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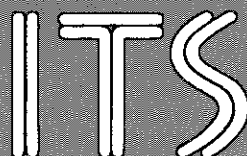
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Published paper

Patterson, N.S. and May, A.D. (1979) *The Impact of Transport Problems on Inner City Firms: A Review*. Institute of Transport Studies, University of Leeds, Working Paper 112



INSTITUTE FOR TRANSPORT STUDIES
THE UNIVERSITY OF LEEDS

Working Paper 112

April 1979

**THE IMPACT OF TRANSPORT PROBLEMS
ON INNER CITY FIRMS :**

A REVIEW

by

N. S. Patterson and A. D. May

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This work was sponsored by the Department of Transport.

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ABSTRACT

PATTERSON, N.S. and A.D. MAY (1979). The impact of transport problems on inner city firms: a review. Leeds: University of Leeds, Inst. Transp. Stud., WP. 112 (unpublished)

Previous studies of inner city manufacturing and service firms and studies of industrial relocation are examined to determine the problems of operating in inner areas, the factors causing firms to relocate, and the criteria which determine the choice of new site. These are related to the issues of retaining existing inner area firms and attracting new ones.

Much of the previous work is limited in scope, largely qualitative, and frequently at a level of aggregation which makes identification of particular problems or factors difficult.

Existing inner city firms perceive the transport problems of their own operations and of their employees as a major disadvantage of their present location, but there is a lack of quantified information on the extent and relative importance of these problems, and whether they are more severe for inner city firms. Transport issues in themselves are not one of the prime reasons causing firms to relocate, although the influence on availability of suitable labour is more significant. At a regional level transport is not one of the most important criteria in the choice of location, but as a determinant of site at the local level it is mentioned frequently enough to warrant further study. A number of other factors involved in these decisions are to a greater or lesser extent related to transport.

To place firms' transport operations in a wider context transport costs, industrial traffic generation, and the effect of some forms of control are discussed.

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THE IMPACT OF TRANSPORT PROBLEMS ON INNER CITY FIRMS: A REVIEW

1. INTRODUCTION

Following the White Paper "Policy for the Inner Cities" (59) the Department of the Environment, in order to improve the state of knowledge of the inner cities, commenced the Inner Areas Research Programme and called for the submission of suitable research projects. This project is a result of that initiative, although because of its nature it was seen as falling more appropriately within the responsibility of the Department of Transport.

The objectives of the study are to identify:

- the extent to which transport problems affect the operation of inner city firms,
- whether these problems are more severe in the inner city than elsewhere,
- transport measures which could ease these problems,

and to fulfill these objectives it is proposed to analyse in some detail a limited sample of manufacturing and service firms in the inner areas of London and Leeds, together with a control group of firms located outside the inner area of Leeds.

In order to give an overall framework for the study it is necessary to review previous work related specifically to inner city firms, and to the general question of the location of firms so as to assess the relative importance of transport, identify particular transport problems, and provide guidance and background data in the development of the detailed methodology.

Chapter 2 contains background material on inner areas and briefly discusses the response of government to the range of problems facing these areas. There is no attempt to give a complete picture of even the economic situation of inner areas, and in some respects the state of knowledge in this subject is in its formative stages. A number of projects within the Inner Areas Research Programme are designed to redress this situation. The chapter is merely intended to serve as a background against which the issues of location and transport factors can be reviewed.

Chapter 3 raises the general issue of location by examining previous studies. The factors causing firms to relocate and the criteria for choice of relocation site are considered. Within the former the advantages

and disadvantages of an inner city location are analysed, together with the firms' reasons for relocation. An assessment is made of the relative importance of transport. This sets the context within which the project must proceed and a number of conclusions are drawn.

Subsequent chapters are concerned with specific aspects of transport and the firm, and refer to particular aspects of the project. Much of the material reviewed is therefore to provide background data for subsequent stages of the project and hence no firm conclusions are drawn. Reference will be made to this data in subsequent working papers and technical notes related to the project.

The development of a framework for the project, guided by the material reviewed and the experience of previous studies, together with the detailed methodology suggested by the range of problems identified in the review will be the subject of a separate technical note.

