TRANSPORTATION STUDIES EXAMINED

By S. P. C. Plowden

INTRODUCTION

Since the last war ambitious large-scale studies have been developed in North America to predict the future transport requirements of urban areas and to plan and test facilities to meet those requirements. These studies are now being copied in this country. Such a study is in hand for every conurbation and for many large and medium-sized towns, although sometimes in an abbreviated form. The recent White Paper on Transport regards these studies as the main instrument for urban transport planning.¹

The aim of this article is to consider the extent to which these studies are well designed to help solve British town planning problems, and, in so far as they do not appear to be so, to make positive alternative suggestions. The article is not concerned in detail with the models of travel behaviour used or with methods of data collection and forecasting. These are important and indeed vital matters, which will no doubt be the subject of future articles in this journal. But they are logically secondary to such questions as what views of our current problems, and of the proper role of governmental authorities in solving them, are inherent in these studies, regardless of whether these views are stated explicitly or only presupposed. It is with this sort of question that this article is chiefly concerned, and technical matters will be discussed only to the extent that they throw light on wider questions of aim and approach.

It is first necessary to describe what is involved in these studies. The following account is intended only as an outline. Its purpose is to describe what transportation studies have in common rather than the points at which they differ, and it is of course very much simplified. But a high degree of simplification is justified in the present context, and is a defect only if it distorts the picture in a way which affects the conclusions drawn. Throughout the article, but particularly in this outline, mathematical and technical language has been avoided as far as possible. It is not necessary to use such language in order to bring out the general logical character of the studies. Nevertheless the attempt to dispense with it has given rise to some cumbersome and at times naive ways of expressing things, which I hope will be forgiven by anyone who would have preferred a more mathematical treatment.

THE OUTLINE OF A TRANSPORTATION STUDY

Transportation studies are directed towards some date, usually 25 to 30 years ahead, for which it is required to predict future traffic and to plan facilities to accommodate

it. The area under consideration is divided into zones. The stages of the study are best described by reference to the origin and destination table which is built up for the design date, which is of the form shown in the diagram.

<table>
<thead>
<tr>
<th>Zone of Destination</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Total Origins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone A</td>
<td>33</td>
<td>12</td>
<td>19</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>Zone B</td>
<td>35</td>
<td>25</td>
<td>6</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td>Zone C</td>
<td>11</td>
<td>8</td>
<td>8</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>Zone D</td>
<td>18</td>
<td>7</td>
<td>7</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Total Destinations</td>
<td>64</td>
<td>65</td>
<td>44</td>
<td>33</td>
<td>206</td>
</tr>
</tbody>
</table>

The study proceeds in four main stages as far as personal journeys are concerned. The object of the first stage, trip generation, is to predict the “Total Origins” column and the “Total Destinations” row of the Origin and Destination table, in other words to say how many journeys are likely to start and how many to end in each zone in a given period. The object of the trip distribution stage is to fill in the individual cells of the table, in other words to give a complete picture of all inter-zonal movements. Modal split deals with the division of journeys between the different forms of transport available; the end result of the three stages of trip generation, trip distribution and modal split is therefore a set of origin and destination tables, one for each mode. The assignment stage makes use of the origin and destination tables which the other stages have built up, and allots the journeys shown in the tables to various possible networks; these can then be compared and a selection made.

The divisions between the stages do not always fall precisely as here described; and there are also important differences, which will be described below, in the point at which modal split is introduced. The more recent and more advanced studies also make some provision for feed-back and interplay between the stages.

It is of interest that the usual definition of a trip in a transportation study excludes journeys not made by some motorised form of transport, in other words journeys on foot or by bicycle, although certain information may be collected about such journeys – work journeys at least – for checking purposes.

The treatment of goods journeys is very much simpler, because it does not start with the movement of particular loads but with the movement of goods vehicles. In other words, the modal split stage is excluded. The prediction of goods journeys also usually follows and makes use of the prediction of personal journeys.

**Trip generation**

It is necessary to say something about how each of the separate stages is handled. Trip generation draws upon surveys of present travel. The number of trips made at present is expressed as a function of measurable characteristics either of households or of zones. The variables chosen may differ according to journey purpose, but income and car ownership are examples of important household variables, and density and distance from the city centre are examples of important zonal variables.

Before the trip generation formulae developed in the present situation can be used for prediction, values of the independent variables must be forecast for the design date. These forecasts are usually extraneous to the study, at least in part, since the
study relies on forecasts of such things as population growth, incomes growth, etc.,
worked out by other people, although they may have to be adjusted to fit the
geographical boundaries of the study area. The substitution of the expected values
of these variables for present values in the trip generation formulae gives the pre-
dicted volume of travel for the design date.

**Trip distribution**

There are two broad methods of tackling trip distribution. The first of these is the
growth factor method. At the end of the trip generation stage it is possible to assign
two growth factors to a zone: the ratio of the total number of journeys predicted to
originate there to the number originating there at present (as revealed by surveys)
and the ratio of the total number of journeys predicted to terminate there to the
number terminating there at present. There is also an analogous growth factor for
the whole area. Growth factor methods consist in applying these factors to the
numbers in the cells of the present origin and destination table in such a way that
the table remains internally consistent, that is, that it continues to add up both
downwards and across to the predicted totals. There are a number of iterative
techniques by which this can be accomplished, and the choice between them seems
to turn on practical considerations, such as how quickly they converge, rather than
on points of theoretical validity.

Growth factor methods make no attempt to explain the present pattern of distribu-
tion, although it could be said that they reflect whatever causes produce the present
pattern, and it is also obviously unsatisfactory to apply them to zones which at present
generate a very small number of trips but in future will generate a large number of
trips. Synthetic methods do attempt to account for the present pattern of journeys.
They are based on the idea that the proportion of journeys from one zone \(i\) that will
be made to another zone \(j\) is partly a function of the “pull” of zone \(j\), which attracts
journeys to it, and partly a function of the difficulty or resistance found in travelling
from \(i\) to \(j\), which acts as a deterrent. The “pull” of zone \(j\) has to be measured in
relation to the “pulls” of other zones, and the difficulty of travelling from \(i\) to \(j\) has
also to be measured in relation to the difficulty of travelling from zone \(i\) to other
zones. For example, if shopping journeys were in question, the floor space in each of
the existing shopping centres might be taken as a measure of its attraction, and the
time taken to travel from a given residential zone to each of the shopping centres
might be taken as a measure of the resistance associated with each shopping centre
for travellers from that residential zone. The general shape of the formula which
takes these forces into account is usually determined in advance, but its precise
formulation is determined by what seems to give the best fit in the existing situation.
This search for the precise formula is known as calibrating the model, and the model
may be differently calibrated for journeys of different purposes or according to other
ways of classifying journeys. Once the model has been calibrated, it can be used for
prediction in much the same way as trip generation formulae can be, that is, when
the values of the independent variables of the model have been forecast.

