixed.

The first of these assumptions implies that in all transport-using markets, price equals marginal social cost, such that the demand curve completely measures all of the benefits associated with the use of transport. Thus any change in the perceived price of transport will be completely and directly reflected in decisions concerning the activities using transport. We return below to what happens if this does not hold. The second assumption of fixed trip matrices means that we assume that changes in transport costs only reassign traffic between links of a network, they do not change the total amount of trip-making in the network, its origins or destinations. This would imply that lower transport costs do not induce additional trip-making or cause the reallocation of trips between different destinations.
(SACTRA, 1994). The implications of this are shown for the two extreme cases of the perfectly fixed and perfectly variable (infinitely elastic) cases in Figure 2.5. Note that in the case where demand is perfectly elastic all the additional benefits disappear and in certain cases (see Venables, 1999) it is possible to show that consumer surplus can be reduced to a level below that obtaining in the do-nothing situation.

In order to make the simple CBA come close to one which represents a more real world situation a number of changes would have to be made. Some of these are relatively straightforward, at least conceptually. It is relatively straightforward to move from modelling the traffic impacts as a single link to one of the whole network. This would also allow for a framework in which fixed trip matrices were replaced by variable trip matrices. These measures are simply ones of defining the traffic forecasting model appropriately rather than changing the principles of evaluating benefits. A further issue is that of whether the values which are included in a CBA should be based on economic resource values (factor costs), market price values or some synthetic generalized cost (Sugden, 1999).

The impact of transport changes on land use and location and how these should be included in a CBA is a major issue. Some of this we shall return to in more detail in the following section, but the issue here is essentially the one determining how far attempts to include detailed information on land use change are simply double counting in a situation in which variable trip matrices have been allowed for, since these presumably reflect land use changes. As long as transport-using sectors are assumed to be in perfect competition, changes in land use will be completely picked up in the

\[ \text{Surplus} = KLMN \]

\[ \text{Surplus} = 0 \]

*Figure 2.5 Benefits with fixed and variable trip matrices*
trip-making forecasts. This is a similar argument to that which shows that changes in land values should not be regarded as an additional benefit of transport changes since these will either simply reflect changing accessibility which determines the changed trip-making patterns or are simply a redistribution from one factor (or one group of individuals) to another. However, this is still assuming that transport-using activities are perfectly competitive; the implications of changing this assumption are much more profound as we shall explore in the following section.

3. TRANSPORT BENEFITS AND FINAL ECONOMIC BENEFITS

In this section we shall explore in more detail the linkages between the transport sector and the transport-using sector which give rise to the possibility of wider economic benefits (or costs). There are four basic parameters which affect this, but the extent to which they have an effect depends critically on the nature of competition in the transport-using markets.

The four basic parameters are: the responsiveness to a fall (or rise) in transport costs; the substitutability of transport and non-transport inputs; the price elasticity of demand for the final output of the transport-using sector; and the proportion of transport costs in total costs. Responsiveness to changing transport costs depends to a large extent on the other three factors, but we have to recognize the role which perception and a degree of path dependency play in this mechanism. Following long periods of declining real costs of transport it is not clear that there is any symmetry in the response to rises in these real costs (Goodwin, 1992; Hanly et al., 2002). The induced location effects of the long-run cost reduction have built in a degree of inertia to the system which may make it difficult to get significant shifts in transport behaviour in the short run. Given the transaction costs of adjustment, quite significant shifts in transport costs may be necessary to effect any major change in actual transport demand.

The substitutability of transport and non-transport inputs has typically been ignored in a model which has assumed that transport is simply the derived demand for some pre-determined level of activity at a given location. Once transport is allowed to be substituted for the non-transport inputs, this recognizes the feasibility of the reorganization of all aspects of production (or consumption) to optimize with respect to changes in real transport costs. One of the most significant changes is the substitutability between land and transport as transport has become cheaper. This is seen, for example, in the advent of just-in-time production which allows for the reduction in expensive inventories using the increasing reliability of transport to deliver inputs.
when needed, or in the development of out-of-town shopping centres where cheaper land can be used, relying on the growth of personal transport to bring customers.