2. THE INNER CITY CONTEXT

2.1 The decline of the inner city

There is general agreement that the inner city areas suffer from a wide range of problems, the severity of which is frequently greater than in other parts of the urban area. Although none of these problems is necessarily peculiar to the inner city, collectively they have resulted in a steady decline of the economic, social and physical well-being of inner areas over recent decades. To the extent that they consistently appear in analyses of inner areas they can be said to be characteristic.

The various elements of this set of problems are both complex and closely interrelated. The present discussion is primarily concerned with the fundamental question of the economic well-being of the inner areas, as represented by industry and its workforce, while recognizing that initiatives taken within this sector will have wide-ranging implications.

There are two basic and overriding trends which typify most inner areas:

- a decline in resident population, and
- a concurrent decline in employment opportunities

which have caused particular problems because they have occurred selectively and tended to aggravate each other (51).

Population movements (partly due to redevelopment and partly voluntary) have left the inner areas with a relative concentration of low income, less skilled and immobile groups, frequently unable to move because, being trapped by the housing system, they have no alternative (39). Owner occupiers, and the well paid and skilled have moved out, pulled by the attractions of a suburban life style. The result is some degree of social polarization. For example in Lambeth in the 10 year period 1961-71 the proportion of skilled manual workers in the resident workforce fell by 12½%, compared with a drop of only 6% for Greater London and no change at the national level. Male incomes were 17½% less than the national average, the most likely cause being the structure of employment, with a relatively large proportion of manual jobs in the low pay service industries rather than in better paid manufacturing jobs. Employed women were relatively better off as regards the labour market and income (39). There are isolated instances of "gentrification" of parts of inner areas by professional and managerial groups but this has not been at all widespread.

The problems caused by population changes have been exacerbated by the decline in employment opportunities, particularly in the traditional industries which have been typical of the inner areas of all the large conurbations. The traditional locational advantages of the inner areas, close to transport routes, markets, suppliers, and the labour market are now less important partly because of changes in the transport network, the relative decline of rail and water as modes of communication and goods transport, and production processes and product demand. The viability of inner area firms has been affected by these developments and the multiplier effects of previous closures (27) and many of those remaining are relatively older, often with products in the advanced stage of their life cycle (69). This has resulted in a certain degree of economic polarization with the more modern, expanding firms being those likely to decentralize (51).

The loss of employment opportunities has been threefold:

- relocation, as firms move out of the area,
- a nett excess of closures over openings,
- contraction within remaining firms.

Coupled with this has been a shift in the type of labour employed, with an increasing emphasis on the more skilled jobs associated with capital intensive operations. The manufacturing sector has suffered a disproportionate decline compared with national changes, and within this sector the single most important component of employment loss has usually been closures. For example between 1966 and 1974 manufacturing employment in Greater London fell by 34.2% compared with 5% for England and Wales. This decline was due to:

relocation outside Greater London	27%
excess of closures over openings (for firms employing more than 20 people)	44%
estimated decline in firms employing under 20 people	7%
contraction within remaining firms	21%

For the same period, manufacturing as a share of total employment fell from 32.6% to 23.6% in Greater London while the corresponding figures for England and Wales were 36.5% and 32.7% (71).

An unpublished review by TRRL (8) concluded that of the studies considered, relocation accounted for about 25% of the change in employment and excess closures for 75%, although contraction was not always recorded and where it

was it could be an important component in particular locations. The relative importance of these components does depend on the study location and the time at which the study was carried out, but no consistent trend is evident. A study in Lambeth attributed more than half of the employment change 1970-1975 to relocation (44), and suggests that small sub-areas may have a different mix of industry or be a particularly difficult area in which to operate, leading to a higher proportion of firms moving.

In terms of employment opportunities in the inner areas, these changes have been severe. As well as the absolute loss in the number of jobs, the decline has worked selectively, affecting the less skilled groups who have relied on firms close to their residences for employment. The high unemployment rates of inner areas are largely explained by the combination of high unemployment amongst the less skilled and unskilled, and the high proportion of these groups resident in inner areas.

There is an imbalance in the local labour market between supply and demand. High unemployment co-exists with a demand for the more skilled categories. The imbalance has two characteristics, geographical and occupational (39) so that the new employment opportunities are not only in jobs for which local residents are not skilled, but also the jobs are situated considerable distances away (50), accessible by car but not public transport (43).

In the absence of positive intervention it appears from the literature that this situation is unlikely to alter, although the sheer bulk of changes over recent decades may mean that the rate of change will be somewhat slower.