**Modal split**

Modal split procedures are distinguished primarily by the extent to which they
regard the different modes as serving different functions or as being in competition
with one another. At one end of the scale, public transport is regarded as being reserved for those who for one reason or another are not in a position to make use of a car: for example, schoolchildren, the old and the poor. This might be called the "captive market" theory of public transport. The studies which tend to this view usually allow that there are some other journeys – in particular journeys to and from the city centre – which will be made by public transport, either because public transport is actually more convenient for those journeys or because of the sheer difficulty of accommodating all the cars that would otherwise be required. In any case, the number of journeys that will be made by public transport is small in proportion and the sorts of journeys concerned can be known in advance. Given this theory, it obviously makes good sense to introduce modal split very early into the predictive process, even to combine it with trip generation. There are in effect two quite different markets, and they can be treated separately from the outset.

At the other end of the scale, the modes are regarded as highly competitive. A traveller will go by public transport or take his car according to which offers the better service for the particular journey. According to this point of view, which is best exemplified in the Toronto study and other studies by the same firm,\(^2\) it is necessary to integrate the modal split and assignment stages: to go by bus, to go by underground and to go by one of the several routes which one might take by car are all alternatives which have to be treated as on a par with one another. The choice will turn on a variety of factors, such as travel time and money cost, and formulae have been developed to predict the individual traveller's choice by reference to these and other factors. These formulae are calibrated in the existing situation and used to predict for the design date, in much the same way as has been described for trip generation and trip distribution.

**Assignment**

The problem of assignment has usually been treated as the problem of predicting the routes that motor vehicles will follow on a road network, although a similar problem arises with respect to passengers on a public transport network. It is assumed that each driver will take the route that will give him the shortest overall journey – shortest perhaps in travel time, or with respect to some aggregate measure designed to represent cost. Clearly the shortness of a route in time depends not only on distance and on the capacity of the roads and intersections, but also on the number of other vehicles using the roads, in other words on congestion; and elaborate procedures have been developed which will take the effect of congestion into account.

**Evaluation**

The criteria by which choices are made between different possible networks are not always easy to ascertain or to state, and there is no general agreement about what they should be. Clearly an assignment procedure should first of all reveal whether the network is roughly in scale with the predicted traffic. It should also highlight particular links or sections of the network where congestion may be expected, either in normal circumstances or as a result of some emergency, for example that a particular road has to be closed. It is usually held that the final choice should be made

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according to some monetary criteria whereby the costs to the authority that has to provide and maintain the facilities are balanced against the benefits to the user, largely in the form of time savings; but the issues in transport economics that this statement raises will not be discussed here.

THE RATIONALE OF A TRANSPORTATION STUDY

Perhaps the best way of approaching the question of how well a study of the kind outlined is suited to British problems is to attempt to describe the situation in which such a study would be most appropriate. It will be seen that in essence the study consists in projecting into the future the situation that is found to exist at one point of time. The present situation is explained, or at least described, by relationships which concern not only the workings of the transport system itself, but also the interactions of the transport system with the pattern of land use and other factors that generate a demand for transport. These relationships are not only very complex, but in their precise formulation are highly dependent on the circumstances of the particular town; as has been seen, it is necessary to calibrate the models by reference to the observed situation. Indeed, one's suspicions would be aroused if this were not so, since one would hardly expect to find a set of precise formulae that would apply to all towns.

The assumption that a set of such relationships found to obtain in a particular town at one point of time will still hold good in perhaps a generation seems to depend on the further assumption that no very radical change is expected in the character of land uses or in the type and quality of the transport system. There could be two reasons for this. It might be that everyone is fairly well satisfied with the way the town works at present: congestion is not thought excessive, the conflict between good transport and other desirable objectives is not too acute, the cost of transport is not felt to be too burdensome. Or it might be that, although the present situation is not regarded as satisfactory, it is thought to be beyond the power or the responsibility of the authorities commissioning the survey to do anything about it. But, whether because there is no call to intervene or because the authority cannot or should not intervene, a study of the sort described seems to be justified only on the assumption that no considerable alterations in kind are expected.

If this is so, what are the responsibilities of the commissioning authority which it requires a study to help to discharge, and what is its problem? The problem presumably is that although the system is working reasonably well now it will clearly not be adequate in the future. This is because of the growth of the city, which means that the transport system will no longer be adequate in scale. The pattern of growth given, the city will continue to expand according to a known pattern, and its magnitude is also something that cannot be controlled. But it is necessary to predict where the growth will take place and what travel demands it will give rise to. The function of the authority is to provide the transport facilities, and in particular the roads, to accommodate these demands. Beyond this its role is passive; it is not called upon either to change the pattern of the city or to exert any positive influence over the way in which the transport facilities are used.

A more or less explicit statement along these lines is to be found in some American
studies, in particular the Chicago study, which is often regarded as a prototype. But problems of urban growth, although the primary stimulus for these studies, are not the only stimulus. The studies seem also to have been prompted by dissatisfaction with present transport arrangements, and this dissatisfaction is not always confined to the scale of present facilities but extends to their type as well: in the Twin Cities, for example, one reason for doing the study was to strengthen the public transport system. But, whatever the stimulus may be, the studies do not seem to be well conceived to deal with any situation other than that where what is required is, so to speak, more of the same, rather than radical alterations of type. Let us look at a number of features of the studies which are explicable on this supposition but are otherwise puzzling.

**Comparison of American and British problems**

First and most striking is the treatment of evaluation. Not only is this by general consent the weakest part of these studies, but it is also regarded as something that can be left to the end, something that does not affect decisions on how data are to be collected, analysed and predicted. This is surprising, as it would generally be thought that only when objectives have been stated in fairly precise terms can sensible decisions be taken on the design of a study. But if the responsibilities of the governmental authority are limited to the provision of facilities, and in particular of road space, and if it is further required that road space must be provided such that travel can be conducted by much the same means and on much the same terms as at present, then the late and limited place assigned to evaluation makes sense.

In this country, too, the role of the government has traditionally been to provide road space and not to exercise much control over the use of the roads, with the exception, of course, of control in the form of rules designed primarily for reasons of safety. But there is almost universal agreement that this approach is no longer adequate; indeed this is almost the only point on which all schools of thought do agree. It is the realisation that a policy of indiscriminate provision is no longer possible that underlies the suggestion in *Traffic in Towns* that a distinction must be drawn between optional and essential traffic, and also inspires the road-pricing theories that have been put forward by transport economists. Our problems are not primarily those of urban growth, although they are compounded by urban growth, but of rising incomes and car-ownership, and of the vicious spiral of congestion which threatens to destroy public transport. We are not faced with the task of increasing the geographical extent of a transport system which in most respects is working perfectly satisfactorily, but with the task of devising new systems to replace a system that has clearly broken down, and moreover is encroaching in an unacceptable fashion on other activities.

