

ECONOMIC RESEARCH CENTRE

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**ROUND
TABLE**

42

**INFLUENCE OF
MEASURES DESIGNED
TO RESTRICT THE USE
OF CERTAIN TRANSPORT
MODES**

EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT

PARIS 1979

ECONOMIC RESEARCH CENTRE

**REPORT OF
THE FORTY-SECOND ROUND TABLE
ON TRANSPORT ECONOMICS**

Held in Paris on 9th-10th November 1978
on the following topic:

**INFLUENCE OF
MEASURES DESIGNED
TO RESTRICT THE USE
OF CERTAIN TRANSPORT
MODES**

EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT

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INFLUENCE OF MEASURES
DESIGNED TO RESTRICT THE USE
OF CERTAIN TRANSPORT MODES

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I. INTRODUCTION

'Restrictions' in principle can embrace any instrument of policy having the effect of lessening vehicle use. They may be physical, affecting the supply of road space; financial, chiefly affecting the demand for the use of modes; or regulatory, affecting both the conditions of supply of specific modes and the demand for them. With such a broad scope for analysis of effects, one must be selective. Not only are the instruments very numerous (for example, J.M. Thomson identified 35 methods of traffic limitation in urban areas(1)), but, equally important, the conditions in which they are imposed vary as to economic circumstance, and traffic involved implying variable effects on travel demand and public concern. Even the bluntest physical restrictions, such as closing roads, will have different implications because of the variation in modes previously using the roads concerned.

This paper concentrates on non-financial measures such as restricting parking spaces, providing bus only lanes, impeding vehicle access and altering work times. These measures, together with other traffic management methods comprise the bulk of actual experience in traffic restriction policies, (fiscal effects - taxation on vehicles, for example, have doubtless been a more important restraint in both developed and developing countries, but have rarely been imposed as part of a deliberate traffic policy). The perceived needs for restraint, and actual practice have been overwhelmingly in urban areas, so we shall necessarily be concerned chiefly with them.

Besides considering the effects of restraint, I wish to enquire what developments in analysis and data generation seem to be required to make choices between instruments conform more closely to the objectives of restraint. This in turn requires attention to the specification of objectives, the decision-making system within which instruments are chosen, as well as the instruments themselves. The prime examples of the latter which will be referred to are those which happen to have been the subject of much recent attention in the UK, namely the possible extension of reductions in parking spaces to privately owned spaces not available for general public use, various forms of bus priorities, restrictions of traffic in town centres, including notably 'zone and collar' systems, and 'flexitime'

1) Methods of Traffic Limitation in Urban Areas: Environmental Directorate OECD, 1972, p. iv.

working. The first two are extensions to well entrenched policies, and the last two represent more innovatory approaches as far as the UK is concerned.

II. THE BACKGROUND TO ANALYSES

In reading some at least of the extensive English language literature concerning these kinds of measures, whether applied in the UK or elsewhere, one is immediately struck by the growing attention to the means of evaluating policies and, at the same time, by the relative lack of models and data appropriate to the circumstances of the urban areas concerned. For example, many contributors to the 1976 OECD "Evaluation of Traffic Policies for the Improvement of the Urban Environment"⁽¹⁾ considered dimensions for evaluation, of which perhaps the most comprehensive was David Bayliss in his paper on London. He showed how choice amongst traffic measures was being extended from the traditional dimensions of benefits and costs associated with changes in total traffic and individual modes to include scores representing nine specific environmental attributes (namely, noise; pedestrian delay; carbon monoxide derivatives; smoke densities; airborne lead; visual intrusion; pedestrian accidents; NOx densities; and vibration), and the implications for income distribution ('equity analysis'). He also listed the 'operational' and 'financial' implications of schemes which would, in a practical decision making context, be required as a supplement to these impact measures, such as levels of service, access to premises, enforcement processes, and the effects on bus companies' and local firms' cash positions. Proliferation of analytical dimensions in this way raises acute problems of public accountability and comprehension to which we shall return. But what of appropriate models and data?

Appropriateness depends on specification of objectives and application to the actual conditions in an urban area. Probably the major concerns, and thus the principal objectives of restraint policies, have been the following: the disbenefits of congestion; the relation of traffic and the environment; the economic and social future of the urban area and more especially the central area ('downtown' or 'CBD'), and, principally on grounds of differential mobility available among the public, concern at the decline of public transport.

These more complex objectives have been superimposed on the single objective, the speeding up of traffic, which underlay most of the earlier traffic measurement measures - for example, control of on-street parking, one-way traffic routing, and signal setting, etc.

¹) OECD Paris, 1976.

These efforts could themselves be criticised by extending the objective of increasing traffic speed to that of considering the net gains in time and cost to the traffic involved. Hence J.M. Thomson's early critique of traffic management emphasised the implications of increasing required trip length as, for example, in imposing one-way systems, and the question of the effects on congestion of generating traffic through improved conditions.(1) Nevertheless, traffic management could still operate with a reasonably clear rationale. The addition of different objectives have, of course, greatly complicated the potential relations between them, and as I shall argue later, have tended to outstrip the capacity of available models and data to illuminate the issues.

This increased complexity has not always been recognised. Very often for example, the aim of preserving the environment has been simply treated as being served by being regarded as the inverse of vehicle flow. This may be true for a single point in a town, but it cannot hold in a simple way for the town as a whole, because if trips are suppressed, it may be that the town's economic activity is lessened, which in turn means fewer residents to enjoy the improved environment. Similarly, because the motor car is at once the dominant passenger mode and therefore component of traffic, the main transport vehicle at work in creating economic competition for the town centre, and the chief threat to public transport, it has usually borne the brunt of restraint measures, and indeed is often crudely equated with the perceived ills of urban life. An exclusive focus on restraining the motor car may, of course, be mistaken if, for example, one of the main concerns of policy is the level of activity in the town centre. In competition with other attractions, shopping by car may be crucial, and to discriminate against the centre via car use perverse.

The growing diversity of policy objectives must also be seen against the different characteristics of, and conditions in, urban areas. The varying scale of urban areas is matched by their variation in economic prospects, prospective future congestion, and therefore appropriateness for physical traffic measures. In the UK, for example, traffic congestion in most urban areas has been falling over the last decade, as measured by average traffic speeds. The Transport and Road Research Laboratory's urban congestion studies give a time series for eight towns in the range of 75,000-500,000 population and five major conurbations, excluding London. Links in the principal road networks of each area were surveyed for traffic volume, and speeds at peak and off peak. For these conurbations and towns the average weekday results are given in Table 1.

1) "The Value of Traffic Management", Journal of Transport Economics and Policy, Vol. II, No. 1, January 1968.

Table 1

CHANGES IN SPEEDS AND FLOWS - U.K. CONURBATIONS AND TOWNS

	OFF PEAK				PEAK			
	1963	1967	1971	1976	1963	1967	1971	1976
<u>CONURBATIONS</u>								
<u>Whole town</u>								
Average speed km/hr	NA	31.7	33.1	38.0	NA	27.6	27.8	33.7
" flow pcu/hr	NA	1310	1385	1360	NA	1850	1955	1915
<u>Central Area</u>								
Average speed km/hr	NA	17.6	20.2	21.4	NA	14.9	17.8	20.4
" flow pcu/hr	NA	1505	1500	1385	NA	1800	1825	1725
<u>TOWNS</u>								
<u>Whole town</u>								
Average speed km/hr	33.1	32.0	33.9	34.0	24.3	29.8	29.4	29.5
" flow pcu/hr	985	1145	1180	1165	1535	1470	1570	1630
<u>Central Area</u>								
Average speed km/hr	20.7	19.6	23.4	25.0	15.1	18.2	19.6	20.8
" flow pcu/hr	1105	1195	1290	1380	1525	1420	1600	1745

Source: Urban Congestion Study 1976, Interim Report 1978. TRRL.

The trends in km/hour show that, whether measured on peak or off, congestion is falling. This seems to be a universal characteristic shared by all urban areas, suggesting that there are strong common forces at work. (The study also reported that congestion measured by the ratio of stopped time to journey time has also fallen, a measure more closely related to junction delays.) The major common forces are increases in capacity because of fewer parked vehicles and improved traffic control measures; a change in the composition of the vehicle flow towards more manoeuvrable vehicles, and, very probably, the technological improvements in the vehicles themselves. Individual urban areas have benefited differentially from the adjustment, and creation of new, road investment, but these have been relatively minor influences. The first two major common points are illustrated by further data from the survey, given in Table 2.

The effect of on-street parking control measures is dramatically demonstrated in Table 2. Parking densities have decreased by about two-thirds over 15 years. By the same token, the scope for further reduction has narrowed, especially because the more important effects in increasing capacity are created by preventing the parking of vehicles at bottleneck points, generally now achieved. These two factors - the effectiveness of street parking control in achieving its aims and the small remaining scope for reducing supplies of spaces on-street have largely prompted the idea of extending control of supply to off-street public and private parking spaces.

Table 2

VEHICLES PARKED AND FLOW COMPOSITION
UK conurbations and towns

PARKED VEHICLES (per KM of streets)		OFF PEAK				PEAK			
		1963	1967	1971	1976	1963	1967	1971	1976
<u>Conurbations</u>									
Whole town		NA	16.8	14.0	9.0	NA	8.8	6.9	5.1
Central area		NA	30.2	24.2	12.5	NA	15.6	11.9	5.7
<u>Towns</u>									
Whole town		19.9	17.6	13.4	10.9	18.7	10.5	7.5	7.2
Central area		54.0	38.9	23.5	16.1	27.3	23.4	12.0	8.8
* PROPORTION OF CARS & BUSES IN TOTAL FLOW									
<u>Conurbations</u>									
Whole town		Cars Buses	NA NA	63 4	66 3	NA NA	NA NA	76 4	78 3
Central Area		Cars Buses	NA NA	64 6	68 5	NA NA	NA NA	72 8	77 6
<u>Towns</u>									
Whole town		Cars Buses	NA NA	61 3	66 2	NA NA	71 3	77 3	75 2
Central Area		Cars Buses	NA NA	63 5	67 3	NA NA	67 6	75 5	78 3

* Including taxis.

Source: As for Table 1.

As Table 1 shows, rising speeds have been accompanied by varying experience in traffic volume. In towns, volumes have increased quite markedly, both in the central areas and elsewhere. In the (larger) conurbations, a slower increase in traffic outside the centres has been experienced along with a decline in central area traffic, more especially off-peak. These changes have implications both for the development of parking policies and the broader questions of relating restraint policies to the needs of individual urban areas. On parking, a comparison of Tables 1 and 2 shows that with the exception of central areas at off-peak times, the absolute numbers of cars in the flow have increased. Thus it is very unlikely that the number of car trips has reduced sufficiently to offset the loss of parking spaces on-street, and this is probably true even for the exception just noted. It follows that off-street parking has increased, so reinforcing the perception that further controls are necessary. By contrast, the reduced importance of buses in the flow, shown in Table 2, has stimulated measures designed to switch

patronage to them, on the argument, implicit or explicit, that this will be more than enough to offset the direct effect in improving speeds of the reduced number of slow moving vehicles.

The changes in flow recorded in Table 1 reflect greatly differing experiences. In general, the conurbations have been experiencing marked losses in employment and population, although at different rates, whereas the eight smaller urban areas in the sample have experienced an average change in populations of only -1 per cent, also with a considerable variance; some are indeed growing quite markedly.(1) The conurbations' decline has been especially felt in the centres. Data due to Professor Proudlove, University of Liverpool, given in Table 3, show how fast this was in certain of them between 1966 and 1971.