2.2 Retaining existing firms, attracting new firms

In stimulating the economic base and improving employment opportunities of inner areas there is a need to distinguish between the concurrent objectives of retaining existing firms, and attracting new firms since it is likely that some proposed measures will be common while others may be specific to one of these groups.

Existing firms fall into two groups, those which may potentially relocate or transfer, and those which will not (25). The former will

generally represent either expanding firms or firms forced to move because of private or public sector redevelopment schemes. In either case they should be encouraged and helped to find alternative premises within the inner area.

The firms which are not potential relocators often represent the older, traditional firms, possibly static or declining which, because of the costs of relocation, have the alternative of remaining at their present site or ceasing business. There is conflicting evidence as to whether they are associated with particular industries, but as a generalisation they tend to be housed in old premises, inappropriate for modern operations and which are difficult or costly to adapt or convert (69).

New firms which may locate into the inner areas will be those firms which are relocating from other sites, or expanding into additional sites, together with entirely new firms starting business for the first time.

Although it may be argued that attention should be concentrated on those sectors of the economy which clearly have a propensity to expand, there are several reasons to suggest that it is most appropriate to consider the manufacturing sector and its associated service industries. These include:

- manufacturing is frequently (but not always) a large or the largest employer in the inner areas
- the decline in other sectors has been less severe, and in many cases easier to explain (42) (eg. personal services which have adjusted to the reduced population)
- manufacturing is basic in the sense that other services directly or indirectly depend on it
- manufacturing provides well paid manual, semi-skilled and skilled jobs, with wage rates in the lower skill categories frequently above those for comparable jobs in other sectors
- overall economic strategy at the national level emphasises the shifting of resources back into the manufacturing sector (44).

2.3 The response of government

The severity of the problems facing the inner areas has been recognised at government level:

"Over the past decade, inner cities have suffered a massive and disproportionate loss of jobs.... Our immediate priority must be to strengthen the economies of these areas."(58)

Largely drawing on the results of three studies commissioned to examine the problems of inner areas (9,39,69), the government White Paper "Policy for the Inner Areas" (59) summarises the current situation of the inner areas, outlines a broad policy framework, and proposes a series of measures to address the problems and regenerate the inner areas. There are four underlying aims to the White Paper:

- strengthening the economies of inner areas and the prospects for their residents
- improving the physical fabric and making their environment more attractive
- alleviating social problems
- securing a new balance between the inner areas and the rest of the city region in terms of population and jobs.

In terms of economic improvement there is a commitment to preserve existing firms, encourage indigenous growth and attract new industry. To achieve this the Paper identifies:

- provision of sites and premises
- good access to communications
- an appropriately trained labour force
- improved travel to work arrangements

as ways of improving the economic base of the inner areas.

Transport is seen as serving employment in two ways. Commerce and industry require convenient and efficient transport for their operations, and those living and/or working in the inner area need adequate public transport services for the journey to work.

The White Paper notes the following factors regarding transport:

- better and improved local roads
- better access to the primary road network
- the need to give weight to the implications for local firms when designing traffic management schemes to improve access for central traffic
- efficient loading and adequate and convenient parking
- the need to review bus routes and schedules to ensure they cater for actual and potential journeys to work by those living and working in the inner areas
- consideration of selective fare subsidies.

To ensure that the problems of the inner areas receive adequate attention, the existing Urban Programme has been given a new dimension to include industrial, environmental and recreational aspects as well as specific social projects, together with a substantial increase in available funds. An initial allocation of funds was made for the year 1978/9 and more recently an allocation has been made for each of the three years 1979/80 - 1981/2. In addition a once and for all allocation was made in 1977-79 to help the construction industry.

The White Paper's proposals (given effect by the Inner Urban Areas Act) include the offer of collaborative partnership arrangements to a selected number of areas and the declaration of designated district authorities, and within them programme authorities, with extra powers and resources to deal with inner area problems. Within the powers of the Inner Urban Areas Act designated local authorities may, among other things, declare industrial improvement areas within which grants and loans are available for improvements to the physical fabric (buildings, infrastructure - including transport - and amenities) of essentially industrial areas. In allocating expanded Urban Programme funds specific allocations were made to each partnership and a block allocation to the group of programme authorities. No specific allocations were made to the remaining designated districts. Local authorities falling within the categories mentioned above are listed in the Appendix.