On the other hand, to the extent that transport remains a derived demand, and to the extent that changes in transport costs affect the final price of finished goods, whether changes in transport costs have any impact will depend on the price elasticity of demand for the finished product or activity. This interacts with the relative importance of transport costs in total costs or in total value added. For activities where transport costs are significant, final price elasticities may be quite small, for example the cases of cement or aggregates given the limited availability of substitutes. Where final price elasticities are higher, transport costs typically contribute a much smaller share to either total costs or value added. This may not, however, mean that changes in transport costs are unimportant as despite the small contribution to value added, transport costs may be seen as one of the potentially most variable costs and hence a significant contributor to variations in profitability.

This leads us to the consideration of how the degree of competition in transport-using markets determines the likely extent of any reorganization and output effects from any change in transport costs. Under perfect competition pressures will force firms to respond fully to changes in transport costs: if costs rise for all firms, prices will need to rise to cover the increase; if costs rise for just one firm then it will be unable to compete and will be forced to leave the industry. Conversely, if costs fall, firms will make an abnormal profit which will encourage new entrants (Fujita et al., 1999; Brakman et al., 2001; Quinet and Vickerman, 2004). Under imperfect competition, how firms respond will depend more on their strategic decisions. Rises (or falls) in costs could be passed on or absorbed according to the attitude firms take towards profitability or market share.

If a reduction in transport costs enables firms to increase their market share then scale economies and agglomeration economies could produce wider economic benefits which are greater than those measured just by the direct reduction in costs. How large these additional benefits may be has been a matter of some speculation. This will depend on the size of the mark-up, the importance of transport costs in total costs and the elasticity of demand for the product (SACTRA, 1999; Venables and Gasiorek, 1999; Newbery, 1999). Estimates of these effects vary, but are dependent more on informed assumptions than detailed estimates: a typical range is of the order of 10 per cent to 40 per cent additional benefit to a local economy. However, it has also to be recognized that such gains are not guaranteed and in certain circumstances, for example where prices are less than marginal costs due to subsidies, such wider benefits can be negatives. In other
words the direct transport benefits may both overestimate as well as underestimate final benefits.

This discussion suggests that transport benefits may not be the most reliable estimate of the final economic benefits resulting from any change. How good the estimate is will depend on the specific circumstances of the change to be appraised; this will include the characteristics of the area where the change is implemented, the nature of the local economy in terms of its sectoral and market structure and the ability of transport users to change in response to the transport change.

Most CBA analyses are both limited in scope and partial in nature. We need to identify clearly what factors are included, and what not, to be able to interpret the outcome and consider how far any changes involve a more general equilibrium. The development of a more appropriate and full CBA can be seen as a set of step-changes which we shall consider in more detail in the following section. However, it has to be decided whether it is possible (or desirable) to try and incorporate all these changes in a single decision variable. A range of approaches may provide a richer set of information which would result in better decisions.

4. A TYPOLOGY OF CBA

The above discussion suggests that a number of stages can be identified in developing CBA from the simple first step which has formed the basis for much previous appraisal, through successive steps which incorporate the various modifications discussed above.

There are essentially three steps (SACTRA, 1999):

- The pure transport CBA (CBA*):
  - assumes perfect competition in transport-using sectors
  - assumes transport cost and benefits are acceptable approximations of final costs and benefits

- The best practice CBA (CBA**)
  - takes account of all indirect and direct responses by economic agents under conditions of perfect competition in the economy as a whole
  - includes all dimensions of travel choice, repercussions on land use and economic activity, all externalities including environmental impacts

- The theoretically optimal CBA (CBA***):
  - all direct and indirect responses by economic agents taken into account
assumption of perfect competition relaxed (price not assumed equal to marginal social cost)
- imperfections or failures in both goods and factor markets: imperfect competition in product markets, wages exceeding the opportunity cost of labour, taxation effects, external costs and benefits including all environmental and social impacts.