Table 3

CHANGES IN EMPLOYMENT AND TRAVEL TO CONURBATION CENTRES 1966-1971
4 CONURBATIONS OF TABLES 1 & 2, AND LONDON

<u>Conurbation</u>	% change in workforce 1966-71	% change in private vehicle commuting 1966-71	% commuting by private vehicle	
			1966	1971
Merseyside	-34	- 2	18	27
South East Lancs, North East Cheshire	-12	+19	22	30
Tyneside	-13	+22	21	29
West Midlands	- 4	+22	26	33
London	- 4	+ 1	12	13

Quite clearly, many conurbation city centres are declining rapidly, which helps to explain the reduction in flows there recorded in Table 1. Others are barely holding their position, while smaller towns are experiencing a variety of growth and decline patterns. Suburbanisation, as is indicated by the relation of the 'whole town' to 'central area' flows of Table 1, is proceeding everywhere, as is well known; but this is accompanied by very differing experiences at the centre. Congestion has become a relatively more important issue in the towns (in the size range 75,000-500,000). The ratio of stopped time to journey time was, at the end of the period surveyed (1976), higher in peak times than for conurbations,

1) Up to 13 per cent.

whether at the centre or in the town as a whole.(1) Thus traditional restraint measures have become relatively more appropriate for 'towns'; in conurbations, the level of economic activity has become a more urgent issue requiring more attention to the relation between traffic restraint and the level of trip making.

Moreover, modal divisions have become less simple than they were. For example, recent work by A.D. MacTavish of the Department of Transport, UK, and the present author, as yet unpublished, demonstrates the growing importance in the UK of taxis and private hire cars as an alternative to conventional public transport. This, in turn, suggests that Table 2's evidence about the increasing share and (in towns) the absolute number of private motor cars plus taxis may, if interpreted in the traditional way as meaning effectively private motor cars, be rather misleading. Taxis and hire cars are no longer an insignificant element in town and especially central area traffic. [Unfortunately for traffic analysts this can only be formally demonstrated for taxis. The equally or more important hire car (in UK called 'mini cab') trade is not distinguished in official statistics or allowed to advertise its presence on the streets. The latter compose production cars which cannot be recognised in traffic counts.] (2)

Taxis, whose fortunes can be traced, have been growing rapidly in importance over the last two decades. But here again important distinctions arise between different urban areas. Thus, in London, their numbers grew by 68 per cent between 1963 and 1976; there are now about 2 cabs for every bus. London's taxi growth is attributable in considerable part to the influence of visitors, favourable experiences in recruiting drivers, and only to some extent to falling relative real fares vis-à-vis other public transport. In the provincial towns, MacTavish indicates a much more favourable real fare trend for taxis against other public transport which has probably made taxis a more important element in the local population's transport options than in London.

So, for differing reasons, it is not fanciful to think of taxis and hire cars as quite soon assuming for the UK the position reached

1) The relevant figures are:

	1971 %	1976 %		1971 %	1976 %
<u>Towns:</u> Central Area	38.3	34.1	<u>Conurbations:</u> Central Area	41.1	31.6
Whole Town	25.0	26.0	Whole Town	28.8	21.7

Source: as for Table 1.

2) Not until 1976 were powers available to local authorities to regulate hire cars. Taxis have always been subject to such powers. They include the well-known London black cab.

in the USA some years ago, that of a preponderance in the public transport services. (In gross expenditure terms, that position may well have already been reached.) The significance of these points is that it is now incorrect to pose questions of traffic restraint solely in terms of motor car versus (conventional) bus or rail alternatives. Paratransit, to use the US term, for taxis, hire cars, jitneys, car pooling and like services, has to enter the picture. Its importance will vary both within, and between, urban areas.

Because objectives, conditions and modes have all become more diverse since the early '60s one might have supposed that there would have been a greater support for methods of traffic restraint which can easily accommodate such variations. The most conspicuous is, of course, congestion pricing. But the technical success, over the period reviewed, in creating road space by traffic management, and, equally important, the failure of manifest congestion to get worse, together with the shift of focus in congestion towards towns smaller than the great conurbations probably mainly accounts for the failure so far to adopt such measures. This failure is, so far as I am aware, complete for the Western world. It is not for want of trying - as witness the repeated attempts in London to secure political assent to pricing restraint, and the espousal, by the Urban Mass Transportation Administration, of demonstration projects aimed at road pricing experiments in the USA. No doubt the fact that road pricing sharpens the issues, among road users, of who benefits and who loses in a manner far more obvious than other proposals has not helped its political acceptance; but had congestion worsened in the big cities (as we who advocated it then all predicted it would in the early '60s) no doubt by now some Western city would have moved to adopt it.

However, there has been also an analytical shortcoming by road pricing's advocates. This is a failure to be convincing about road pricing's effects on the future of city centres. To decision-makers either dimly or, as in the USA, quite explicitly aware about the actual or impending decline of the city core what is in effect a tax on car trips to downtown looks threatening. In the context of declining conventional public transport, hopeful statements about promoting trips by increasing the efficiency of public transport substitutes for cars are unconvincing. And in fact, there has been analytical integration of congestion taxes with urban area structure only by theorists concerned with explaining the use of urban land at a highly aggregated level (as, for example, in work on urban density functions).

The underlying requirements for improvement in prediction are shared by proponents of road pricing and other measures alike. From our discussion, it is clear that these have to be capable of

distinguishing between towns in varying stages of development. Significantly, where road pricing has been adopted or may well be adopted (as in Singapore, Kuala Lumpur and Bangkok) the context is one of very rapidly growing cities of relatively low motorization. Here congestion can be substantially avoided by focussing on the chief growth element, private cars.

Taxes levied on them will not be an important tax on existing travel to the centre, because relatively little is done in cars, and what there is has low elasticity. In these circumstances, the issue of the actual impact of road pricing on activity will be perceived as a minor consideration. This has been the reported attitude of business proprietors in the case of Singapore.

III. MODEL SPECIFICATION AND PERFORMANCE

From this brief review of the varying and rapidly changing background of city development and its traffic one would expect models setting out to evaluate non-financial methods of traffic restraint not only to be capable of dealing with the several objectives of policy, but also to recognise the likely impacts of improvements on (especially) downtown's competition with other localities, and to be sensitive to the emerging shifts in modal supplies. Models must be capable, one might think, of modification for the very different town sizes and structures in which policies are applied. The actual models used do not appear to display this apparently desirable relevance and variety, and it is useful, by reviewing what has been done in particular cases, to ask why, and how they might be developed in the future. The main culprit is the ubiquitous and standardized urban transportation model, which, because it is there, and has been undertaken at great expense, imparts an immediate bias to the modelling approach.

An important recent example of an approach based on the standardized transport model is the "Study of Some Methods of Traffic Restraint" by the UK Department of the Environment conducted over 1973 to 1975, and reported in 1977.(1) This selected a town of 350,000 (Coventry) to compare several methods of restraint, namely parking control; supplementary licensing; road pricing, including cordon pricing (at the border of the CBD); and physical restraint (limiting the capacity of roads entering the restraint area). It was selected partly because cities of the size of Coventry "are likely to experience serious congestion problems by the 1980's, if not before".(2) It was to stand as general guidance in such cases.

1) Department of the Environment, Research Reports 14 and 15, 1977.

2) Report 15, p. 1.

It focussed on the "restraint area", composed of the inner city, roughly 2km by 4km, and within that, the downtown area, of roughly 1km diameter. It started from forecasts of traffic volumes, distribution and speeds for 1980. An initial estimate of trip levels at 1980 was derived from the Coventry Transportation Study (CTS); a base condition for the networks was constructed against which to judge the alternative restraint policies. A traffic model was then developed to translate the base demands into flows and speeds on networks and links. The model was sensitive to travel costs in its distribution and assignment phases, and incorporated an own-price elasticity of demand for travel of -1.0. Calculation of volumes on links enabled an extension into noise and pollution effects to be made, according to population potentially exposed. Measured benefits and costs (time and cash outlays) were traced at different interests - car users; commercial vehicles; bus users; bus operators, parking providers; and local and national government.

This was, in short, an attempt to extend the conventional urban model to embrace some at least of the newer concerns described earlier - environment and individual welfare. Surveys of central area employees were also made to assess land-use effects qualitatively; it was concluded that there would be little effect. "Indeed, a peak restraint system accompanied by improved public transport and emphasis on provision for short-term parking, would tend to strengthen the major retail and commercial interests in the central area. All day restraint, on the other hand, might reduce the attractiveness of the area to customers and clients, particularly the depressed parts of the area difficult to serve by public transport."(1)

It proved impossible to model the physical restraint option, defined as reducing the flow of traffic entering the restrained area. Measured differences in outcomes for the other four methods, all of which involved fiscal penalties, were not great for 1980, but became greater for 1990 as assumed congestion without intervention grew. Table 4 sets out the measured net benefits for the restraint schemes.

Table 4

NET BENEFITS FOR RESTRAINT SCHEMES IN COVENTRY
 £000 per year 1980, 1990

	Parking	Supplementary Licence	Road Pricing	Cordon Pricing
1980	3600	3450	3250	4200
1990	3040	8270	6700	8610

Source: Department of the Environment, Research Report 15, 1977.

1) Department of the Environment, Research Report 15, p. 1.

The principal reason for the relative decline of parking's effectiveness by 1990 was because control of parking was assumed to be confined to the central area, whereas the other schemes could catch the greatly increased trip making by 1990 expected to cross, but not be destined for, the central area. (In essence, therefore, the chief test being applied by the model was of the 'through' traffic problems associated with the different areas over which trip end control could be exercised.)

Unfortunately, the report does not present data essential to appraising the question of the model's predictions of impacts on downtown activity. For one thing, the model focussed on peak hours. But this, heavily weighted by work trips, is only one part of the story. What is needed to judge activity is also customer, client, etc. trips, mostly made off peak. Even more remarkable, we are not even given an account of total trips that were modelled; private vehicle trips are shown to reduce substantially with the several restraint measures,(1) but the effect on all person trips is not disclosed. The terms of transfer of suppressed trips to public transport is not stated; no figure for cross-elasticity as between modes appears, which one would wish to set alongside the assumed -1.0 own-price elasticity for all trips. Some indirect inferences may be made, however. The charges associated with each scheme were assumed to fall on private vehicles only, and they affected only central area-bound trips. Then there was probably a large diversion of car trips to alternative destinations. The very considerable reductions of vehicle flows that were predicted, which yielded the environmental benefits, probably indicates that a large-scale transfer of passengers to (conventional) bus modes was assumed for trips to the centre, as does the considerable gains in bus revenues recorded among the benefits of schemes.

This kind of approach, based heavily on the urban transportation survey technology, is of very limited use in answering some of the important questions about restraint which were identified earlier as relevant for many urban areas. It can deal well with questions involving use of whole networks in a city; thus, as we saw, it is useful for contrasting the efficacy of restraint schemes with respect to control over given trip ends in part of the network, and, because of its good description of flows on network, is strong on working out environmental implications of traffic levels. But for key questions - what is the overall impact on the economy of the town as a whole, on the economic future of the downtown area, and, further, what is the bearing of the treatment of alternative modes on these, it yields no insights, and indeed may well be extremely misleading

1) Table 4, Report 15.

in burying the questions in such global assumptions, unsupported by argument, as an overall price elasticity for trip making.

By contrast, an approach not so constrained by past technique and data availability would go as follows:- We must start from some account of the competition of the town as a whole vis-à-vis others - as we have seen, conurbations and towns vary considerably at any one time in their economic competition. Such a statement is indeed implicit on the starting point of the conventional model - the assumed zonal populations and employment deemed to exist in the future year (in Coventry's case 1980 and 1990). But the rationalisations used, if any, are usually not even deemed worthy of exposure, as was true for the case at hand. So in a sense, many of the interesting effects are already dismissed when the model is set to run on the assumed zonal data. We wish, then, to model the competition of the centre with other locations which may attract economic activity. The terms of competition between the centre and its alternates - e.g. other large shopping and office centres of similar importance must be represented to yield prospective accounts of trips. This has a demand and supply format. Customers are attracted to alternative locations by, amongst other things, time and costs of trips, and so also for inputs to economic activities such as labour. The behaviour of firms in responding to these forces is critical. Choice of mode has to be handled carefully here; for example, the car (and perhaps paratransit forms) is a vehicle which often yields not only quicker times per shopping trip but also allows - as in effect a large shopping basket - choice in the scale of shopping attempted per trip. Office visitors often combine several calls in one day: so the linked trip is of considerable importance for this section of demand.