The treatment of goods traffic is an important illustration of the need to be clear at the outset about one's responsibilities and objectives. As has been said, the movement of actual loads, as opposed to goods vehicles, is never ascertained. This makes

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3 *Chicago Area Transportation Study*. See in particular Volume 2, page 54. For a similar passage referring to the Washington area see a quotation in *Summary Review of Major Metropolitan Area Transportation Studies in the United States*, by Zettel and Carll, published by the Institute of Transportation and Traffic Engineering, University of California, page 64.

sensed on the passive view of the authority's responsibilities which has been described, but it would make no sense if it were thought desirable to attempt to rationalise goods transport. In that case, knowledge of the movements of goods would be required, but the present pattern of journeys by goods vehicles would be almost irrelevant, except as a benchmark against which to judge possible improvements.

The emphasis on a particular design date, or at least on a situation that is expected to arise at about a certain date, is again explained if the sort of situation I have attempted to describe is borne in mind. No doubt there are powerful practical reasons to state the problems in this form, since to think in terms of designing for a static situation is much easier than to think in terms of designing for a constantly developing situation. But if one can assume that the situation will continue to develop in a known way, and that the present designs can be extended indefinitely to cope with it, and indeed that there is no alternative to this process, then it makes good sense to think in terms of a date a reasonable distance ahead and to plan for that. As the date approaches it will be time to think of further extensions.

No doubt the fact that British development plans are also directed towards a single date has helped the acceptance of this particular feature of transportation studies. But it is an inappropriate and dangerous approach, particularly if it is accepted that new "rules of the game" as much as new facilities are required. For it may just be possible to stretch the present system so that it works until the date chosen but will break down shortly after. That this is a real and not merely a theoretical danger is shown by the two most famous British town planning cases, Oxford and Piccadilly Circus. For both places plans have been advanced which, if the arguments put forward in their support are granted, will work for 1981, the date chosen, but on the same assumptions will clearly not work only a few years later.

A noticeable feature of the studies is that the stages of trip distribution, modal split and assignment require some knowledge of the transport facilities that will be provided, but that trip generation is estimated without reference to the proposed facilities. Of course this does not mean that anyone supposes that the same number of journeys will be made whether new facilities are provided or not. What is tacitly assumed is, once more, that the new facilities will match the demand to approximately the same degree as existing facilities. This is inappropriate in British conditions, since it fails to take into account the well known phenomenon of suppressed demand: the number of journeys made, or at least the number of car journeys made, is limited by the road space available, so that further provision of itself brings about further usage.

The same view of the governmental authority's task also accounts for the failure to distinguish between "demand", "requirements" and "usage" in transportation studies. In fact what the studies do is to ascertain present travel - that is, usage, or in commercial language sales - and from that to forecast future usage or sales. This is a perfectly respectable forecasting procedure, but it cannot be identified with forecasting demand, if by that is meant what in some sense people would like, except on the assumption that the present situation offers a reasonable choice. The most

obvious example is modal split: only if one is satisfied that the present arrangements allow each mode to operate reasonably satisfactorily is one justified in taking what people now choose as a guide to what they would like. And “demand” in its turn can only be identified with “requirements” if it can be shown that the present situation is in some sense unalterable, at least in type. The identification of “demand” with “requirements” deserves very close scrutiny if there is reason to believe that to continue the present transport arrangements would be unduly costly or would involve serious conflict with other important objectives. Surely there is ample support for both these beliefs in Britain today.

The neglect of pedestrians and cyclists is something that again may well be justified given the shape that most American cities have assumed, but cannot be justified in most European cities, since these are important classes of traffic now and in the right conditions could be more important. Cyclists, incidentally, offer the most vivid example of the dangers of identifying present practice with demand. As a consequence of traffic management measures, conditions for cyclists become increasingly disagreeable and probably unsafe, and it would clearly only be adding insult to injury to say that present usage offers a guide to demand. First we drive cyclists off the road, and then we say that there is no demand for cycling.

What we can learn from transportation studies

I have given arguments to show that transportation studies, which have been developed to help solve problems very different from ours, are seriously inappropriate in British conditions. This does not mean that we have nothing to learn from them. It is impossible to read the better American studies without gaining insight into urban problems. It should also be possible to borrow certain techniques from them. In my view we have most to learn from the stages of modal split and assignment, which enable one to assess the capacity of transport systems to handle given loads. The forecasting process of the trip generation stage is unremarkable, in the sense that forecasting methods developed in other fields are at least as sophisticated and are readily applicable; and although much thought and ingenuity has gone into trip distribution models their validity remains very doubtful. We may borrow techniques, but we can only do so selectively, and we must be sure that they are applied only in the context of a study which in its total conception is well matched to the problem.

I have so far emphasised national differences which make a different sort of study necessary in Britain. But the problems of individual towns also differ widely. Some towns expect much larger population increases than others. In some towns the pattern of land use must be taken as more or less fixed, so that the problem is that of finding the best transport arrangements to fit; in others, both land use and transport can be altered. The problems of towns differ so much according to size and density that one would hardly expect the same study to be generally appropriate; one cannot take a study of a kind which has originally been devised with the problems of a large city or urban region in mind and cut it down to size, so to speak, so that it fits a

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It could indeed be questioned whether they are always appropriate to American conditions, or whether the passive view both of land-use planning and of transport planning is generally adequate even in America. But that is beyond the scope of this article.
smaller town. For all these reasons, any attempt to devise a standard British study would be mistaken. But there is enough similarity in the problems for it to be possible to say something about a general approach, in terms of what organisation and “rules of the game” are appropriate, and in terms of the stages in which one would attempt to devise a transport plan for a particular town.

GENERAL CONSIDERATIONS

There would, I think, be general agreement about the broad nature of our problems. Unfortunately this agreement breaks down very soon when detailed methods of tackling the problems are in question. Since the discussion of these differences soon leads into abstruse philosophical realms, perhaps the best I can do is to list what appear to me to be the main requirements, arguing the case for some of them in full, but merely indicating the reasons for others.

Land use and transport

It is generally agreed that the problems of land use and transport are inseparable. The most obvious reason for this is that the disposition of land uses affects the number, length and pattern of journeys that are made. A further important reason, which has been too little stressed, is that the control of transport facilities is the most powerful means available to the town planner to bring about a desired pattern of land use. The town planner usually has very few resources and is limited to negative methods of control. The control of accessibility should allow him so to influence market forces that they work with him rather than against him.

Although this principle is generally accepted in theory, it could not be fully applied in practice without a considerable change in organisation. Take the case of a town which faces an increasing demand for shopping space. One way to meet this demand might be to redevelop the existing centre at a higher density. Another way might be to build a road which would encourage a second shopping centre to be developed. Clearly an organisation is required that will allow these courses of action to be compared as the alternatives they are, regardless of the fact that one involves an investment in transport and the other does not. In other words, an organisation based on geographical units should be primary, and at each geographical level transport should be considered as one of the possible means of bringing about desired objectives. This argument is very much strengthened if it is also accepted, as has already been stated and will be argued further below, that the provision of transport facilities must be considered in conjunction with the rules that will govern their use.