Most practical applications of CBA, such as the COBA model in the UK and its urban equivalent URECA, are, when applied correctly, only equivalent to the pure transport CBA*. If allowance is made for induced traffic it is possible that it can come close to the best-practice CBA**. However, in both of these cases application in the UK has not made full economic allowance for environmental and similar external effects of transport projects and so tends to remain largely a transport CBA with some allowance for directly related land use and transport demand effects. Moving to the theoretically optimal CBA*** requires a much fuller analysis of the linkages discussed in the previous section and hence some more detailed modelling outside the strict CBA framework; it is to this possibility which we now turn.

5. TRANSPORT BENEFITS AND FINAL ECONOMIC BENEFITS: NEW APPROACHES

Even the theoretically optimal CBA defined above depends on the ability to identify the likely impacts outside the transport sector and the feedback which these will have for travel demand and transport. Hence implementation of an ideal appraisal model depends critically on the modelling which lies behind it.

The adoption of multi-criteria decision analysis (MCDA) has been a partial solution which allows the incorporation of a wider set of impacts. Although it provides a useful and sophisticated decision model it has only a limited role in assessing the wider economic impacts. MCDA models have been useful in allowing for the inclusion of effects which can be measured physically fairly precisely, but on which there is greater uncertainty of the monetary value.3 The advantage of MCDA is that it allows the use of explicit weights to be put on a range of possible impacts and thus achieve a greater degree of transparency. It allows for consistency with economic impact measures because the methods of determining weights imply the use of a form of utility function (Keeney and Raiffa, 1976; Bogetoft and Pruzan, 1991). It shows clearly whether different overall assessments depend on differences in outcomes or differences in preferences. However,
MCDA depends on being able to assess the impacts unambiguously. In the case of wider economic impacts it will depend, as we have seen, on the possible range of responses of different economic actors and, whilst MCDA can generate a series of 'what-if' outcomes, it cannot by itself evaluate these in such a way as to secure robust planning of the outcomes. In this way it is as limited as CBA.

Modelling of the wider impacts requires a more comprehensive approach such as can be provided by either advanced Land Use Transport Interaction (LUTI) models or Computable General Equilibrium (CGE) models. LUTI models have been used by urban planners in particular for some time as extended travel demand models which allow for the interaction of transport and land use (Simmonds, 1999). In this way they are close to the best practice CBA**. More recently LUTI models have been extended to deal with regional and inter-regional impacts of transport development (Wegener and Böckemann, 1998; Bröcker et al., 2004). These models vary in the precise way they operate but essentially comprise a series of linked detailed models covering travel/transport, production and GDP, labour markets and population and land use. At the heart of the model is the transport sector which, through changes in accessibility which change the cost of transport, impacts on both production and the labour market. The production sector is typically modelled through a set of input–output relationships which define the need for transport to move goods into and out of a defined spatial area. This includes the need for labour inputs which interact with the available labour force (and hence local population) to determine commuting and migration patterns. Land use acts as a constraint on the development of the economy since production and the resident labour force have minimum requirements for land.

The main problem with LUTI models arises from the assumptions implicit in each of these constituent models. Hence input–output models are often static in nature, dependent on existing patterns of behaviour, and are solved by ensuring that equilibrium is reached in each relevant market. Similarly the links between population, labour force and labour demand also depend on assuming that existing patterns of behaviour do not change, when the evidence from major changes in the transport network is that behaviour can actually change quite significantly. Furthermore, the models make assumptions about the land use requirements which do not allow for changing capital and labour intensities and tend to treat different sectors equally. The output of the LUTI model is typically a measure of GDP change for each spatial area which raises the question of the validity of GDP as a measure of the consumer welfare which a typical CBA seeks to estimate. LUTI models assume perfectly competitive markets in which the market outcome is a valid measure of the welfare change.
CGE models, by their nature, also assume equilibrium and are based on the fundamental input–output relationships in the economy, but in this case they allow for more interaction between constituent markets in order to achieve a general equilibrium of all sectors through a process of numerical iteration. The key difference is that CGE models have at their core the possibility of assuming that consumers display preferences over differentiated goods which are produced by imperfectly competitive firms (Bröcker, 2001; 2004: Bröcker et al., 2004). Because of this use of a utility function, CGE models can make a direct estimate of the welfare effects resulting from a change.4 But CGE models do still have major drawbacks: assumptions about equilibrium, the need for large data inputs from existing sources and the ‘black box’ nature of large models all limit their usefulness and ease of application. Thus far CGE models have tended to be used for cases where there are thought to be significant non-transport impacts; their use as part of the regular appraisal of minor transport projects would be difficult to justify (SACTRA, 1999).