The natural focus of the analysis is, then, the aggregate person trips made to the centre as reflected in firms' adjustments to alternative opportunities. In the case of the conventional analysis, this tends to be journey-to-work trips, because of the connection to peaks and therefore congestion. But this, for the problem at hand, may well be a secondary consideration, and for two reasons. As we saw earlier, peak and non-peak congestion is tending to converge: and the most fundamental trip number concerns both demand and supply conditions, not, as in the journey-to-work only one of the supply conditions, namely that for labour. Relative accessibility of labour is, of course, of importance in determining profitability of operational alternative locations, and should be regarded in that light; but one must aim to get the activity generating the trips right. Interestingly, when the Coventry study, as an ancillary exercise, fell to considering the likely impact of restraint on land uses, it focussed attention on the effects on businesses' costs, defined as

trips made to or from business premises during work hours. The effects on labour supply in general were not systematically considered.(1)

From the Coventry study, we can piece together what might have been an appropriate starting point from the supplementary studies of uses, trips to premises, etc. Table 5 is the result. The CTS did not lend itself to categorising and summarising trips in a way useful to illuminate impacts on specific activities, hence the supplementary surveys. They were, however, small-scale and thus can be used only to illustrate a more desirable approach. (Comprehensive transportation surveys, wedded to home-based data are, of course, usually weak in accounting for downtown trips, but the more fundamental problem is one of decisions about what categories of trips ought to be distinguished for particular purposes.) Such comprehensive accounting for trips in a CBD is so seldom attempted as to be worth recording.

The focus in this case might well have been the three major activities - shops, offices and hotels, etc., each of which would have doubtless required a different locational framework for considering effective competition. (Coventry's activities, as represented in Table 5, are doubtless quite differently weighted than many other towns.) The supply side, including notably the journey-to-work and the non-person trips such as lorry deliveries (small in this particular case) would be described in a possibly much more constrained locational framework. Close substitutes for the car, such as taxis might well have been featured, because of their importance in downtown travel. Changes in costs associated with differing restraint schemes would have been fed into the accounts of customer behaviour and supplies, enabling a judgment to be made about the levels of future activity.

In short, one's modelling strategy in this case might well have been rooted in firms' adaptation to changing economic conditions, and a chief source of evidence of what is actually done at trip ends and sources in the downtown area. Neither is well served by the standard urban transport model. It is doubtful whether any patching-up or further manipulations of the basic available material would have helped much. To a disconcerting extent, in this type of problem, one has to start anew. It might well naturally be asked what evidence is there that such an approach would yield significant results? Can one expect to detect a transport-oriented effect on downtown activity when the larger economic and social forces, notably

1) At one point the cat peeped out of the bag. At p. 109, in discussing industrial premises in the major inner area, the report notes effects on workers, saying "the effect on industry may vary sharply depending on location. Thus although workers in these areas seem initially susceptible to restraint, factors such as the availability of public transport must be taken into account. It is likely that the usefulness of public transport varies considerably...".

Table 5

ESTIMATED PERSON TRIPS TO CENTRAL AREA LAND USES
Coventry, 1974 - by trip type

Trip Type	Percentage of total trips								
	Total %	Use: Shops	Of-fices	Manu-factur-ing Industry	Ware-hous-ing	Retail ser-vices	Indus-trial ser-vices	Hotel Cafes Enter-tainment	Public-ser-vices
Journey to work	22.7	3.3	2.3	12.5	0	0.2	3.3	0.8	0.1
Customer journeys	72.3	59.1	3.4	0	0.4	1.9	0.6	5.9	1.0
Employ-er's on Firm's business	4.3	0	2.7	0.4	0	0.5	0.1	0	0.5
Visitors to Business	0.7	0.1	0.3	0.2	0	0	0	0.1	0
	100	62.5	8.7	13.1	0.4	2.6	4.0	6.8	1.6

The figures do not add to totals because of rounding.

Sources: Tables 6 & 3, Section 6, Report 14, op.cit. It is assumed that trips to uses would be appropriately aggregated by using employment data, 1972, for the several uses.

No total trip figure is given: the sources do not enable this to be estimated. The study mode report attempted to reconcile the figures in these small samples to trips estimated from the Transportation Survey.

underlying trends towards suburbanisation, are so powerful? After all, one is trying in effect to measure the impacts of a once and for all shift in transport prices in a complex situation. The truthful answer to this is that we do not know, because no one has seriously tried, so far as I am aware. But work currently in hand at the Urban Institute, Washington, is mildly encouraging in this respect. This relates observed changes in the share of activity held by the CBD in relevant metropolitan areas to differences in provision of car parking, its price, and the price of public transit, standardising in each metropolitan area for such factors as numbers of competing first order shopping centres in the area, average distances to the centre, income etc. Still at a very early stage, there are signs that one can distinguish at least some transport related effects - though the problems of settling causation in this kind of cross-sectional plus time series model are formidable.(1)

1) The work is being performed by Dr. U. Ernst and Dr. M. Cheslow. Hopefully, I will be able to report progress at the Round Table.

It seems to be a characteristic of (at least UK) studies of restraint to be optimistic, usually by implication only, about the substitution of public transport for car trips. This reflects the attitude of the policy-makers themselves. When one considers the problem of reconciling the different objectives now at issue, it is easy to see why such optimism is fostered. The earlier policy objective of traffic management in improving travel conditions for all users also serves the later, and added policy objective of support for central area activity, because it encourages trip making in the more severely congested roads. On the other hand, protection of the environment is inversely related to vehicle numbers considered as a direct relationship. Moreover, increases in public transport supplies are favourable to lower income groups, ceteris paribus - which is the usual interpretation of the correct aim in furthering equity. So, if public transport can take up car trips to enable lower vehicle flows to be realised and, better still, be so effective as to lead to an increased number of personal trips in total, all objectives are served: there are lower total vehicles, less environmental damage, more public transport consumption and a more active centre. 'Public transport' is typically identified with conventional bus operation. This is a practical advantage, too, in that organised labour is a strong interest which must be dealt with in any practical policy-making context; policies consistent with maintaining employment in public transport are usually preferred.(1)

Thus the attractiveness of conventional buses is a critically important link in the chain. It is also the weakest. Where formal models to test restraint schemes have been explicit about the cross-elasticities between car and bus they have assumed preposterously high values, as in the study of central area licensing in London, which assumed a value of 3.0.(2) More frequently the required connection is left as an assumption or a pious hope. The UK Policy Paper on the control of Private Non-Residential Parking in 1976, for example, noted that "it is only common sense that discussion of restraint should be focussed on the area of private cars, as long, that is, as there is adequate public transport which motorists could use to get to work".(3)

Yet the overwhelming evidence is for low cross-elasticities and indeed own-price elasticities for buses. Even the response to increased bus service levels generally yields elasticities below 1.0.

- 1) Compare M.E. Beesley and K.M. Gwilliam: Transport Policy in the UK. Journal of Transport Economics and Policy. Vol. XI No. 3 September 1977.
- 2) Methods of Supplementary Licencing: Greater London Council, 1974, p. 31.
- 3) P.2 Transport Policy: A Consultation Document. HMSO, July 1976. A similar sentiment is expressed when considering the impact on "industry and commerce" at p. 8. We can note also the focus on what we have identified as a secondary problem - the journey-to-work.

True, much of the evidence has been created in non-ideal experimental conditions. The sources have principally been time series of public transport prices (for own-price and service elasticities) and choices between cars and public transport as revealed in the household data in transportation studies. The conditions of supply have not typically been controlled satisfactorily. But more careful, recent evidence, based on studies of household trip making when faced with concrete opportunities to make public transport trips at reduced prices has amply confirmed the orders of magnitude of earlier work. Thus, the Dutch experiment in 1975-76, offering reduced fares to families on local and national public transport networks clearly indicates a tendency to make more trips by public transport but little impact on switching from cars to public transport.(1)

Experiment with reduced fares for public transport in cities has proliferated in recent years in all western countries. Experience has been remarkably similar - increase in patronage, substantial decreases in total revenue and little effect on car use.(2) The combination of low own-price elasticity plus rising real costs of supply have, in the UK, at least recently (since 1975) severely discouraged what was in effect an attempt to reconcile the objectives by holding down the prices of public transport in conditions of severe inflation. A growing realisation of the implications of the costs of increasing bus supplies, especially when the increases have a substantial peak element, has contributed to this recent scepticism about direct public transport subsidy. Clearly, if the objectives are to be reconciled, some other tactics must be found.

In these circumstances, it has been natural for policy-makers to consider working on the physical conditions in which public transport and its competitors operate. The work and experiments to be described in the following sections include these, together with what can only be regarded as a hang-over from previous policies - proposals for extending the control of parking off street. Our earlier discussion suggests that it is important to distinguish elements in experiments which bear directly on the issue of downtown versus other locality competition. Obviously, experiments which change the nature of downtown business transactions - e.g. the pedestrianisation of central shopping areas - have a direct effect on encouraging demand irrespective of the public transport changes almost always associated with them. Meanwhile, the connection between change in transport and change in centre is still frequently disregarded, as if it did not need to be argued. A good example occurs in a paper on Gothenburg,

1) Compare: Het Experiment Openbaar Vervoerkaart: Rapport aan de Minister van Verkeer en Waterstaat: Tweede Deel Bijlagen: The Hague, May 1978.

2) Summary of PG/MEB: UMTA work.

where the author presents an exposé of municipal traffic planning's aims. Having set up as a principal objective the maintenance of the city centre's activities, he proceeds to name "improvements of public transport to the central area" and "limitation of private car traffic to the centre" as self-evident means to this end.(1) Actually, in that case, the particular form of the "limitation" adopted, in a town of Gothenburg's size, (450,000) may well, as it happened, have helped the centre's competitive position. There was, it seems, a heavy restriction of commuter parking coupled with an improvement of parking facilities for shoppers and residents of the central urban area. Thus, the problem was in effect tackled in part from the point of view of directly encouraging activity. However, what the net effect in activity was, allowing for Gothenburg's longer-term development trends, and for changes in the supply side via changes in labour accessibility, etc., we are not told.(2)

IV. CONTROL OF PRIVATE NON-RESIDENTIAL PARKING

Because partly of the very success, that we saw earlier, in suppressing parking supply in urban streets over the years, an attempt was made in 1977 in the UK to extend control to off street car parking places in private ownership (P.N.R.). Of these, a large proportion is parking at work-places, amounting in London to over 50 per cent of total places, with even higher amounts in other large towns. Several means were canvassed:- to use existing town planning powers to suppress space directly; to use various means of taxing spaces; or regulation via parking permits, to be issued by a local authority and paid for by parkers. Probably because of the difficulties of presenting a direct volte-face, the first method was dropped in the circular to authorities of August 1977 announcing the new policy.(3) (Planning controls had, up until fairly recently, insisted on providing parking spaces as a condition of permission to build.)

The approach was said potentially to fill a "gap" in the powers to "implement comprehensive traffic management;" subject to appeal, the local authorities could designate the controlled areas which were expected to be in "congested urban centres", and establish exemptions. These exemptions would "minimise the impact of P.N.R. control on

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- 1) Brandberg: Evaluation of the Results of Municipal Traffic Planning in OECD, op.cit. 1976, p. 81 ff.
 - 2) There is an isolated comment that "in 1973-1974, turnover in the CBD rose by 19 per cent, while retail trade in the region rose by 9 per cent. This was partly due to new offices and supermarkets." p. 89, op.cit.
 - 3) Additional Powers for Local Authorities to Control Off Street Parking. Department of Transport. 1977.

industrial and commercial activities on essential community functions". So excluded might be: all vehicles over a certain weight (covering commercial vehicles); disabled persons' vehicles; other "essential operational vehicles"; vehicles owned by workers "whose hours of work require them to arrive or depart at times when public transport is not available"; sites too small to be monitored; private residences; and those serving visitors to hospitals, shops and hotels". For the rest, a number of permits, to be decided by the authority, would be on offer. The charge would be decided by the local authority. The Government believed that these charges could "amply cover their financial costs".