The environment

A town is not merely a place in which people move about, but one in which they live and work. Environmental considerations must not be neglected, as at present they are almost entirely. How are they to be taken into account? In my view, they must be treated as constraints. This is not to argue that one can set a standard which is immutable regardless of its costs and other consequences; this is the criticism that, whether justly or not, has been levelled against the approach of Traffic in Towns. A compromise may have to be worked out between environmental considerations and
other considerations. But it is important that environmental requirements should be formulated in advance of the consideration of the transport plan itself, so that the extent of the compromise involved in particular transport arrangements is known and any decision to compromise is an informed and deliberate decision.

**Flexibility**

A transport plan must be flexible. We are not planning for a given date or for a particular set of circumstances, but for a constantly changing situation. Even if we were planning for a given date, it would be a date so far ahead as to make attempts at exact forecasting rather silly, particularly if, as has been argued, the changes that we should be prepared to consider in the transport system itself are of a radical nature. The problem is not to eliminate uncertainties in forecasting, which are inescapable, but to take the sting out of this fact by the flexibility of our arrangements. This means that it is not sufficient to judge a transport plan in terms of whether it is in some sense optimal for a given set of demands; it is much more important to be able to show that the plan could be adapted to meet any situation in the whole range of situations that can reasonably be foreseen.

How is this adaptability to be achieved? One of the important claims made by exponents of various new urban forms, in particular linear towns, is that they permit towns to grow indefinitely without any risk of the town's outstripping the transport system. These claims should certainly be taken seriously in the situation where one has the opportunity of building the town round the transport system. But in the majority of existing and expanding towns this opportunity does not exist. The infrastructure of transport, the actual roads and tracks, is capable of being altered only slowly. Adaptability must therefore come from different ways of using this infrastructure, and this brings the argument back to the central question of operating rules.

**Operating rules**

The chief reason for laying down operating rules has already been referred to: it is that there is no alternative. But it would be unfortunate to leave the argument in this form, as if operating rules were merely negative and restrictive. Let us take the example of the operating rules that already exist, that is, the rules of traffic management. Traffic management involves the prohibition of parking and of certain turns and the imposition of one-way streets. These rules could be described as restrictive, but to the extent that they permit greater volumes of traffic to use the streets at higher speeds they are instruments of a positive policy.

But traffic management, apart from its unacceptable environmental consequences, is insufficient because its effects are once and for all and the extra capacity it creates is soon taken up. We must therefore find other means of increasing the capacity of the system; this can only be done by some attempt to encourage high capacity modes of transport and to discourage low capacity modes.

Traffic management is not only insufficient but of doubtful logic, since it is based on the tacit principle that all vehicles (at least all moving vehicles) should be treated equally, regardless of the number of travellers they carry. A more logical starting point would be to treat all travellers equally, so the control of modes would not be
a further encroachment on the liberty of the individual but, on the contrary, a means of righting an injustice in the present situation.

It is indeed misleading to talk as if we could adopt a policy of control over modes or refrain from doing so as we chose. Present policies, whatever their intended effects may be, do in fact seriously affect the service that different modes can offer. In London in particular, there is substantial evidence to show that traffic management schemes, taken as a whole, have had an adverse effect on the competitive merits of the bus system. The only choice that confronts us is whether to exercise this control in a purposive way, in the light of some criterion that can be defended rationally, or to permit arrangements to continue in which some arbitrary system of priorities is inherent.

To use the terminology of the transportation study, modal split is the crucial issue, and it must be treated as a planning matter, not merely as predictive matter.

But even if this is accepted in principle, there remain stringent questions about the objects of control, the degree of control that should be exercised, the new arrangements that would then be made possible, and the kinds of disciplines that would be required to implement different possible arrangements.

Criteria of a balanced system

It would be generally accepted that no one mode is sufficient to cater for the great number and variety of journeys that have to be made in towns. The problem is to find the best balance of modes, to use a well worn phrase. The basic logical requirements of the criterion by which what constitutes the best balance must be judged are that it should take all journey demands into account and should be something common to, or neutral between, all modes.

To state the requirements in this general form is not to say much, but it is enough to call into question one widespread and persuasive point of view, that our aim should be to allow as many people as would like to use cars to do so. This is an attractive statement, since certainly it is a reasonable aim that people should do what they like as far as possible, but it is hard to see why it is more important to allow as many people as want to to use cars than to make an attractive and convenient system available for those who are unable or unwilling to use cars. Nor is it easy to see how one can tell, or even how the individuals themselves could tell, who would want to use cars without knowing what the possible alternatives might be. In practice, those who hold this point of view tend to assume that anyone who has a car will want to use it for every journey, and that the evident truth of this can be seen from a consideration of what the car and only the car offers: door-to-door service, availability at all times, the freedom to stop en route or change one's route at will, and so on. But the ability of the car to offer all these advantages is not just a function of its mechanism; it is dependent on the conditions, and in particular on the number of other people wanting to use cars. Cars frustrate each other; only a criterion which takes all journey demands into account enables one to judge whether the degree of frustration is such that a system based on some other mode would be more convenient in a particular town.

7The main evidence is that rail and Underground travel in London increased quite substantially at the same time as bus travel declined. See London Traffic Survey, Volume 1, Table 2.17.
This point is so important that it may be worth trying to illustrate it by an analogy. Those who think in terms of maximising the use of cars are inspired by the admirable desire to extend to as many people as possible the advantages that only a small minority have enjoyed in the past. No doubt it is true in a sense that most people would like to be able to enjoy those advantages. It is true in a sense that most people would like to live in a country house, but if we were to adopt this as an aim of housing policy we should not succeed; we should spend a great deal of money in the attempt, we should destroy the very amenity we were trying to let everybody enjoy and we should fail to exploit the opportunities that the situation really does offer.

The most obvious measure common to all modes is door-to-door journey time. Thus, to take a much simplified case, one might say that for a given set of journeys that balance of modes was optimal which minimised the total door-to-door time needed to perform them. There are, however, a number of objections to this criterion.

Economists are not likely to be satisfied with any criterion which does not express the benefits in money terms. The main reason for this is that they have been chiefly concerned with the question of how much of our total resources should be devoted to transport, and have therefore sought a criterion which would not only be common to all modes of transport but would apply to the other alternative fields in which the money might be spent. But it seems more realistic to suppose that the total budget to be spent on transport can be taken as given, at least within fairly narrow limits, and the problem is how best to spend it. Moreover, the task of assessing in money terms how people value their time is extremely difficult. Experience in commercial fields, where the problems of evaluating demand are much easier and where the market provides some sort of test of whether estimates are right or wrong, is not very encouraging; and, even if it were possible to make valid estimates for one point of time, it takes a further heroic assumption to use the same estimates over the time span for which a transport plan would have to last. It is important that the criteria used should be in terms of measurements which are reasonably stable.