6. UK ROAD APPRAISAL: COBA TO NATA

In this section we turn from the abstract discussion of principles to look at the way in which practical appraisal methods for road projects have developed in the UK from the simple use of the COBA (COst Beneﬁt Analysis) model to the rather wider New Approach to Appraisal (NATA) approach and the Appraisal Summary Table (AST) which lies at its core.

Although road appraisal has traditionally seen the COBA model as its core component, COBA is in fact only one element in a 28-step decision procedure which runs from identifying problems, through determining and evaluating alternative solutions to public inquiries and final decisions. COBA involves a computer-based assessment which undertakes a rigorous evaluation of those elements which can be unambiguously defined and monetized. It provides a common treatment to evaluate and rank all projects and is accepted as a recognized element in oﬃcial public inquiries.

COBA comprises a rigorous traffic model which can be deﬁned with either ﬁxed or variable trip matrices. The main elements included are the value of time savings and the beneﬁts from reductions in accidents. Not directly included are any environmental costs or beneﬁt from a project or any wider economic impact. All costs and beneﬁts are discounted at a standard rate (currently 3.5 per cent) over a 30-year period and the resulting beneﬁt–cost ratio (BCR) is used to rank projects (HM Treasury, 2003).

Although COBA has a clear pedigree based solidly in welfare economics, it has been increasingly seen as rather too limited for the
changing nature of the decisions required. In a ‘predict and provide’ world, what was needed was a robust way of ranking alternatives in terms of the main contribution they would make to the primary objectives of making transport more efficient (time savings) and safer (accident reduction benefits). In the newer world of increased environmental concern and the need to compare alternative modal solutions to perceived problems in a more budget constrained situation, a rather broader approach was needed and one which could be applied equally to new investment in any mode, traffic restraint or alternative methods of supply.

The New Approach to Appraisal (NATA) set out to provide the basis for this, initially with respect to road appraisal, with the stated objective to ‘develop a clear and open framework to appraise and inform the prioritization of trunk road investment proposals’. NATA is based on five criteria: environmental impact, safety, economy, accessibility and integration as detailed in Table 2.1 (see DETR, 1998a; 1998b; Prince, 1999; Glaister, 1999 and Vickerman, 2000).

**Table 2.1 NATA criteria**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Nature of measure</th>
<th>Indicators</th>
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<tbody>
<tr>
<td>Environmental Impact</td>
<td>Physical</td>
<td>Noise</td>
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<td></td>
<td></td>
<td>Local air quality</td>
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<td>Landscape</td>
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<td>Biodiversity</td>
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<td>Heritage</td>
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<td></td>
<td>Water</td>
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<tr>
<td>Safety</td>
<td>Money value</td>
<td>Accident reduction (value of statistical life saved)</td>
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<tr>
<td>Economy</td>
<td>Money value</td>
<td>Vehicle operating costs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scheme costs</td>
</tr>
<tr>
<td></td>
<td>Physical and</td>
<td>Journey time reduction</td>
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<tr>
<td></td>
<td>money value</td>
<td>Reliability</td>
</tr>
<tr>
<td></td>
<td>Qualitative</td>
<td>Regeneration impacts</td>
</tr>
<tr>
<td>Accessibility</td>
<td>Qualitative</td>
<td>Access to public transport</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Community severance</td>
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<tr>
<td></td>
<td></td>
<td>Impact on pedestrians and others</td>
</tr>
<tr>
<td>Integration</td>
<td>Qualitative</td>
<td>Contribution to integrated transport</td>
</tr>
<tr>
<td>COBA score</td>
<td>Money value</td>
<td>BCR</td>
</tr>
</tbody>
</table>