In view of such distributions of total central area trips as in our Table 5, one might well wonder whether there would, after all these exemptions, be anything to control. And the three studies made before the policy pronouncement, while they attested again to the limitations of the urban transportation study data for the purpose at hand, did throw up indications of difficulties. For example, a supporting Nottingham Study detected 70 per cent of PNR spaces at the fringe of the central area, just at the point where boundaries have to be carefully drawn.(1) However, these tended to be larger parking concentrations and thus presumably easier to pull into the net. In Sheffield, about one-third of all cars were parked in small PNR parks of less than 10 places.(2) Many PNR sites would be difficult to detect. Largely because of the availability of substitutes of varying potential legality, the consultants were rather sceptical about the prospects of controlling PNR.

Though the areas selected for study had recent transportation surveys, and were selected because of this, the consultants found it difficult to predict the effects of controlling PNR. It turned out that only one of the three towns selected had surviving data bearing directly on the issue, in the sense of having data on trip makers to PNR spaces. This was in Bristol, a high PNR area (60 per cent of total parking spaces). Here the analysis was based on a special sub-survey of 435 household trips to PNR parking in the central area. Person trips were recorded in the normal way for work, shopping, social recreation, education, and firms' and personal business. The difficulty with using home interview data for tracking use of PNR was disclosed by the dominant "work trip" category. This meant, of course, to denote commuting, firms' business being a separate category. However, average parking duration for white-collar workers was just over 6 hours, indicating a most implausible average working day.(3) This contrasted with blue-collar workers' 8 3/4 hours. As

1) P.N.R. Parking in Central Nottingham. Freeman Fox & Associates. 1976. p. 9.

2) P.N.R. Parking in Sheffield. A.M. Vorhees & Associates. 1976. P.6.

3) Table 34: PNR Parking in Bristol. Jamieson MacKay & Partners. April 1976.

the report remarks, this "may" be due in some part to the use of a car on firms' business. At least a half, and probably more, of users of commuting cars made unrecorded central area trips.

In Nottingham, it was noted that PNR trips to the centre, off peak, carried markedly fewer total passengers than did trips to ordinary parking (occupancy 1.1 as opposed to 1.6). Incomes also rose as occupancy fell, indicating the probability that trips linked to PNR spaces are indeed heavily weighted by users having business in the centre. In these circumstances, exemption from parking control would not be difficult to claim. The prospects for effective enforcement were probably remote, and the effect upon the central area not calculated. Most local authorities rejected the offer of powers. They no doubt felt that they would be more trouble than they were worth. The Government, in the event, collected insufficient support to proceed with legislation. The attempt perhaps marks the turning point in reliance on parking as an instrument of restraint in the UK. There had also been canvassed, immediately before this, a proposition to control private off street parking also, i.e. spaces in residences. This, together with PNR, would have very substantially increased the scope of control. It was deemed too controversial to persist with. As things stand, the proponents of restraint have to look to other instruments.

V. ZONES AND COLLAR CONTROL OF TRAFFIC

An experiment in combining bus priorities and delaying non-bus traffic at peak hours was carried out at Nottingham in 1975-76. This was remarkable for its being the intended culmination of a system in downtown Nottingham (a city of 300,000 people) in which restricted penetration of the centre by cars was allied to improved bus services and pedestrianisation measures. Thus, when the 'zones and collar' experiment was added, the issue of the centre's functioning had already been dealt with (probably in the direction of helping its competitive position). The question was whether public transport could be aided by direct penalties in time as well as improvement in bus times.

The experiment was also remarkable for the unprecedented care with which it was monitored (by the Transport and Road Research Laboratory) and the local authority. A battery of surveys - 17 in all - focussed on the before and after study, including home interviews, journey time surveys by modes, observations of traffic flows at restricted points and bus-only lanes, roadside O & D, park and ride surveys, accident and infringement studies. It is the unusually careful examination of the factors at work which make this a

significant study. In particular, it did not rely, as so many other studies have done, on assumed responses to changed trade-offs between modes, but instead traced them. The scheme itself was adjudged a failure, and the experiment was discontinued after a year. (The scheme cost about £280,000 to mount and resulted in a disbenefit of some £50,000, mostly in the form of time losses to private and commercial traffic.(1)

Private traffic was discouraged by suburban zone exit controls from the two adjacent target areas in the morning peak, so that cars would be delayed in joining the main road traffic. 'Collar' controls were set up on each of the six main radial roads concerned at points where traffic from the two suburbs entered the central area (called the "Inner City"). The internal street management system was also such as to discourage through inner city traffic. Buses were aided by signal proximity at the 'collar' points and at the more important zone exits. Bus commuting was simultaneously encouraged by providing four special peripheral car parks and from these a frequent limited stop coach service was provided into the city.

These measures were intended to constitute the most determined effort yet made in the UK to weight conditions in favour of buses by physical means. Yet before and after replicated household surveys focussed on the affected suburbs revealed virtually no modal shift.(2) The park and ride facility was practically unused, and accounted (at £168,000 for the year) for a large part of the costs of the experiment. There were some shifts of behaviour within modes - for example, the careful monitoring of the experiment was able to reveal some tendency for motorists to start earlier in the morning to avoid the control times. Another change in behaviour was a considerable amount of light signal and bus lane infringements (8 per cent of the total vehicle flow); so motorists sought with some success to compensate for the handicaps imposed. (There was apparently no increase in

1) Nottingham Zones and Collar Study: Overall Assessment. R.A. Vincent and R.E. Layfield. TRRE Report 305, 1977, p. 25.

2) The same households were surveyed in two surveys. For regular journeys to the Inner City area, the full matrix before and after was as follows: (from Table 12, op.cit.).

Method of Travel used in 1975	Method of Travel used in 1976: Regular journeys							Total
	Car Driver	Car Passenger	Motor Moped	Bike	Bus Passenger	Park/Ride	Other	
Car driver	93	1	0		4	1	1	100
Car passenger	-	39	0		10	0	0	50
Motor bike/Moped	1	0	11		0	0	0	12
Bus Passenger	5	1	0		163	2	1	172
Park and Ride	-	-	-		-	-	-	-
Other	0	0	0		2	0	7	9
Total	100	41	11		179	3	9	343

accident rates on the affected roads, however.) There were more important reasons for the failure, which are instructive.

Undoubtedly, the chief reason was that, if anything, the conditions for the trade-off between bus and car actually worsened over the experimental period. A generalised cost computation for one typical one-way journey from the affected zones to the city centre made after the event showed that bus time reductions were more than offset by increases in real bus fares (happening because, unfortunately for the experimenters, 1975-76 was a year in which reversals of Government policy about cash limits on public spending forced all bus companies to reduce fare subsidies). Meanwhile, reductions in the real price of petrol (nominal prices were held steady after the previous oil crisis leap) ensured that car journey time increases were also offset. However, even without these 'accidents', against which there is no certain experimental insurance, it is fairly certain that very little shift would have been observed.

For one thing, the experiment bore on about only 1/3 of the average trip generalised cost; important elements at trip end, like walk, wait, and parking cost were unaffected. This is partly due, in turn, to the typical trip length. This was 6 1/2 km, not in essence giving much scope for manipulating the line haul element - though we should note that this is also on the upper end of the range of urban commuter trips. The obvious inference - that trip end conditions would have to be tackled was drawn. In particular, it was concluded that car parking (virtually free in this case) was a suitable target. No doubt this experiment helped to convince UK policy-makers that a fresh initiative on car parking - resulting in the proposals noted earlier - would be inevitable. But the very careful and comprehensive data gathering exercise also clearly shows other limitations. Bus performance - measured by punctuality and variation in headways - did not change significantly. A substantial one-way improvement in bus times (in evening peak) was not balanced by morning improvements - that is, it seemed difficult to use the techniques to bear on the whole decision to use cars, which must, of course, involve the return journey also. The scope for switching was also revealed to be limited, first by the fact that there was a simultaneous shift in job trips away from the centre, and also by the considerable proportion of car commute trips made with some contribution to cost from employers or other help (45 per cent).(1)

From the point of view of mounting experiments, the moral of this case seems clear - it would have been quite easy to foresee, with some representative journeys by alternative modes, that changing

1) Nottingham Zones and Collar Study - Results of the Before Surveys. R.E. Layfield and M.D. Bardsley, TRRL Supplementary Report 1977 No. 343, p. 20.

the trade-off substantially towards buses would have required substantially more change in relative in-vehicle time than was likely to be accomplished by zones and collars. (If these 'before' calculations were indeed done, they are not reported.) The study was also impressive in unveiling the variation in circumstances in which commuter trips are made. The shifting trip end objectives noted in the follow-up household survey which were quite independent of shifts in transport conditions are inherently unfavourable to bus operations. (These were simply due to changing jobs, household compositions, etc.) So also is the scope for adjusting car driving behaviour, the time of trip, and additional services (to family, to employer and to self) often combined in the car commuter trip. The exhaustive picture which the 12 surveys together give of the actual conditions of choice facing commuters warn very heavily against optimistic predictions of modal split change.

Technically, as an exercise to create free flowing traffic conditions weighted towards buses, the zones and collar did not work well. The reason given is the lack of outer control on radials beyond the suburbs, which overwhelmed the specific measures taken. A contrast is drawn with a previous experiment in Southampton,(1) in which controls on traffic joining a main road, as in Nottingham, were combined with a peripheral control to ration traffic from outside the built-up area. In the Southampton case, journey times in peak were reported as falling by 11 per cent, with most, but not all, the time savings going to bus passengers, with the rest to car users. (This kind of experiment is, of course, analogous to the ramp-monitoring procedures used in urban freeways elsewhere which have also reported improved achieved speeds.) In Southampton, too, though it was an objective of the experiment, no switch to bus by patrons was noted. While, in view of such considerations as were thrown up in the Nottingham study, this is not surprising, we should note the rather different overall impact on traffic generation. No significant change was reported for Nottingham, whereas traffic entering the relevant Southampton corridor, and downtown, increased by some 7 per cent, according to the after study of traffic there.(2) Thus it seems that, again, though an attempt to combine a policy of favouring both the use of the city centre and public transport, as in Nottingham, was not successful, it is possible, by similar rationing measures, to create conditions favouring the centre if there is a simple concentration on increasing effective capacity.

The detailed examination of experience in Nottingham also makes one sceptical of reported favourable experience with reserved bus

1) Reported in "Bus Demonstration Project" Summary Report No. 8
Southampton DoE.

2) Ch. , p. 13, op.cit.

lanes where that is not backed by a careful consideration of the change in conditions facing travellers. Optimism can be falsely generated both by assuming higher cross-elasticities between bus and other modes of travel even in otherwise carefully laid out experiments, and by simplistic interpretation of observed changes. An example of the latter may have occurred in reporting the Paris 'pilot lines' experience.(1) These reserved lanes are credited with helping a 'reversal of trends' on the Paris bus system, in which the "pilot lines have acted as pathfinders enabling all the other lines in the network to develop in their wake". (p.168.) Specifically, the 'pilot lines' bus routes exhibited a higher average rate of growth than did the rest of the city network over the period 1973-1975. Since there was a simultaneous improvement in average service frequency and favourable fare experience, it is not surprising that there should be increases in patronage (a phenomenon shared by, e.g. London Transport in the same period). The real question, of course, is the effect on modal split, and on total trip making. One is left to infer switching from private to public transport; but these are not shown along with the appropriate monitoring. Unless that is done, one is left unclear about either whether the bus lanes benefited traffic as a whole or not, and whether the net effect is to favour or disfavour total economic activity in the city.