It is certainly true that the same criterion would not be appropriate to every problem. The criterion must be adapted to the opportunities of the situation. In a new town where one is free to decide both the land use pattern and the transport system, in other words where there is an opportunity to choose between complete town designs, a measure of accessibility is required which takes into account the choice of destinations offered by the transport system. Thus design A might be preferred to design B because a journey of 20 minutes on the transport system brought a wider range of job opportunities to the average resident. At the other end of the scale, in a town where, for historic reasons perhaps, the land use pattern had to be taken as fixed and the scope for new road construction was limited, the simple criterion suggested of minimising travel time for a previously estimated set of journeys might be appropriate. Of course it is true that any numerical criterion has to be used with caution. To minimise total journey time might in particular circumstances have an unfavourable reaction on the land use pattern that was being sought, which might for example make it advantageous to favour short journeys rather than long ones, or to encourage development in one direction rather than another. This sort of effect
is inherent in the use of any numerical criteria, which can never be regarded as absolute but must always be used with caution and common sense. 8

The limits of comparability and control

The search for a criterion which is neutral between modes and which takes all journey demands into account should not blind us to the fact that modes are not completely interchangeable and journeys are not all alike. Modes differ not only in their technical capabilities but in secondary ways as well. For example, among the advantages claimed for a car are comfort, the fact that the car is an extension of one’s own home, that one can travel in it when suffering from an infectious complaint, and so on. Among the advantages claimed for public transport are that the time spent travelling can also be put to other uses, such as reading, and that the traveller is free from the responsibility either of driving the vehicle or of looking after it when not in use. These various considerations will be differently valued by different people. Journeys differ in the urgency of their purpose, in the modes by which they are conveniently accommodated, in their need to be made to specific destinations and at specific times, and in the importance of the time the journey takes.

How are these differences to be taken into account? To a very limited extent it is possible to lay down rules which will explicitly favour journeys for which priority can be claimed. Emergency services – fire, police and ambulance – have urgent and special requirements from all the points of view just noted, and one test of a transport plan should be that it gives effective priority to these services, not the merely notional priority which in practice is all that they often enjoy under our present arrangements.

The treatment of emergency services would cause little dispute, but beyond this it is much harder to see what attempts should be made to give priorities to particular journeys. An attempt to lay down rules favouring certain journeys according to their purpose would be particularly invidious. There is a much better case for attempting to control mode and timing. Commuters, for example, generally have tight requirements with respect to timing, but not to mode; with goods traffic it is just the other way round. But these are only generalisations. Individual commuters may have some particular reason to use a car, or may suffer from a pathological dislike of trains, for example; certain goods deliveries may be very closely tied to a given time of day.

From a practical point of view it is also clear that the degree of control which any authority can hope to exercise is limited. How can the particular kinds of traveller that one wishes to favour or discourage be identified, and how can workable rules be formulated that will single out just those travellers and not others? Considerations of principle and considerations of practicality both lead to the same conclusion. We must think in terms of systems which offer a rich range of alternatives, and in which

8It is often claimed for numerical criteria that only by their use can decision-making be made precise. But this remark can be interpreted in two senses, and is only true in one. It is not true that all objectives are properly and fully expressed in terms of numerical criteria; there is bound to be arbitrariness and distortion in even the most elaborate numerical criteria. It is true that once the choice of criteria has been made comparisons can be made between alternatives according to precise rules. In a situation where there are a great many interests to be considered, and a great many designs could be suggested, precision and ease of calculation are essential, but the optimal design or designs which result must always be inspected in the light of considerations which the criteria distorted or did not take into account.
control is exercised in such a way that the individual traveller is left as free as possible to make his own choices.

**Different kinds of transport systems**

Bearing these requirements in mind, what kinds of systems could be made available? The obvious failings of our present system of urban transport, based as it is on the motor vehicle, have led to great interest in new mechanical forms of transport. But there is a danger of a logical confusion here — curiously enough exactly the same confusion as that so often found in the arguments of the advocates of the motor car — between the motor vehicle itself and possible ways of using it. The motor vehicle is a remarkable invention which can take a great variety of forms and can be used in a great variety of ways. We should not reject it before we are sure that we are making the best use of it.

This is not to dismiss the usefulness of other mechanical forms. Trains and trams already have an important part to play in larger towns. New inventions should certainly be useful, particularly in new towns where it is possible to build the town round the transport system. But certainly in existing towns, and for many purposes in new towns as well, the motor vehicle is always likely to retain advantages over tracked modes. Nor can we wait until new forms are developed and tested. The urgent problem is to make the best use of the technical means already at our disposal, and of the motor vehicle in particular. In other words, we should be looking for new organisational systems rather than new mechanical systems.

The need to encourage high capacity modes has already been stressed. Clearly, high capacity modes do not usually permit individual travellers to make an unbroken journey from door to door. Therefore we must think in terms of systems which allow convenient changes to be made. These changes may be from one part of the high capacity system to another — from bus to bus or from train to bus, for example — or they may be between the high capacity system and other modes which feed it. Everything must be done to facilitate mixed means of carrying out journeys, such as those vividly described by the Americans as “park and ride” and “kiss and ride”. Nor is there any reason why the vehicle parked should be a car, rather than, for example, a bicycle.

In larger towns at least there will be room for the different parts of a connecting high capacity system to operate in rather different ways: Professor Buchanan’s concept of a hierarchical network applies here as well as to road design. An example of this would be the sort of bus system that London Transport is now proposing: express buses with limited stops linking with local buses operating on short routes which may vary by time of day.

Even with the most highly developed scheduled system there will always be a need for more individual, flexible modes, whether these are private (for example, the private car) or public (the taxi). There is also a need for something between the completely individual and the completely scheduled system. One example that has been suggested is the “excuse me” taxi, which when occupied but not full indicates where it is going so that it can be hailed by other travellers going to approximately the same destination. Another example would be that taxis could be used as they are at present during most of the day, but as supplements to the high capacity system at peak periods. For example, taxis could be use during the rush hour to ferry pas-
sengers from given pick-up points to bus stations or railway stations. The taxis would not leave the pick-up point until full of passengers for one destination. The agreement to help provide such a service could be a condition of granting a taxi licence.

There would seem to be scope for rationalising goods transport in towns by treating the town, or areas of it, rather than the firm as the unit of organisation, thereby taking advantage of economies of scale which at present are available only to the largest organisations. This would mean having a depot serving the town; goods coming from outside would be brought to the depot, as at present, by lorries belonging to the firms concerned, or by train, but would be distributed within the town by lorries whose only function would be internal distribution.