With regard to transport the existing Transport Supplementary Grant and Rate Support Grant funding within the Transport Policies and Programme (TPP) is seen as providing the bulk of the financial resources required for transport improvements to inner areas and, as with other main programmes, the authorities concerned have been requested to give emphasis to inner areas in their TPP submissions. In addition there is provision within the new Urban Programme for the funding of transport schemes in inner areas, and a number of authorities have exercised their discretionary powers and allocated funds in that direction (eg. some 24% of the urban aid funds available to the Docklands Inner City Partnership have been allocated to transport improvements, and in the case of the Leeds Programme Authority this figure is around 20% for 1980/1).

Funding for transport may also be available from a number of other sources. Under the Industrial Access Roads Programme it is required that improvements have a clear benefit in terms of employment. The Local Employment

Act applies to both the public and private sector and includes funding of basic services, employment gain being a criterion again, while the EEC Regional Development Fund provides grants to local authorities for infrastructure projects associated with industrial development and job creation.

Much of what has been said in the preceding sections is self-evident and to a large extent leaves unanswered the question of appropriate improvement measures. The White Paper refers to the need for adequate transport facilities as an instrument to retain and foster existing firms and encourage new ones; the funding arrangements make provision for transport; and some of the initial distributions of expenditure under the urban aid programme suggest that local authorities perceive transport improvements as an important instrument in the rejuvenation of inner areas.

It is less clear however what may be an appropriate distribution of expenditure between competing sectors, and within the transport sector what are the areas where allocation of resources is likely to be most beneficial and cost effective. To start to assess this in terms of inner areas and their industrial base it is necessary to determine the importance of transport to existing firms and firms which may relocate, and to estimate which transport problems present particular difficulties for firms operating in the inner areas.

3. LOCATION OF INDUSTRY

It is not intended to review location theory except to note the distinction between the more traditional approach based on micro economic theory and the minimization of transport costs, and behavioural theory which claims that it is insufficient simply to consider costs alone and that there are many other factors involved. While the importance of transport costs per se in the location decisions of the firm has been questioned more and more, particularly in terms of regional policy (eg. 28, 65, 66), this does not necessarily imply that transport itself is not a significant factor. Quantitatively there are indirect effects such as the influence on availability of labour, reliability of supplies etc. Qualitatively transport problems, irrespective of their actual magnitude, are readily observed and are an everyday experience of both employers and employees. Further discussion of basic theory is contained for example in ref. 7.

In order to gauge the position of transport factors in the location decisions and operations of inner city firms, it seems more useful to look at the current evidence from studies of firms in different situations, from the point of view of:

- factors causing firms to relocate (or close)
- criteria for firms' choice of relocation site.

The problem is compounded by the fact that it appears location decisions are not necessarily "optimum", in the sense that they do not satisfy readily identifiable criteria such as maximization of sales, profits etc. (66) The final site chosen is frequently the first, or at least the first suitable site found, and in the majority of cases there has been no economic evaluation of the site (8).

3.1. Factors causing firms to relocate

A firm will leave its present location either because it can no longer satisfy the firm's operational requirements or because the disadvantages of the present location combined with advantages of a new location indicate to the firm that it is economically advantageous to move. It is therefore appropriate to consider the factors from two points of view:

- what do firms dislike about their present location
- what reasons do firms which have relocated (or are planning to) give for moving.

3.1.1 What firms dislike about their present location There is relatively little specific data available, although the reasons firms give for relocating will often provide additional indications of deficiencies with the old site, but are unlikely to show their relative importance. Clearly the perception of present site is likely to depend on whether the firm is committed to stay at that site, or whether it can or will relocate, or has done so already.

A Hull study (21) asked 30 inner area firms their site deficiencies specifically under "poor local access" and "space constraints". Although 67% of firms were at least fairly satisfied with their sites, 50% mentioned poor local access roads as a problem (narrow and twisting roads congested by heavy traffic and parked vehicles). Two thirds mentioned space constraints (eg. insufficient unloading or warehousing space) as an actual or potential disadvantage of their site, however few thought it a sufficient reason to relocate.