VI. FLEXIBLE HOURS

The theme of transport policies running in conjunction with, or against the interest of helping the urban economy, is seen also in the effects of shifting working hours. The notion that were working hours to be modified selectively, so that peaks on public transport and demands on road space are lessened is, of course, an old recipe for congestion, if not often applied in practice. It has usually been noted that a small adjustment in peak demands can have, via lessening congestion at the margin, a greater than proportionate benefit to passengers in public transport and all other modes. The method of achieving the adjustment is, however, important. If changes in working hours are imposed by regulation, the usual proposal, there is a cost, namely, of increasing the constraints facing firms in recruiting labour. This may, or may not, be more than offset by the falls in cost of commuters' travel viewed separately. This is because there is more to labour's willingness to work at the centre than the simple costs of getting to work, for labour is

1) Lafere: Measures in Favour of Surface Public Transport Services, in OECD Evaluation of Traffic Policies for the Improvement of the Urban Environment, Paris 1976, p. 153.

confronted with a package of conditions representing benefits at different locations. These will include the benefits of using the centre in non-working hours, which is usually superior in this respect. These, in turn, may well vary during the working day, and may not always coincide with changed work times. More importantly, an imposed change in working hours obliges adjustment in domestic arrangements, which the worker will view as a cost. But it is quite another matter if, instead of imposed staggered times, labour is offered a free choice of hours worked (perhaps within fairly broad limits). This is an unequivocal potential gain to labour. If it results in spreading hours of work, then the costs of commuting will have fallen in a manner necessarily consistent with the improvement in labour's willingness to work in the centre. Such a change to flexible working hours in Newcastle, monitored for its traffic effects, is worth reporting in this connection.(1)

The office is a complex of some 10,000, mainly clerical, staff, in the Department of Health and Social Security. Car parking was unrestricted on site, and local public transport ran many special and duplicate sources on peak to cater for this very large concentration of workers. Until January 1976, hours were rigidly fixed - 8.15 a.m. to 16.24.p.m. The changeover to flexible hours required employees to be present during a core time of 9.30-15.30, but otherwise they could start and finish before 7.30 and 18.00; they were also allowed freedom to work required total hours in a month when they preferred. This was therefore a very big change in working constraints, allowing considerable freedom to travel when preferred. Such had been the impact of rigidity in the previous situation that departures from car parks had been forbidden in the period 16.15-16.30, to protect pedestrians.

The results, monitored in before and after surveys, were marked. Morning vehicle arrivals in the hours 7.30-8.30 fell from 84 per cent - 71 per cent; departures between 16.00-17.00 from 81 per cent to 60 per cent. The peaks within the peaks were almost eliminated; virtually all site vehicle congestion disappeared. The modal shifts were equally interesting. Car occupancy, which had been exceptionally high because of the high proportion of women and relatively low incomes, declined; the proportion of single occupant cars increased from 50 per cent to 55 per cent. Vehicles parked at the site increased by 6 per cent, some having transferred from nearby streets where they had been left to avoid the banned exit periods. Most important, the peak demand for public transport declined; the Tyne and Wear PTE was able to remove 4 of its 19 special peak services.

1) Some Effects of Flexible Working Hours on Traffic Conditions at a Large Office Complex. Traffic Advisory Unit, DoE, Feb. 1977.

From the point of view of directly promoting the use of public transport, or indeed car pools, the change to flexible hours was perverse. Indirectly, however, it may well have had an effect via the costs incurred by buses. Peak hour operation for buses is known to be performed at very high marginal cost in UK conditions - as in many other Western countries. Because of the change, bus costs for the Tyne & Wear PTE must have been brought closer to bus revenues. A given level of subsidy would then support higher output at other times or places. This kind of change in cost structure and, consequently, in supply conditions, has probably far greater potential impact on achieved service levels than have efforts directly to alter the car-bus trade-off conditions, as in the Nottingham example.

Because, noted earlier, the change to flexible times was voluntarily undertaken, we have a rare example where one can be certain that there was a shift in favour of the office complex's location (it is 5 Km. from the centre of Newcastle, but its scale and the effects are comparable to city centre conditions). The change sparking it off was, of course, exogenous to transport conditions - it was part of a national wage and conditions negotiation. But such gains in freedom of worker choice of hours can confidently be predicted to increase in the future. This is, to judge by the Newcastle results, a trend inherently (if exceptionally) in favour of city centres, and one which may well substantially change the position of the centre vis-à-vis its competitive locations. The principal reason for this is that flexible hours are more valuable where the complements to that flexibility are highest. One can presumably fit in other non-work activities more readily the higher the density of those opportunities; hence the locational attraction and freedom to choose working hours is essential here. These other activities, in turn, benefit from flexible labour supply conditions. It is probably already the case that the most formidable competitors to central area locations - the suburban shopping malls - rely heavily on part-time and occasional labour for their all-week operations. The spread of flexible working hours to all labour contracts would help to modify this competition. (Given a spreading scepticism about public transport supply, more might even be done to permit central area replicas of suburban shopping malls, which must have a large car-servicing capacity to be viable in the centre also.)

Finally, one can even discern potential benefits to the fitting of transport models in changes towards flexible hours. With appropriate survey methods, they would provide useful opportunities to make observations about transport behaviour uncontaminated by the fixed arrival and departure constraints. This would be particularly

helpful in value of time studies, which, though they are strong in many other respects, have virtually always suffered from an uncontrolled variation in such constraints.

VII. INTER-URBAN TRAFFIC CONSTRAINTS

In common with most other countries, the burden of restraint measures in inter-urban traffic in the UK has fallen on lorries. In terms of impacts on lorry costs and activities, most impact has been felt from general country-wide constraints falling on the lorries of different size classes - differential taxation, speed limits on working hours, and absolute weight prohibitions. Curiously enough, very little measurement of these impacts has been attempted recently in the UK, and none worth considering in the context with which we are concerned - of physical restraint to movement. (The reason for this comparative neglect is, however, not far to seek - the UK has now reconciled itself to conforming to EEC rules with greater or lesser expedition and good grace and so it is beside the point to attempt to wring out sympathy for the road haulage industry's costs of adaptation.)

The principal interest has been in the possibility of confining lorries, of weight classes to be determined, to specified routes. The Heavy Commercial Vehicles (Controls and Regulations) Act, 1973, popularly called the 'Dykes Act' after its main sponsor, places on local authorities a requirement to carry out a survey and to prepare local lorry plans to "preserve or improve amenity", and to publish at least one traffic order. At the national level, the Government considered the possibility of nominating what was called in representations to the haulage industry as a 'coherent national network' for medium and long distance lorry traffic in the interests of environmental protection. In 1974 a 3100-mile network was canvassed. Though this particular version was subsequently rejected, the idea of restriction still appeared in the Government's consultative document on Transport Policy of 1976.(1)

The 3100-mile route suggestion prompted a national survey of routes taken by lorries, in which the Department of the Environment set out to cost the effects of restriction and describe the environmental gains, and this remains the substantive work on the problem in the UK. In the event, it proved impossible then to quantify the environmental benefits, a task attempted in the local context later, as we shall see. The survey involved a complex response from operators about actual routes used throughout England. Re-routing to

1) Transport Policy: op.cit. Compare paragraph 8.17, which spoke of "a national system of lorry routes".

national networks of different milages was assumed to follow shortest distances to the nearest main ('A' Class) road and thence to the network. The order and nature of work done by a lorry was assumed unaltered (so that no alterations to commercial relations to minimise costs of diversions were allowed). The results are of interest in two ways: the absolute costs which would be incurred (assumed first to fall in 1983 for the most restricted networks), and the behaviour of costs as the national networks were made more sparse.

Directing lorries over 16 tons gross vehicle weight and over to the 3100-mile network, it was thought, would cost £225m. a year in 1985, a cost calculated on the long run marginal costs of operating vehicles, i.e. allowing for changes in work to be done by that date and changes in vehicle fleets, but not in overheads of operators. Tax paid by operators, principally fuel, was also omitted, to give a form of 'social opportunity cost' measure of the restriction. The social effects measured did not extend, however, to possible external effects such as changes in congestion costs and road expenditure. Considering that these were good inter-urban roads, and the set of vehicles assumed to be affected accounted for only about 5 per cent of the total traffic flow on relevant roads, this was probably realistic. (At the time of the survey, some 120,000 vehicles fall into this category, though there will be considerably more by the 1980s.)

No estimate of what the £225m (at 1974 prices) might mean in terms of raising industrial or other costs was officially expressed, but that it is a quite formidable sum can be shown by dimensioning it in terms of the total fleets likely in 1983, using figures at the time of the survey and the projected increase of like vehicles to 1983. Depending on whether one compares the £225m with the lower end or the upper end of the range of vehicle size within the 16 ton gross weight and over category, one can guess that it might have been about 18 per cent of total relevant costs.(1) This is a formidable potential tax on future transport. Moreover, the assumed environmental benefits in prospect would be bought at quite sharply rising marginal costs to vehicles as networks get smaller. It was estimated that confining vehicles to a 10,000-mile network would cost only £20m at 1983. At that level of restriction, minor diversions would occur and, correspondingly, negligible environmental benefits. A 4300-mile network would imply vehicle costs of £140m and one of 3800, £170m compared to the £225m for the 3100 network. For changes in network rules of 5700, 500 and 700 respectively, and corresponding changes in costs of £120m, £30m, and £55m, the vehicle costs per mile are £21,000, £600,000 and £785,000.

1) Assuming 160,000 vehicles costing £8,000 a year each to run, i.e. 1/3 more than in 1973, to allow for greater mileage run, valued at 1974 prices.

Hence it is not surprising that, when the consultative documents proposal for restriction was announced, it was met with the response from haulage interests that environmental improvement implied road improvements, e.g. by-passes, ring roads, to carry the 'through' traffic they identified as the main problem. A typical verdict was that the national network proposed by the DoE, which consisted of routes already taken by lorries between main towns, needed 'substantial enlargement'; and that the routes should be advisory and not mandatory.(1) A national network has yet to be settled, and it seems unlikely to occur soon.

Meanwhile the local legislation has to be complied with. Action under this is at the individual local authority's initiation, and appropriate research work has been stimulated. The restriction of lorries to given routes involves detailed, if conceptually straightforward, models of routing, a somewhat more difficult translation to impacts on lorry costs and activities, and, more controversial, a measurement of the environmental impacts, necessary to aid judgment on particular schemes. The main UK work in this field has been for one county area by TRRL in conjunction with Hertfordshire County Council. This study, and the supporting work, raise interesting issues.(2)

The comparisons made are essentially cost-effective measures. An index of environmental damage or gain is set alongside costs arising from restricting lorries to different networks, by gross vehicle weight class, so that the impact of controls over different weights of vehicles can be judged. On the environmental side, changes in the conventional measure of traffic noise, L10 dB (A), has been used as a proxy for the class of environmental effects, nominated as noise, fumes, vibration, dust and dirt, severance, visual intrusion and fear of accidents.(3) A lorry nuisance index has also been constructed, based on personal ratings of 'overall nuisance' from goods vehicles, and it was this (which probably correlates highly with the noise measure alone) which was used for the Hertfordshire Study.

A lorry not exceeding 3.5 tons in gross weight (i.e. carrying about 1.5 tons) is assigned a nuisance factor of 1.0. Nuisance is then deemed to be proportional to gross vehicle weight, as seemed appropriate from some earlier investigations of attitudes; the highest factor is 10.9 for vehicles over 28 tons gross vehicle

- 1) Routes for Heavy Lorries: Submission by the Freight Transport Association on the Department of Environment's Consultative Paper.
- 2) An Analysis of the Study by the Hertfordshire County Council for the Heavy Commercial Vehicle Act: A.W. Christie & M. Hull TRRL Report 759, 1977. See also Review of the Results of Lorry Planning Studies, P.J. Corcoran & A.W. Christie, TRRL Supplementary Report 881, 1978.
- 3) p. 9, A.W. Christie and M. Hull, op.cit.

weight. The relevant lorry proportion in vehicle flow, weighted in p.c.u. terms, is then allowed for, which acts to raise the lorry nuisance weights as total flow diminishes (at 1500 p.c.u.'s this factor equals a ton; at 150 it equals 10). These nuisance weights are then applied to links in the affected networks as assessed to their relative numbers of pedestrians or households. Thus the impact of a change in a goods vehicle of given weight is the product of its nuisance weighting and the population exposed, separate for pedestrians and households.