Such a system, which might be described as a public transport system for goods, would not suit all goods journeys, any more than a passenger public transport system, however much improved, could serve all personal journeys. But among its advantages would be that it might be used to make services available which exist at present in only a very rudimentary form. For example, very few shops run an adequate system of deliveries to customers – a failing which in turn brings about an increased demand for the use of cars. The town goods system could supply this lack. It could also perhaps be used to supply a parcels service akin to that sometimes found on country buses.

The development of a public transport system for goods would open up the way for some integration between the goods system and the personal system, which at present act almost independently. It has already been noted that, whereas personal journeys are often very closely tied to a particular time, goods journeys very rarely are. The first aim of any integrated system should be to exploit this fact by controlling the times at which deliveries of goods are made. But integration could go further than this, by the use of the same garages, the same crews and perhaps even some of the same vehicles for the public passenger system and the public goods system.

There will of course be wide variations in the transport systems suited to different towns. Perhaps the most important difference is the extent to which the town can and should support its own transport system, rather than relying on vehicles which also serve other places. This will depend on size, density, the layout of the roads and the extent to which land uses or individual buildings must be regarded as fixed. Central London is obviously an extreme case from all these points of view, and one would expect that it would support a highly developed specialised system – as indeed it already does, in the form of the Underground, buses and taxis, which between them carry the great majority of journeys which begin or end within the area. Indeed one might almost describe the problem in central London in terms of getting rid of those non-specialised elements which frustrate the workings of the existing highly specialised system, and then radically improving the specialised system.

Many of England’s historic towns would also, one would have thought, be best served by a specialised system, because the pattern they have assumed cannot now be altered and because the claims of the environment must be put exceptionally high. Naturally the system would not be so complex, and it would be less self-contained in the sense that one would expect more exceptions. For example, very few towns could support a specialised system in the evenings or at weekends. But, although there would certainly be departures from a specialised system, the best way of approaching
the solution might well be to think first in terms of a fully specialised system and then
of the individual departures from it that would be necessary or desirable on various
grounds.

A specialised system is not necessarily a system in which one authority provides
all the services; the example of the London taxi should remind us of that. The dangers
of a single transport authority with that sort of function are very real. In my view
the best form of organisation is one whereby the public authority lays down the rules
but plays as little part as possible in the provision of the system. For example, specialist
firms could be invited by the local authorities to tender for running the buses. The
terms of the contract could perfectly well include the provision of services which
might be uneconomic in themselves but required in the interests of a wider system.
This sort of organisation means that the bus undertaking could not altogether ignore
competition, as it otherwise well might, particularly if it were protected by various
rules designed to give it priority. It also means that the customer could address
complaints to the local authority if he failed to get satisfaction from the bus company,
which is a further safeguard against the possibility of bureaucratic paralysis.

Disciplines

It is clear that transport systems of the kinds indicated can only operate in the
right conditions. For example, a bus system which depends on its being possible to
make connections between routes requires that the buses on the separate routes
should run more or less to time, and this in turn requires that the volume of other
traffic on the roads concerned should not exceed some critical level. In practice, the
kind of transport system which it is possible to make available depends on the sort
of disciplines that it is possible to operate. There are many different kinds of disci-
plines which can be applied to users of a road network; it is important that the possi-
ble limitations and limitations of each should be carefully examined without initial prej-
udices in favour of one or another.

The actual physical design of a network itself provides a powerful means of disci-
pline. It was pointed out in Traffic in Towns that the problem of protecting the
environment from traffic is primarily a problem of design. But design can also be
used within the context of a transport plan to encourage pedestrians and cyclists,
whose interests should certainly not be lost sight of in the consideration of more highly
powered forms of transport. Design can give pedestrians and cyclists the protection
from better armed and better armoured travellers that they chiefly require; it can
also help by providing short cuts in the form of paths and alleys, while motor vehicles
are obliged to go round by road. Design should not be thought of only as a long-term
strategic weapon. The physical shape of a network can be altered quite quickly by
putting down barriers, some of which may be only temporary; for example, gates
could be used to prevent through traffic using roads in parks or quiet residential areas
during the night.

The physical design of the network can be artificially altered, so to speak, by the
use of traffic lights, turning restrictions, one-way streets and the like. Such devices
serve much the same ends as can be served by physical design, and in a sense are an
admission of the inadequacy of the design. For example, when it is not possible to
create an environmental area which by its design is completely protected from
through traffic, traffic lights can be used to impose such penalties on those
attempting a short cut through the area that they would be effectively discouraged. These traffic management devices can be used to a limited extent to implement policies of modal split, by exempting certain classes of vehicles from some of the rules: for example, a ban on turning right need not apply to buses.

This way of using traffic management leads on to a whole host of what might be called legal, as opposed to physical, disciplines. Legal disciplines can be used both as a means of protecting the environment against traffic and as an instrument of a modal split policy. They have the great advantage that they make it possible to discriminate between traffic in ways which are not open to other disciplines. Among the legal disciplines which already apply in certain situations are the prohibition of lorries of over a certain size from town centres; the prohibition of certain classes of traffic from motorways; the institution of play streets; check points at factories or similar premises, which constitute filters acting in terms of certain kinds of journeys rather than certain types of vehicles; the banning of buses from certain streets, which is implicit in their routing.

The possibility of charging for the use of the roads has recently been very much discussed. It is an attractive suggestion, particularly if we accept the desirability to find a method of exercising control which still leaves the final choice with the individual traveller. Charging has the further advantage over the other methods so far discussed that it is a means of controlling the volume as well as the type of traffic to be permitted. The example has already been given of a bus system which might be able to operate efficiently with a certain volume of other traffic, but not in more congested conditions; to impose charges on other traffic might be the best way of regulating it.9

In addition to disciplines affecting the network, there are of course disciplines affecting the terminal facilities, in particular parking control. The obvious advantage that parking rules have over other forms of discipline is that they allow discrimination between private vehicles which require parking space and public vehicles which do not (or at any rate do not require it close to their passengers’ destinations). In other words, parking rules allow a control over modal split which is related to specific areas of trip origin or destination – something that cannot be achieved by charging for the use of the roads or by legal means of control over moving traffic, except of the most drastic kind. Parking rules can easily be varied by time of day, which property can be exploited so as to favour certain broad classes of people, such as residents, and to discourage others, such as commuters. Since parking control can be exercised by financial as well as by legal means, it also permits individual travellers to buy priority when they have an urgent need to use a car.