*Source:* DETR (1998c)
The key point to note in Table 2.1 is that there is no attempt to place a monetary value on environmental impacts. The traditional sources of monetary evaluation, safety and time reduction are still included, although the latter now has an attempt to include reliability on which the evaluation evidence is less robust. The new areas included, economic regeneration, accessibility and integration, are all handled by qualitative evidence. Significantly here there is no attempt to quantify or evaluate the impact on economic regeneration, which is a key objective in the wider economic impacts; it is simply measured in terms of an assessment of the degree of regeneration impact that a project will produce. Similarly, despite the availability of sophisticated measures of accessibility, the definition used here is about access to alternative modes of transport measured qualitatively. Integration is also assessed in terms of the contribution of a measure to the overall policy of integrated transport, but again assessed purely qualitatively. The BCR produced by COBA from the money values in the economic impacts section is also included.

From the assessment of the NATA criteria the decision-maker is presented with an Appraisal Summary Table (AST). The AST brings together all the relevant information, but there is no attempt to impose any pre-determined weighting on the various elements as in a formal MCDA approach. For an example see Table 2.2. This scheme was accepted despite a relatively low, although positive NPV under COBA of £14m giving a BCR of 1.5 and some negative environmental effects. The decisive factors here were probably the positive scores for improved reliability and the contribution to regeneration. Of course, increasing experience with the use of the AST means that, at least for a given decision-making body, its decisions will begin to reveal an implicit set of weights on the various criteria.

7. BEYOND NATA

The problem with COBA was always that it separated decisions on road investment from other public investment decisions, including in other modes of transport. The use of a consistent CBA framework did imply that NPVs or BCRs of road projects could be compared with investment decisions in other areas for which public investment competed in accordance with procedures laid out in the Treasury’s Green Book (HM Treasury, 2003). However, COBA excluded many of the increasingly important aspects of a road investment given that the efficient supply of road capacity is not tested in the market in terms of directly priced services. Most other transport services could be appraised in terms of a more direct financial test using revenues as a more comprehensive measure of project value. It can
still be argued that in the case of imperfectly competitive markets for both transport and transport-using activities, user revenues will not be a perfect measure of user values, and in particular may misestimate wider economic benefits and costs, and above all environmental impacts will not be adequately accounted for. There is a strong case therefore for extending the developing NATA framework to all modes of transport, as was done through a series of multi-modal studies which aimed to consider a range of solutions to perceived transport problems, including comparing alternative modal solutions or developing genuine multi-modal solutions for given corridors (Department for Transport, 2003).

### Table 2.2 Example Appraisal Summary Table

<table>
<thead>
<tr>
<th>Scheme</th>
<th>A2 Bean-Cobham Phase 1: 1996 Scheme – 6km D4 on-line widening. Cost £44m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criterion</td>
<td>Indicator</td>
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<td>Environmental impact</td>
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*Source: DETR (1998c)*
There was also a need to provide a robust method of evaluating alternative urban solutions such as the comparison of rail or light rail with guided busways. Reliance on financial appraisal, especially where complex private finance or public–private partnerships were to be used, could omit some of the key environmental and wider economic impacts. Multi-modal studies have been developed for a number of situations where serious transport problems existed, but there was no clear solution. These included a number of key inter-urban corridors experiencing serious congestion, and towns where poor accessibility was perceived to be a constraint on economic development. Delivering multi-modal solutions to multi-modal problems has, however, proved to be a greater problem since non-road solutions have typically depended on the need for private sector finance raising problems of traffic forecasting and risk transfer. As Flyvbjerg et al. (2003) have shown in a critique of forecasting problems, there has been a consistent tendency towards the over-estimation of traffic and under-estimation of costs, especially in rail-based projects.

This raises the question of how far the public sector should be paying for the possibility of capturing wider benefits from a scheme largely financed by the private sector. The danger is that some of these effects may already have been captured in user benefits which are paid for by users. Additionally, as we have seen, depending on the nature of competition wider impacts can be negative as well as positive. Some may also simply involve redistribution between one area and another.