Since the underlying observations are of reported relative nuisance, there is of course implied no absolute evaluation of environmental gain or loss. The cost measurements are also limited to operational cost changes; there is no attempt to aggregate for effects of many routing schemes or to predict the effect of cost changes on lorry output via demand for services. (A fixed O & D matrix is employed in the route modelling.) Hence there is no final evaluation on this side of the account either. (There could be, in principle, because own-price elasticities of demand for lorry output have been computed.) Nevertheless, some fairly strong inferences for policy can be derived.

In the Hertfordshire Study, for example, 4 vehicles weight classes, and 3 types of network - fine, medium and coarse - were tested, corresponding to more or fewer permitted road links for lorries to use. Two rules for getting to final destination or from origin, where these fell in the study area, were tested - Free or Fixed Access. With the former, lorries were deemed to be free to join or leave the designated network at any point of their choosing; with the latter, they were deemed to minimise the time spent off the network. The study thus required detailed knowledge of the origins and destinations of lorries. The basic trade-offs which resulted were as shown in Table 6 (the cost elements are net of tax at 1975 prices, to reflect what are called 'social opportunity costs'. Hence, they were less than the corresponding costs as entered in hauliers' books).

The preferred scheme was chosen by arguing as follows: the Fixed Access rule appears dominated by the Free Access rule (higher costs, lower environmental benefits). The free access options, the 'medium' network, is dominated by the coarse network. Comparing the remaining Fine and Coarse networks, "environmental improvements are considerably greater than with the fine network whilst costs are only marginally higher". Thus, the coarse network (fewer permitted links) but with free access emerges as the recommended solution.

This logic seems impeccable until the last step, when, of course, the remark about "marginally higher" costs is not warranted. Since there is a trade-off in the Table between the last two options,

Table 6

THE ENVIRONMENTAL/COST TRADE-OFF FOR GOODS VEHICLES
Herts Study

Weight of Vehicle G U W tons	Free Access Rule						Fixed Access Rule					
	Fine Network		Medium Network		Coarse Network		Fine Network		Medium Network		Coarse Network	
	Reduc- tion in Nui- sance**	Addi- tional Costs*	Reduc. Nusce.	Add. Costs	R N	A C	R N	A C	R N	A C	R N	A C
24	3	.04	8	.08	8	.05	1	.04	8	.14	10	.14
16	3	.05	13	.14	13	.07	2	.05	15	.25	16	.28
11	5	.08	17	.26	17	.11	2	.08	16	.62	20	.74
7½	6	.09	18	.28	19	.12	2	.09	20	.78	20	.97

* Additional costs - £ m annually.

** Nuisance was the sum of the products of noise overloads and numbers of people exposed to them. A noise overload was "the amount by which peak noise exceeds some level considered to be acceptable" (p. 9). This was 65 dB(A). Traffic speed, composition and road gradients were allowed for. See Appendix, p. 17, op.cit.

Source: Tables 2 & 3, op.cit.

rising costs versus rising environmental benefits, and no values can be assigned to environmental gains, on the evidence one cannot choose between them. We are later told that in any case because of problems in assignments in the base networks one can only regard costs as ranking devices.(1)

Nevertheless, the exercise was clearly valuable in eliminating possibilities. The choice of a final weight limit (with the coarse network) was deemed "subjective". 16 tons was alighted upon, partly because of the sharp increase in costs against a less than proportionate gain in environmental improvement as one moves down to 11 tons, and partly because of practical enforcement problems, including identification by numbers of axles. More generally, the results illustrate the acceptably commonsense conclusion that environmental gains diminish sharply at the margin as more restrictive measures are imposed (the medium to coarse comparison). This necessarily follows from the fact that exposure (numbers of people) varies considerably, but is far more likely to concentrate on or near the large routes which must necessarily carry inter-urban lorries. (No explanation is advanced for the counter-intuitive result that costs are higher for the medium network under free access, however.) The

1) p. 10 op.cit.

coarse (preferred) system was roughly equivalent to a national network based on the primary routes (motorways and major 'A' Class roads).

The system referred to here was of a 'no entry except for access' character. It was thought impractical in this study to test for controlling via no entry controls to apply to all nominated vehicles including locally destined and through, which would have involved calculations about the terms, and effects, of transferring freight to non-controlled, smaller vehicles.

This characteristic enables some comparison to be made with parallel studies in urban areas. One such detailed study, of Swindon (a town of 125,000, 124 km. west of London, also concluded that a weight limit of 16 tons would be preferable.(1) This, it was thought, would cut nuisance (as defined earlier) by 20 per cent and impose a cost of about 4p. per inhabitant a year. Unfortunately, direct comparisons of the two studies are not provided: however, we may note that the 4p. consists of the net result of two opposing costs - those imposed on the heavy goods vehicles and reductions in congestion costs (the latter is roughly 2/3 of the former). Such congestion relief would not be available in the non-urban areas of course; and the costs per inhabitant implied by the Herts Study is of the order of 60p. a year per inhabitant. This suggests that no-access measures are more cost-effective in towns than in inter-urban applications, a point not apparently confuted by considering the results on the 'nuisance' side. (These were computed with a rather different nuisance index, and for lorries over 8.5 tons, instead of 7.5 tons as in Table 6. But the measured relief seems of the same order of magnitude.) The Swindon Study also showed sharply rising costs as smaller areas were considered for control; and come down in favour of whole town control. So, in sum, the UK studies seem to point towards a better pay-off if lorry routing restrictions are confined to towns, conclusions which seem to be followed by current policies.

The conclusion of the work just reported was in favour of free access to the lorry network. This means collection and delivery relatively unrestricted by considerations of size and weight of lorry. It also reflects the relatively mild limits actually placed on such operations in the UK. In London, for example, the 40-foot length limit for access to the centre excludes only the very largest vehicles from collection and delivery operations there such as large oil tankers. Most commercial operations would in any case combine large vehicle trunking to depots with smaller distribution and

1) Swindon Freight Study: Assessment of Possible No-Entry except for Access Controls. M.A. Cundell, C. Deaves, D.R. Edmondson & S.P. McCarthy. TRRL Report 792, 1977.

pick-up vehicles for the work in large towns. A certain scepticism about the consequences for increased costs of more stringent limits is in order however. So far, the Government and local authorities seem to be persuaded that the cost penalties as described by haulage interests should induce caution, which is in itself sensible given the speculative nature of evidence. But the line taken to establish cost changes seems rather narrow, and considerations arising from the arguments of earlier sections suggest that a more comprehensive account may be somewhat more favourable to restraint.

In 1974, for example, the Freight Transport Association published "Planning for Lorries", covering many aspects of lorry control, the conclusions of which might well be said to be extremely close to the measures since adopted, in its general acceptance of "radical changes" in "some areas" to "improve the environment," but arguing that "commissioning of systems must be slowed down" to allow the advantages of reappraisal and experience to be gained.(1) (Local authorities in particular had just been faced with the Dykes Act, referred to earlier, at a very awkward moment when widespread local authority reorganisation was in train.) In discussing the question of a weight limitation for distribution lorries, it noted that "much food distribution" is carried out in 5-ton unladen vehicles, and remarked that "setting a limit on vehicles allowed access to urban areas at 3 tons unladen could double the cost of food distribution". (p.4 op.cit.). Its own general cost comparisons for lorries of different weights suggests, however, a cost measure of the order of 50 per cent, allowing a straightforward replacement, at full costs, of the smaller with the larger vehicle.(2)

This kind of calculation assumed normal working hours in each condition, and that the same amount of goods have to be delivered at the same points - an assumption often emphasised by hauliers to underline the judgment that 'commerce has to go on'. Several points however suggest that, if anything, the 50 per cent may be too high. First, not all lorries engaged in distribution would be subject to the change; many would be unaffected. Second, the substitution necessarily involves lessening the number of drops per vehicle. This is taken into account in the calculation in that the lorry numbers are higher for the lower weight; but having to do less drops

1) Planning for Lorries: An F.T.A. Guide to Lorries and Traffic Management, 1974, p. 19.

2) Compare p. 25, op.cit. We are given costs for box vans at 4.5 and 3.5 tons unladen. Per hour costs seem apt for considering an identical amount of delivery work to be done. The replacement of the latter with the former would cost roughly 29 per cent more, working in terms of relative payload as defined by gross weights minus unladen weights. Extrapolation to 5 and 3 tons unladen raises the difference to about 50 per cent.

per trip does imply more choice about when and how to drop. Third, simultaneous changes in the constraints affecting urban deliveries are in progress - restrictions in hours, waiting and loading bans in particular places. These inherently favour the smaller, flexible capability in response. So the trade-off usually expected to favour the larger vehicle - namely the saving of travelling time to depot versus increased between-drop time - may be substantially modified in practice. It would be rather surprising if it is sufficient in all the circumstances to bridge the gap between a 50 per cent increase and one of 100 per cent.

Some confirmation that a 50 per cent increase should be regarded as an upper limit is to be found in a study of town centre deliveries and collections in Swindon.(1) This was based on a sample of such work in 1973, finding that the imposition of a 3 ton unladen weight limit would reduce the average gross weight of vehicles involved from 12.3 to 6.6 tons - the former roughly corresponding to the starting point of between 4.5 and 5.0 tons unladen. Three variables, corresponding to different but important items of costs were computed, namely the number of vehicles, which set the numbers of drivers required, vehicle mileage, and fuel consumption. These were found to increase by 44 per cent, 63 per cent, and 24 per cent respectively.(2) Interestingly, another study of the same town, designed to test the scale, and cost, of a transshipment centre, so as to limit goods vehicles over 3 tons unladen to delivery there, and to substitute lighter vehicles for the in-town work, found that it would be cheaper for most firms to use the lighter vehicles themselves than to retain their existing fleets and use the transshipment depot, assuming that the depot were operated commercially.(3)

We should also note that, in so far as flexitime, and similar changes, is increasingly affecting working hours, the difficulties facing distribution are eased, because on average, premises are open longer the more flexible hours are worked. Thus flexitime is of more potential importance in its effects on costs than for labour supply; it may help to counteract time restraints on delivery and indeed lessen the need for such constraints in so far as they are based on congestion and therefore peak hours. Finally, one must question, on the broader view of impacts, the implied assumption

1) The Cost of Using Light Vehicles for Town Centre Deliveries and Collections. J.A. Battilana, TRRL Report 710, 1976.

2) Table 10, p. 20, op.cit.

3) Design and Cost of a Transshipment Depot to Serve Swindon Town Centre. J.A. Battilana & J.H. Hawthorne, TRRL Report 741, 1976, p. 1.

A similar conclusion was reached by the Lorries and the Environment Committee's Report on Transshipment, 1976.

that raising delivery costs will not affect the amount of delivery to be done in urban areas. Even if, as we have just argued, these impacts may be exaggerated if viewed in isolation, it still remains the case that weight restrictions raise costs, and these in turn lessen the attractiveness of locations which are the subject of the restrictions. In the long term, the direction of impact must be to reduce activity, and for the specific locations served by deliveries, there is little compensating environmental gains to be enjoyed - rather these will accrue to the locations en route.