These various methods of control are, of course, much more powerful when used in combination than when used individually. For example, a criticism sometimes made of parking control is that by preventing local traffic it merely clears the streets for through traffic, which would seem to be undesirable from almost every point of

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9Road pricing theories are of different kinds, which should be carefully distinguished. The suggestion given in the text is an example of the selective use of road pricing as one means among others to implement a transport plan which has already been decided upon on other grounds. It is not claimed that road pricing would of itself produce the right volume of traffic on a given network, or the right balance between modes. Nor is it suggested that it would be generally desirable for all road users to be charged.
view. This criticism applies only if there is reason to believe that there would be a sufficient volume of through traffic to take up the extra space created; whether or not this would be so depends, among other things, on the extent of the area subject to parking control and the attractiveness of the alternative routes available to through traffic. But even where this criticism might apply, for example in central London, it can be met by the introduction of other forms of control aimed specifically at through traffic. These might be physical barriers, as suggested in the study of Norwich in *Traffic in Towns*, or they might take the form of some discriminatory legal barrier: for example, checkpoints through which buses and any vehicles belonging to the town's specialised system were allowed to pass, but not other vehicles.

This discussion of possible transport systems, and of the powers of different disciplines, has been extremely cursory, but it should give some indication of the richness of the alternatives that are available to us, within the limits of present technical knowledge and without any great expense.

**PARTICULAR TOWNS**

I have argued that transportation studies implicitly contain a view of urban transport problems that is incorrect when applied to British towns, and a view of the responsibilities of the governmental authority that is inadequate. I have tried to put forward an alternative view and to describe the kind of possibilities that would be opened up if it were adopted. It is now necessary to translate these general ideas into a method of approach for studying particular towns. How would one decide what system would best suit a given town? What things should one look at, in what order? What kind of studies would be involved?

There are of course a number of objectives, of very different logical kinds, that a town plan should satisfy. They may be broadly grouped under the headings of land use, transport, environment and costs; in addition, the need for a plan to be flexible and to allow for growth has been stressed.

The first difficulty in knowing where to start lies in the fact that none of these requirements can be expressed definitely. This is partly because of the difficulty of making predictions (for example, land use requirements depend partly upon future population, which is notoriously difficult to predict), and partly because there seems to be no way of setting an absolute standard (for example, people can be housed at different densities). The second difficulty arises out of the fact that the requirements under the different headings may conflict, and if they do there is no way of saying that one should automatically take priority over the other.

The best way of dealing with the difficulty that the individual requirements cannot be known with certainty is to make various estimates of each on different assumptions, in order to get a range. The best way of dealing with the difficulty of resolving a possible conflict between different sorts of requirements is to dodge it until real conflicts have been identified. There is absolutely no point in trying to set out rules to deal with all the conflicts that might arise; it is hard enough to find a rational procedure for coping with those that do.
Stages of a study
These considerations suggest that a study should proceed in the following stages:
1. The brief. Objectives are laid down under the various headings.
2. The initial search for a design. A design is sought that will satisfy all the various objectives. Any conflict between the objectives is identified and described precisely.
3. It is decided which of the original objectives should be abandoned or modified, and the brief is re-formulated.
4. A number of alternative designs are prepared compatible with the new brief; the advantages and disadvantages are set out.
5. A final choice is made.

Before going into more detail about what these various stages should comprise, it is perhaps worth noting that the most important difference between this approach and that of the transportation study is in the treatment of evaluation. Objectives are set out at the beginning: this is not the function of the experts of various kinds whose job it is to do the study, it is part of their brief. The job of the expert is to work out the implications of the brief in terms of the feasibility and mutual compatibility of the objectives, and to refer any points where the brief is not feasible back to the decision-maker. Thus decisions are not taken in one huge stage of evaluation at the end of the study; they are taken as necessity arises while the study proceeds. Similarly, all the fact collection is not carried out once and for all at the beginning of the study; facts are sought as necessary in order to throw light on what would be involved in various courses of action. It follows from this that it will not be possible to specify at the beginning of the study precisely what work will be involved. Each stage is a purposive enquiry leading to a conclusion, but only in the light of that conclusion can the next stage be planned.

How the brief should be expressed
One would expect the land use requirements to be set out in the brief in two parts, one in terms of the population, industries, etc., that have to be provided for, and the other in terms of the acceptable standards to be applied, standards affecting residential density, the ratio of open space to dwellings, and the like.

It has been the argument of this paper that the transport requirements must be described in terms of the need to provide a transport system to accommodate personal journeys and goods movements, not in terms of vehicles. In a particular town it will be necessary to specify in some terms what journeys have to be accommodated and to what standards. Here we run into difficulties about different towns. In an existing town, one might lay down as a first requirement that present journeys should be accomplished no less conveniently than at present, according to the criteria of convenience that have been discussed. The risk of specifying the requirement in this way is that it might seem to imply that the present pattern of land uses is something that cannot be questioned, thus leading to the position of the Piccadilly Circus Report, for example, in which it is proposed to spend very great sums on multi-level designs before it has been considered whether the pattern of land use which will be so expensively perpetuated is desirable. But, although the existing pattern of land

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10Piccadilly Circus, op. cit.
use should not be taken as sacrosanct, there is much to be said for adopting a mild presumption in its favour; it should be taken as desirable until it has been shown to be otherwise. This is to allow a certain force in the argument that the pattern that has evolved naturally is likely to be the most convenient, if only because people will have chosen their residences and made other arrangements in order to adjust themselves to it. It also provides some starting point for the designer.

In order to provide other points in the range of travel requirements, it may be sufficient to make quite crude assumptions, for example that the average distance travelled to work will increase by 20%, or that the number of leisure trips will double. It is far from clear in fact that this procedure would be cruder than the predictive methods of transportation studies; the main difference may be only that the crudity is acknowledged. Crudity is in any case acceptable in the first exploratory stages of a study, the point of which is just to find out what are the significant assumptions and requirements on which decisions will turn. If it turns out that the assumptions about future travel significantly affect the possible designs, then it will be worth attempting more sophisticated predictions as a second stage.

In existing towns, some knowledge of the present pattern of travel will be required and will have to be provided by surveys. In new towns, it will clearly be necessary to apply generation rates that have been found to obtain in other towns and to use some sort of trip distribution model, playing about with various parameters of the model to obtain a reasonable range.

The considerations that can be broadly grouped under the heading "environment" are of two kinds. There is the question of preserving places of beauty or of creating new things of beauty. These opportunities will be specific to individual towns; therefore not much can be said in general terms about how they should be treated, except that they must be identified and marked on a map as requiring special treatment and in particular as requiring complete exclusion of traffic. This is sometimes the only way to safeguard open spaces, for example, which are so easily and so often destroyed. Once again, it may be necessary to sacrifice some open spaces, but not before we know exactly why. Other environmental values are of a less absolute kind; they require reasonable protection from traffic for activities which are vulnerable to it. The brief should contain at least some ideas of what districts should be treated as environmental areas and what standards are to be expected in those areas.

Finally, the brief should contain a statement of what the budget is. It has been argued that there should be a budget for the town plan, rather than a budget for transport, still less a budget for road building. But, for whatever purposes a budget is specified, its size must be ascertained at the beginning, even if only in order of magnitude terms. This may sound too banal to be worth saying, but it is not done at present. It is hard to imagine a reform that would be simpler to bring about, or one that would have a more powerful effect in narrowing down the range of possible alternatives to those that seriously deserve study.