What implications does this have for appraisal? At the heart of any transport appraisal the primary concern is to ensure that the transport benefits and direct external costs are both measured and evaluated correctly. No attempt to include wider indirect benefits and costs can overcome inaccuracies in the estimation of the basic transport user benefits. Thus, first, the situation depicted in Figure 2.4 has to depend on the accurate measurement of the traffic impacts of a scheme, taking into account the position expected to obtain at the date of its introduction. As Flyvbjerg et al. (2003) and others have shown it is poorly executed forecasting of both demand and costs which has often undermined the appraisal process.

Beyond this it is desirable to include directly the measurable elements of directly attributable external costs. The uncertainty surrounding precise valuations of environmental impacts has often led decision-makers to be reluctant to incorporate these directly into CBA and instead use MCDA or the even less ambitious AST which avoid placing monetary values on these effects. The disagreements between analysts of the precise monetary values to be placed on greenhouse gas emissions or local air pollution have often been used as an excuse for avoiding methods which require such valuations. However, not placing a monetary value on such factors does implicitly
place such a value in the overall appraisal and it is more satisfactory to include a value (or range of values) which can demonstrate the sensitivity of the overall appraisal to each factor in turn. More difficult are such factors as landscape impacts and visual intrusion where the physical measure is also less objective. The danger of excluding factors which are difficult to evaluate is that they may finish up being accorded excessive weights in the more qualitative stage of appraisal.

What SACTRA (1999) and others have shown is that there is no simple rule for ascribing wider economic impacts to a particular value of transport user benefits. It is not possible for example simply to utilize a multiplier which aggregates user benefits by a factor of 1.1 or 1.2. It has been well established (Dodgson, 1973; Jara-Diaz, 1986) that in a perfectly competitive environment the user benefits will be a sufficient and complete measure of all the benefits. More significant is the situation in an imperfectly competitive environment. As Venables and Gasior (1999) have shown in a theoretical model, reinforced by attempts to apply a working model to specific situations (for example Bröcker, 2000; Oosterhaven and Elhorst, 2003), a wide range of different outcomes can be obtained according to the precise nature of both the sectoral and geographic situations.

The problem is whether it is feasible to develop and use large scale CGE models for every appraisal exercise. If these are only thought to be effective for the appraisal of major changes to networks, what constitutes the minimum size of a project, and how would we know if a particular project might have wider impacts which are worthy of more detailed analysis without having first carried out the analysis? As theoretical analysis in the new economic geography (Fujita et al., 1999) has shown, the impact of a given change in transport costs can differ in different situations; small changes can in some cases have disproportionately large impacts and vice versa. Even changes which have a large impact on transport costs and accessibility may have a very small impact on regional economies; Bröcker et al. (2004) show that the EU’s TENs programme may produce changes in accessibility of up to 40 per cent but the overall economic impact is typically between one-twentieth and one-tenth of this.

The great advantage of the CGE approach is that it directly produces a measure of the overall change in welfare; as long as the appropriate direct external effects are included in the model structure it can give us an overall appraisal evaluation. But the big question is how far decision-makers are prepared to accept this essentially black-box approach to appraisal. The great advantage of the AST approach is its apparent transparency where each element is spelled out, but it then requires great consensus amongst the various interested parties to accept the implicit weighting attached to each value. After nearly eighty years of CBA we clearly still have a long way
to go in resolving the questions over its acceptability as an objective methods of analysis firmly rooted in economic theory.

NOTES

1. This section draws heavily on the analysis provided in SACTRA (1999) of which the author was one of the members. See also Quinet and Vickerman (2004) for a more formal analysis.
2. Although we can conceive of a case where the supply curve at current levels of use would effectively be perfectly elastic, there would be little need for any evaluation of new investment for a road where usage was so far below capacity.
3. For a comprehensive guide to the use of MCDA in public decision-making see ODPM (no date).
4. Moreover this is of the technically more correct equivalent variation in income resulting from a change rather than the (Marshallian) consumer surplus of the traditional CBA model.

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