VIII. CONCLUDING REMARKS

The arguments of the previous sections together raise important issues of public accountability for measures to restrict vehicle use. We noted in Section I the growing complexity of interests which have to be accounted for; following sections explored some of the increasing variety of policy instruments which are available. These have to be seen in relation to those many specific measures we have not been able to explore here. Moreover, there is a combinational problem with instruments; they can interact more or less fruitfully. As M.R. Wigan has recently pointed out in an exploratory study of the effects of combining truck routings and vehicle charges to enter a town, the two types of constraint, regulatory and fiscal can "play complementary roles in the attainment of economic and environmental goals," and that regulations alone are "not necessarily very effective in environmental terms, and cost society real resources."(1)

We have also argued for a closer specification of the economic forces at work in producing more satisfactory predictions of effects, and have suggested that to adapt the traditional transport modelling techniques has severe limitations, calling for substantially new approaches. The shortcomings, at least, are also recognised by Wigan, when he notes that "no current operational model can respond adequately to both congestion and to operational restriction to lorry movement regulation.(2)

1) The Complementary Roles of Regulatory and Fiscal Methods of Traffic Restraint. Transport Research, Vol. 12, p. 63, 1978. The study was of Coventry, and developed the same data base as for the studies noted in Section II. The environmental measures were for noise, the L 10 measure, taking account of populations affected and air pollution.

2) Op.cit. p. 56. He shows how the traditional models might be developed to become capable of handling lorry flows and environmental effects more adequately. But, as he also says, "the severe technical demand of these kinds of high precision assignment and demand responsive models should be recognised." (p.59). I would argue that "demand response" is the key point. When applied to both goods and person movement one needs to review effects in the alternative framework suggested above.

Analytical progress will doubtless enable the relation between interests, instruments, and effects to be more clearly perceived.

It will not, however, reduce the inherent conflicts to which specific proposals to restrain vehicles movement gives rise. There will still be the generic difficulty facing all proposals for changing the practice of users seen in the normal cost benefit analysis of road improvements, namely that the benefits are diffuse (accruing to a wide variety of users typically in small amounts) and the environmental costs are concentrated (falling typically before local inhabitants in their roles as householders and pedestrians). The same propositions, in reverse, are generally there for restrictions of users. The costs are diffuse, and the benefits concentrated. Some means is required to decide who gains and who loses, and this becomes more difficult, not less, as the interests to consider increase and the power to disseminate in effect becomes more available.

Many questions about how the decision processes affecting constraints might be changed could be raised here; it is practicable in this paper's scope only to consider one important attribute which these decision-making processes share in Western countries, namely the judgment that they should become more publicly accountable. We are concerned with the analysts possible contribution. The issues, so far as the UK is concerned, have been very recently the subject of a committee of enquiry into the appraisal of trunk road schemes - the Leitch Committee.(1) This concentrated on inter-urban roads, and, though its focus was on investments in road capacity, it of course dealt in effect with exactly the same problems as are implied in restriction schemes.

The Committee's main proposal was that the cost benefit analysis now made should be extended to become a "comprehensive framework". It felt that while present CBA appraisals which stress economic costs and benefits "are sound as far as they go," there should be a "shift of emphasis" towards factors not susceptible to valuation in money terms, and to rely simply on an additional checklist to comprehend environmental factors was inadequate.(2)

They proposed a form of N. Lichfield's planning balance sheet, which distinguishes interests impacted by proposed changes, to "embrace all factors" involved in scheme assessment. They also felt it important that such an approach should be employed as far as possible throughout the stages comprising the decision process - from the initial formulation of a scheme to its final adaptation. So they were led in a practical example of the application of the assessment framework to distinguish five major groups of interests

1) Report of the Advisory Committee on Trunk Road Assessment, HMSO 1977.

2) p. 95 op.cit.

directly affected by the outcomes of decisions and over seventy dimensions in which those interested parties might discern benefits and costs, some of which were of course common to more than one interest. Benefits and costs for options were represented in the four basic forms - money values, non-monetary cardinal measures, assessed rankings, and verbal descriptions of effects. (The sought for connection of the imbalance between monetary and other measures were to be achieved, it seems, by the determination to be comprehensive and the inclusion of all four forms in one format or statement.)

Thus the role of the analyst is seen as discovery and setting out of the findings about more detailed accounts of the effects upon interests. The hope seems to be that, with this extra knowledge, and demonstrated consistency in its application to problems of choice, that more satisfaction with the existing decision-making process will be secured. One has great reservations about this. Cost benefit analysis and its developments has historically been, and is now, a process essentially engaged in the discovery of potential conflicts. Every extension, fed by analytical enquiry, discerns new potential interests. As argued earlier, policy making is becoming more sensitive to these too. As a tool to help decision-making, cost benefit analysis is just as likely to demonstrate new, rather than point towards ways of reconciling existing, conflicts. Thus I would argue that analytical developments in this area must be recognised as part of the means to discover and legitimise interests in proposed changes - i.e. to help show their reality, bearing and extent.

Demonstrating the legitimacy of an interest's claim to suffer losses - or that benefits will ensue - however necessary - is not sufficient to resolve conflict. The latter will be achieved in many ways, of course, and - in UK conditions at least - may call for new ways of compensating the losers more effectively. It is unlikely, therefore, that analytical developments alone, and their deployment in existing processes, will do much to convince those affected that these will become more just. Probably, the settling of the relative claims of losers and gainers will oblige the development of further mechanisms. A possibility appropriate to the UK is the institution of neutral juries to weight the issues, rather than the present administrative treatment.⁽¹⁾ However, the message for analysts in this seems very widely applicable - if analysis is to be used to illuminate, and help towards the resolution of difficult choices, it must become a great deal more accessible to reasoned, but non-expert, discussion than it has been. And this must be done in spite of the

1) Peter Kettle and I have recently argued the case for this in an unpublished paper on the Leitch Committee's recommendations.

growing complexities. So the bias must be towards building analytical links to more general and widely understood economic forces at work in shaping the positions of the interests, rather than the accumulation of methods and procedures even more specialised to specific transport interests. Hence, the reformulations suggested earlier may turn out to be directly useful in helping to resolve the practical problems of improving the ways in which restrictions are decided upon.

SUMMARY OF THE DISCUSSION

I. GENERAL APPROACH

1. The significance of restraints

The Round Table first emphasized that any traffic restraint is instrumental and so must be judged by reference to an objective. In no case can it be an end in itself.

Two approaches were thus conceivable when the discussion began: either an overall approach or a more selective one. In this latter connection, there could be some doubts as to the economic efficiency of unduly isolated measures.

Restraints must fit in with a personal mobility policy. It follows that better co-ordination is needed both between modes and with respect to considerations of space and time. On this point, the concept of public and private transport as being opposed to each other should be replaced by that of co-operation between them.

It is essential to go beyond the more or less "conservative" aspects of specific restraints and to set an objective for the human environment generally and for urban centres in particular. Seen in this light, restraints fit into a general planning framework aiming to improve the quality of life and give fresh consideration to city centre activities.

Any suggestion of restraint inevitably raises the question of alternatives, hence the importance of ascertaining how this can be provided by public transport.

Depending on the objective ("revigoration" of city centres, environmental protection, traffic management), restraints can differ distinctly; that is why the objective must be plainly defined and arrived at by negotiation. Education of public opinion is relevant in this respect.

Many disputes are due to lack of information; in some cases, this even goes so far as deliberate distortion which makes it even more necessary for the public to be properly and fully informed. In some countries, projects are at present being held up for long periods because of institutional procedures for objections and this leads to inconsistencies besides substantial waste of resources.

Questions concerning quality of life can be tackled from two different angles depending on whether they are seen as a matter of personal choice or the choice of a particular "type of society". Depending on the response to such questions the corresponding measures can differ accordingly.

The Round Table also considered that restraints in urban areas seemed to have reached their limits; in consequence, they could no longer be anything more than complementary in such cases.

2. Complementarity of the methods adopted

The point here is to judge measures by reference to their over-all effects and not only those they are intended to bring about. For instance, the impacts on the economics of the activities involved must be evaluated. It seems that there is not sufficient knowledge on this point, but some countries have undertaken "strategic" traffic studies, notably in order to investigate the relationship between availability of a vehicle and distribution of activities.

A basic distinction in this connection is that between "urban" and "inter-city" traffic; most observations so far have been focussed on the "urban" side. The Round Table was accordingly inclined to give closer attention to the "inter-city" aspects of the problems in question.

3. Fields for further research

3.1 Range of alternatives and scope for action

Leaving aside the conventional framework of transport planning in the strict sense, the Round Table considered it proper to ascertain the views of interested groups so as to be better able to judge the feasibility of proposed alternatives. This draws attention to two particularly important points:

- research does not throw enough light on the "growth and "dynamic" factors of the urban environment; this means that there is a gap in the identification of decisive factors;
- the too frequent absence of continuous monitoring leaves some uncertainty as to the impact of restraints.

Transport is not sufficiently studied with an eye to its effects on urban activity, nor is enough attention given to "alternative mobility". Scope for the latter lies partly in the quality of public transport and partly in the location of urban activities. In many cases, people have to travel by car because no public transport is available. This scheme of things ultimately affects other sectors of urban activity.

Restraints very soon reach threshold limits beyond which it is better to seek a consensus for improvements to what is judged to be an unsatisfactory situation.

Experience also shows that physical restraints are often more effective than pricing, this being an instrument of limited scope because of political intervention.

It is accordingly advisable to begin by working out a system of evaluation and to back this up with the political will to provide alternative facilities.

The matter at issue cannot be rightly appraised unless it is seen in a consistent overall context; here there is a continuing problem of negotiation between the many interests at stake. In this connection, it was pointed out that there could be a conflict between the desire to undertake local experiments and the inclination to make forecasts.

3.2 A long enough timespan for observation of behavioural changes

This important aspect was already mentioned at several previous Round Tables which dealt with similar topics involving changing habits.

The effects of a change cannot be judged over too short a time: a fairly long "running-in" period of psychological readjustment (six months to two years) is needed for the change to really take root. This situation is sometimes at variance with the eagerness of political or administrative bodies for quick results, so it is advisable to inform them beforehand as to how long it should take for the people concerned to have digested the advantages and disadvantages of a new scheme of things.

This point was found to be of relatively greater importance in smaller towns as in their case habits were more firmly entrenched and it was easier to give vent to protest. Apart from some length of time for assimilation, it may also be useful to allow for a "cooling off" period.

3.3 Financial aspects

The introduction of restraints may run into institutional problems, more especially cost constraints, in which case preference is given to the least expensive measures, but the disparity between aims and means may bring about unforeseen undesirable effects; it often disrupts the pattern of what is basically an overall picture.

3.4 Inter-disciplinary co-operation

The inadequacy of certain specific restraints (which simply shift the problem elsewhere) are often due to a unilateral approach, hence the need for a general approach embracing experts in various fields who will be involved in the project at one or more stages (notably engineers, economists, sociologists, planners, and so on).

Similarly, there must be sufficiently close contacts from the outset between the authorities responsible for designing projects and those who will put those projects into effect (administrative and police authorities).

3.5 Evaluation methods

Problems concerning the evaluation of restraints are often due to things being seen out of focus, but this difficulty can to some extent be overcome by a multi-disciplinary approach (see point 3.4 above).

But it is also necessary to take a realistic outlook, that is to judge each case on its merits. Problems of re-location are indeed often little familiar and often prove to be less substantial than one is inclined to think at first sight. The same applies to the greater or lesser degree of accessibility of a downtown activity; in some cases, closer investigation may show that the very heavy cost of this activity is little related to its accessibility, but in other cases the converse may be true. Generally speaking, however, it is found that these activities are inclined to overestimate the effects of restraints.

Evaluation should be fitted into the general context of quality of life and suitable research should throw up more light on such aspects.

3.6 Effects relating to ENERGY

As restraints were mainly intended to deal with certain problems of traffic flow, their impact on energy consumption has been relatively slight. Had they been planned with an eye to energy considerations, they would have been of different kind. This again is an aspect deserving closer enquiry during the coming years.

3.7 Effects on the motor industry

In this field too, important effects seem unlikely to appear. As a general rule, restraints are dictated by acute congestion also affecting public transport. Future restraints will mostly affect the smaller centres.

As to any sharp expansion of public transport, this does not seem a very realistic prospect within the foreseeable future as the

operating costs increase sharply as compared with private transport which, by definition, means that drivers are unpaid.