The implications of the brief

The first stage of design is, then, to work out the implications of these various requirements. Certain features of any feasible design should emerge very quickly indeed, because they will be implied by more than one of the requirements taken separately, even stated in the most relaxed form. The example of central London
has already been given as an area which requires a highly specialised system of transport depending largely on high capacity modes. This conclusion does not emerge as a result of some kind of choice between different desirable objectives: it is indicated by each of the considerations one would look at separately, land use, transport requirements, environmental objectives and the budget. But there will without doubt be a number of decisions of principle to be taken at the end of this stage, when genuine conflicts have been shown to be inherent in the situation.

It is not possible to decide by general rules how this first stage of design should proceed, or the order in which the various considerations should be examined, beyond saying that those considerations should be looked at first which are likely to be the easiest to examine and to have the most limiting effects. It may sometimes be obvious which those considerations will be, but it is just here that the skill and experience of the designer must enter; it is not a matter that can be reduced to rules.

The particular studies which have to be done at this stage must also depend on the circumstances, and not least on the information which is already available. It has been suggested that in any existing town a knowledge of the present pattern of journeys will be required. But it would be wrong to lay down in advance by what studies this information should be collected. There are a variety of suitable survey methods; one would expect for a first look at the problem that an appropriate method would be something simpler and quicker than the whole range of surveys usually considered to form part of a transportation study.

**First stage of decision making**

How should the decisions of principle that will emerge at the end of this stage of the study be taken? This again is a point on which there is likely to be disagreement of a philosophical kind. I would say that once all the various consequences of each course of action have been made clear there is nothing further that can be done to help the decision-maker; it is then a matter for individual judgment expressed through whatever constitutional means may be in existence. In particular, the attempt to give marks to the different objectives is hardly likely to reconcile any disagreements; if people disagree about the merits of schemes which have been precisely described they are no more likely to agree on how marks should be allotted, whether these marks are in terms of money, or some abstract system of points. Such methods do not remove the need for judgment; they bring value judgments in at an earlier stage, where they are much harder to recognise for what they are. They have the further logical disadvantage of treating as commensurable values which are in fact incommensurable, and some of which (aesthetic values) are not properly expressed in numerical terms at all.

**Examination of detailed designs**

The next stage is the re-formulation of the brief. By this time it should have been possible to identify a number of possible courses of action, each of which will have certain advantages and will pose certain problems. It should therefore be possible to express the brief in terms of these courses of action: particular designs should be examined and particular problems reported on. For example, if it appears that a city centre without private cars is desirable, detailed questions will arise about where exactly the boundaries of the central area will fall and where interchange points
should be sited. If it is decided that the town's problems arise primarily because of
an unfortunate disposition of land uses, for example an ill-sited shopping centre, it
will be necessary to consider the questions of alternative sites and the program-
ing of a transfer from one site to the other.

The final stage of decision taking does not of course need to be final in the sense
that all the decisions about a town's future have to be taken. It is necessary to dis-
tinguish between irreversible or strategic decisions and reversible or tactical deci-
dions. Even strategic decisions should compromise future development as little as
possible.

CONCLUSION

In attempting to set out a framework for studies that would be more appropriate
than transportation studies I have left many gaps. This is not surprising; we are faced
with new, large and complex problems which we are only just beginning to under-
stand. But if this framework is even roughly correct, it should at least indicate what
direction further study should take. What seems to be most urgently required is work
on the different kinds of transport systems that could be made available. A com-
mercial analogy may help here. The main emphasis in transportation studies has
been on forecasting. Economists have been mostly concerned with pricing and mone-
tary policy. These lines of attack must be supplemented by research on new product
development. We know why our present products are unsuitable, we know in broad
terms what improvements are required; we now need to explore the possibilities in
detail.

I have suggested that more hope lies in finding new ways of organising the use of
motor vehicles than in developing alternative mechanical systems. This will require
a number of skills, most obviously those of traffic engineering and operational re-
search, served by market research and set within constraints imposed by the town
planner. But the work cannot proceed unless there is a new approach to organisation
and finance, and these may turn out to be the most crucial problems of all. We need
an organisation which makes it possible to think in terms of moving a shopping
centre rather than building a new road, to take the example given previously, or at
the very least an organisation which permits us to view different investments in
transport as alternatives.

The problem of organisational structure is likely to be central, whether or not the
ideas put forward in this article are accepted. Second only to the question whether
transportation studies contain a correct appreciation of the problem is the question
whether they are a useful instrument to the decision-maker, given the limitations of
his powers. Such studies in this country as are already well advanced, including the
London Traffic Survey, give the impression that the study and actual planning pro-
ceed almost independently of each other. This must inevitably be true of relatively
small planning decisions on the scale of most traffic management schemes, but it is
disquieting when major investments appear to go forward without reference to a total
plan simply because they were planned a long time ago and there is now no way of
stopping the administrative machine. The link between Western Avenue and Mary-
lebone Road, which is now under construction, appears to be an example of this; an even more important example, should it ever come to fruition, would be the plan for Piccadilly Circus.

To emphasise the importance of organisational and financial problems is not to say that everything must wait until the organisational structure is perfect. Highway authorities and planning authorities already have considerable powers both over moving traffic and over parking. These powers have so far been used to further a policy of traffic management; they could be used in pursuit of other policies. No doubt other valuable powers could be assumed without a radical change in the organisational structure. But we must follow where the argument leads, and if the organisational structure really is seriously inappropriate our efforts should be concentrated on ways of remedying it. Otherwise even the best conceived study is in danger of producing only a mass of interesting but unhelpful statistics.

It may seem that the approach I have outlined, since it tries to bring into the scope of the decision-making many considerations that have so far been neglected in transportation studies, can only complicate impossibly what is already a hard enough task. This objection will be particularly felt by those who believe that only when all considerations have been reduced to a single scale of value can fully rational decisions be taken. But we cannot ignore important considerations simply because we do not yet know the "right" way to take them into account. Nor will the various considerations always conflict. In particular, there is no necessary conflict between the claims of the environment and the requirements of accessibility; in some situations, the kind of control that will be required over the number and behaviour of vehicles to safeguard the workings of the most appropriate transport system will resemble quite closely the control required for the sake of the environment. Moreover, the attempt to bring in all the relevant considerations at an early stage should usually make the designer's task simpler rather than harder, since it will immediately narrow the field of possibilities that require serious study.

The ideas that have been put forward in this article cannot be pursued much further without experiment in actual towns. The opportunities and problems inherent in different approaches will only reveal themselves in this way. The obvious towns to start with would be the larger historic towns, which are large enough to support a specialised system of some complexity, and in which the pattern of land use must be taken as fixed and environmental standards must be jealously safeguarded.

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