The standard of living also plays a by no means insignificant role as regards the prospect of certain substitutions (i.e. use of the car for other purposes) without this involving an appreciable reduction in private car mileage.

Restraints on long-distance traffic may be required to put right certain ill-effects on the economy and on road safety, notably with regard to abusive practices connected with holiday traffic flows. In this particular case, however, the main object will be a multi-modal readjustment of the balance rather than a straightforward transfer from mode to mode.

II. PRACTICABLE INSTRUMENTS OF RESTRAINT

A. Inter-urban traffics

1. Specified routes for lorries

The assignment of special routes for lorries has been fairly extensively experimented, notably in the United Kingdom, but the results are not conclusive. It has indeed been found that lorries do not usually make up the main bulk of the traffics involved and that the timing of lorry traffic is fairly evenly spread. Furthermore, in the course of seasonable peaks, lorry traffic is rather inclined to fall. This means that effective "load-shedding" by means of special lorry routes could be fully effective only at critical periods during the week (usually on Friday evenings) when various passenger and goods traffics coincide.

This being so, it is a better economic proposition to provide for trunk routes equipped to cope with high-density traffic flows comprising different types of vehicles.

2. Combined transport applications

In the event, transfer facilities should also be improved.

Large-scale introduction of "mixed" goods traffics may lead to new transport and environmental problems, especially in the vicinity of terminals. Here there would be a concentration of traffic in place of the previous, more widely scattered pattern. However, such problems would arise only in the case of very wide-scale applications, and even so, careful planning can provide for the location of terminals on urban ring roads so that the traffic load generated by the terminal may be suitably spread.

3. Special regulations

This heading covers speed limits. These were exhaustively dealt with by Round Table 37.

B. Urban traffic

1. Parking control

The Round Table considered that public parking control has been carried about as far as it could go.

Private parking often raises bigger problems because of the wider disparities in vehicle turnover. Control in this case is accordingly very difficult unless one is prepared to take fairly drastic measures.

Where private parking facilities already exist, indirect inducements to convert them to other purposes can be envisaged. But it would be advisable in the first place to maintain a balance between parking capacity and traffic output capacity of the area concerned; this should be borne in mind for any future policy and it is unfortunate that an elementary consideration such as this was lost sight of when permission was given for the construction of certain carparks.

What is more, regulations systematically requiring the provision of parking space for building permission were rather unwise in that they misguidedly confused carparks and garages: the former are intended for cars coming from elsewhere and so can increase road congestion by attracting additional traffic, whilst the latter are essentially intended for local residents and so help to clear the roads of "limpet" cars. It would accordingly be advisable to impose suitably balanced requirements for parking space and make "garage" parking compulsory in saturated urban areas.

In this connection, it must be pointed out that any future conversion of carparks for other purposes runs into financial problems.

2. Better allocation of road space

The more successful improvements include the regulation of output of access roads by suitably adjusted traffic lights at inter-sections.

The most important changes needed are in medium-sized towns where they are especially important for organisational reasons. In ancient towns, the protection of historic sites and the influx of visitors raise special problems.

In the case of the more elaborate experiments (such as Besançon and Gröninguen) there is no restriction of access, the aim being rather to rationalise traffic flows in order to make the town centre

more attractive. Thus, "through" traffic in the town centre has been banned and questions of accessibility sometimes arise in pedestrian precincts where the lengthening of journeys on foot is clearly apparent.

The same applies to the more far-reaching exercise at Göteborg which is above all an "amenity" exercise in the town centre. This has led to easier flow of public transport vehicles, the re-organisation of the bus transport network and the improvement of certain commuter services on transversal lines. Again in Sweden, consideration is at present being given to licensing requirements for vehicles entering certain areas that are saturated or worthy of special protection.

Generally speaking, it was found that the pricing of public transport was of far less consequence than its quality (speed and regularity) and that certain measures had considerably stimulated wider car-pooling. This latter device must above all be regarded as a useful procedure for rationalisation of urban land-use.

If the outcome of some experiments has been somewhat unsatisfactory, these relative failures are especially attributable to

- unduly narrow aims; for instance, the imposition of straight-forward restraints instead of bearing in mind the quality of life;
- unduly piecemeal applications leading to disrupted patterns;
- failure of park-and-ride facilities planned for unduly short distances; this is a fairly common error which may lead to misjudgements in the provision of public transport services;
- "political" interference in what should be treated as a technical issue.

III. ALTERNATIVE AND COMPLEMENTARY ARRANGEMENTS

1. Time management and staggering of timetables

On this point, a clear distinction must be made between three concepts which may overlap to some extent but which differ in kind and in their effects.

First, let us take flexible hours; this means that within specified margins, there is scope for free individual choice as to when to begin and finish work provided that a specified number of hours' work is accomplished within a given period. This device gives more individual freedom, spreads traffic peaks to some extent but does not raise the productivity of plant and machinery.

The second is that of planned staggering of working hours: it gives less freedom of choice of working hours, or none at all, and its aim is to spread traffic peaks over a longer time by staggering

the beginning and end of working hours. This arrangement is also applicable over weekly timespans (i.e. staggering of weekends) and yearly timespans (staggering of annual holidays).

Thirdly, "time management" aims to reduce the number of people working at the same time; besides the staggering of trips, it thus yields better productivity of "working" facilities, by staggering the use of space, buildings and equipment over a longer period.

The Round Table mostly considered the first two arrangements mentioned above and their practical impact on traffic.

They can be an inducement to more intensive use of cars by lightening traffic peaks and they can also encourage car pooling. But if these arrangements are well co-ordinated with other measures they can make for well-balanced timing of both public and private transport.

On the other hand, effective use of a "free margin" depends on whether it can really serve a practical purpose; for instance, re-allocation of certain stretches of "free time" is of little use if shops are not open at those times.

While the staggering of working hours can help to give more life to a town centre, other practices may work against this: for instance, reduced home delivery or post office services increase individual traffic since customers then have to go to the post office or shops concerned. In the long run, this absence of services makes living in the town centre less attractive.

Measures with regard to the timing of journeys should accordingly be part of a coherent whole for this has a far more decisive effect than any isolated step. Only in this way can staggered or flexible hours help to reduce road congestion, re-vigorate town centres and reduce public transport costs by raising the speeds of public transport vehicles and spreading their occupancy more evenly.

It should be noted that the ECMT entirely devoted Round Table 29 to matters concerning the spreading of traffic peaks.

2. Re-location of urban activities

Suitable transport planning in urban areas is becoming an increasingly difficult task. Though the crucial problem usually lies in city centres and consequently on a few radials, it has to be admitted that the thinking on the outlook for town centres is not altogether clear. The kinds of activity it is intended to retain and develop there are barely apparent. It is accordingly difficult to recommend restraints or ways of rationalising access without too much risk of error unless these recommendations are differentiated to match the objectives selected as priorities.

In very large cities, far-reaching changes are unlikely because the alternatives (i.e. shifting of activities) are on too big a scale

and too expensive. In medium-sized towns, on the other hand, variants can be introduced fairly simply.

Several countries are now practising a policy which aims to diversify activities in urban centres and this includes the preservation or re-development of housing accommodation. Regulation is preferred to restraints in order to facilitate access to these centres and make the activities that are located there more competitive.

In the Netherlands, "woonerven" (specially protected residential areas) are a particular form of urban development where the aim is to limit the disamenities due to motor traffic by giving it least precedence. Successful achievements here are mostly attributable to good planning. The time factor also plays a far from insignificant role since car drivers must get used to complying with new rules and even conforming to a different scale of values.

The re-allocation of land-use is a very complex problem and the Round Table more particularly dealt with the planning aspects:

- transfer of certain specific activities to "sub-centres"
- limitation of urban growth and investigation of suitable ways of achieving this
- deconcentration of certain types of jobs
- provision of adequate parking facilities for pedestrian precincts
- re-peopling of city centres
- more attractive public transport services (see below)
- priority for location of activities in smaller towns
- accurate calculation of hyper-concentration costs.

Another particular point concerned the widespread development of detached houses in peripheral areas as this may involve heavy social costs if badly planned. From a transport angle, this tendency generates much additional traffic and often also hampers the smooth working of public transport services.

A suitable land prices policy, taking disamenities into account, could give useful guidance in this respect; this would also encourage better urban land-use planning (e.g. airports and terminals) and provide a more direct safeguard against disamenities.

3. More attractive public transport services

Logically, the supply of a good public transport service should come before the imposition of restraints. In this connection, special problems often arise with regard to links between various peripheral districts which have developed rapidly whilst public transport services have not always kept pace. What is more, as these links are scattered over a wide area, they are a relatively less attractive proposition for public transport.

Insofar as conventional public transport "line" services work less efficiently, the aim must be to develop preferably some forms of para-transit. The importance of the latter is already made plainly apparent by the changes in urban structures. Furthermore, since the trend of public transport costs largely depends on the trend of wage costs and as these are plainly still rising, there is good reason to encourage more particularly the type of para-transit which operates without wage-earning labour, namely, car-pooling.

In this same connection, it must be pointed out that every form of para-transit does not help to reduce the necessary labour costs and that, apart from this, public transport services could also achieve certain savings in this respect, for instance by recruiting part-time staff.

Some participants considered that para-transit should fall within the realm of free enterprise subject to some degree of control to ensure that overall requirements are suitably catered for.

In this way, it would be possible to give conventional transport networks a more consistent pattern since they would be provided only on main traffic corridors; other services would be provided by para-transit. Such an arrangement, which undoubtedly has the advantage of dispensing with expensive, widely scattered services, nonetheless raises problems for people living in the area concerned: transport service thresholds will have to be determined and people living in the area concerned would have to be informed accordingly; before settling at a particular place they would thus be told that a regular "line" transport service would be provided only when a certain density had been attained. While this procedure inevitably calls for a period of transition, it seems unlikely that public transport could be continued indefinitely on a basis which involves catering invariably for the slightest need.

As for park-and-ride, it was found that this facility was used only where journey length was sufficiently long and where motorists could conveniently transfer to a rapid transit mass transport system (i.e. in practice, train or metro). Another consideration is that this latter leg of the journey saves the inconvenience of driving in town traffic. A side effect of park-and-ride is that it reduces bus traffic on feeder lines to the railway stations concerned.

Other points to which the Round Table wished to draw attention include:

- better information
- urban roads reserved for public transport services
- right of way in "conflictual" situations (e.g. intersections, road congestion)

- quality of service
- equipment of passenger interchanges for quicker transfers
- siting of stops
- flexible arrangements for bus services.

4. Improvements to freight transport by rail

The Round Table could only touch upon this wide subject incidentally and only insofar as it was relevant to draw attention to the complementarity of the measures discussed.

The specific advantages of particular modes of transport are not always apparent from an economic angle. A case in point is the shortcomings of the railways as regards fairly large-scale transport, even more so on very densely trafficked routes. This state of affairs is notably due to the slow and unproductive conventional system of operation which consists in re-forming trainsets in marshalling yards.

In the case of combined transport, the need for permanently coupled block trains precludes too many terminals since these must be carefully located by reference to road networks.

Road/rail transport will be dealt with by a Round Table at some future date.

5. Technical progress in the Motor Industry

The latest advances in this field put a lesser strain on road infrastructures; indirectly, the substantial reduction of empty runs in recent years also has a similar effect.

The present-day inclination is to reduce energy consumption.

As regards noise abatement, this is a long-term process which includes the specification of standards by Government (and also, indirectly, of standards for weights and dimensions of vehicles). It can, however, reasonably be admitted that, despite the disamenities, lorries often are essential to the continuance of economic activity in town centres and that the repercussions of any restraints in this direction must be carefully measured beforehand.

CONCLUSIONS

By extending the scope of its topic far beyond restraints as such, the Round Table has more particularly tried to show the complementarity of the various measures capables of improving the quality of life and the flow of traffic.

Success in this direction implies provision for a series of measures within which restraints are only a part. What is more, the contents of this mix of measures will depend on the aim pursued in each particular case. In no circumstances can restraint be an aim in itself, it is only an instrument among others.

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