A working party representing firms in the Holbeck/Hunslet inner area of Leeds (48) asked firms to express their views on transport/access, expansion, and general aspects (suggesting possible problems within each of these areas). From the replies the following priority measures were considered necessary in order to foster the area:

- improved car parking, mainly off-street so as to free local streets (adequate parking was seen as an important aspect of labour retention and the existence of vacant public land suitable for off-street parking was a source of annoyance)
- better access to premises in terms of surfacing and maintenance, and improved alignment to allow manoeuvring by large vehicles
- more effective bus services, especially during peak periods to correct the present lack of penetration of the area by public transport
- the removal of dereliction
- encouragement of a local community.

Their work highlights the concern felt by firms, many of which are long established, for the physical and social well-being of the area and the importance of these factors for its long term viability. Blighting caused by the urban motorway proposals and uncertainty of the future of the road network was identified, but there was general acceptance of the cut backs

in major roadworks and the problem was seen as mainly one of local access.

A local authority study of the same area (49) subdivided the problems facing the local industry into physical and economic. The serious physical problems were

- access to premises through narrow streets and/or unsatisfactory entrances; often on-street loading and unloading and stopping by goods vehicles
- parking problems, especially on-street where it adds further to congestion
- expansion space at a premium
- inadequate premises, some of which required altered loading facilities, on-site parking, and better internal traffic circulation
- appearance of the physical fabric.

These added to the economic problems which were often more important and less tractable:

- shortage of capital investment in new building or expansion
- lack of land or the right type of property at the right price, aggravated by the processes of urban renewal
- firms affected by redevelopment schemes

A mailed questionnaire of all manufacturing and industrially orientated service firms in an inner area of Bradford (12) sought views on local conditions. Firms were asked without prompting to describe problems with their existing site, were specifically asked about the local environment, and questioned as to what improvements were needed. A number of suggested improvements were given as examples. Replies obtained from 174 firms (71% of the total in the area) are shown in Table 2.

Table 2 PROBLEMS OF THE AREA - BRADFORD
Number and percentage of firms mentioning problem as "major".

problem (major)	number of firms	% of firms
car parking	23	13
access (local)	44	25
adverse environment	64	37
vandalism	27	16
itinerants	18	10
poor street condition	42	24
poor bus service	16	9
outdated buildings	9	5
none	26	15

source: reference 12

As might be expected (because it was a prompted question) many firms saw adverse environment as the major problem of the area. They also raised the associated problems of itinerants and vandalism. Access and street condition are a major problem for about a quarter of the firms. Access in this sense refers to the local streets within the study area. 45% of all firms had a shortage of parking spaces and it was seen as a major problem by 13%. Although the area is well served by buses, several of the larger firms expressed concern with services, indicating that frequency was the problem, especially at night.

The results suggest that even for the relatively small study area, many of the problems were extremely localized. For example, particular locations where on-street parking and poor roads combined to create access difficulties; and vandalism/itinerants was in general concentrated around one street. It appears that there could be a potential danger in simply considering aggregate data, since it is likely to conceal quite large localized differences in the condition of the area and its firms, and extent of their problems.

The Lambeth Local Employers' Study (44) specifically asked employers what they considered the difficulties in operating on their existing sites by listing a number of possible problems. Unfortunately two of the most important factors affecting existing operations and possible relocation, space and labour constraints, were investigated separately. The 39 firms interviewed responded to questions on site difficulties and recruitment difficulties as shown in Table 2.

Table 2 (a) PROBLEMS WITH EXISTING SITES - LAMBETH
Number of firms mentioning factor

factor	manufact.	service	total
parking	14	6	20
public transport	14	4	18
road access	12	5	17
vandalism and crime	9	6	15
surroundings	8	5	13
loading	4	4	8
rates	4	1	5
rents	2	0	2
lease	1	0	1
other	1	4	5

Table 2(b) RECRUITMENT DIFFICULTIES - LAMBETH

	number of firms experiencing difficulty (1975)		
	manufact.	service	total
don't know	0	0	0
not recruiting at all	4	2	6
no problems	5	5	10
difficulties with skilled	11(3)	1	12
difficulties with non manual	3(1)	3	6
difficulties with women (manual)	4(2)	1	5
difficulties with semi skilled	2	4	6
difficulties with unskilled	1	0	1
difficulties with all types	0	0	0
Total number of firms	25	13	38

(Number of firms with serious difficulties in brackets)

Source: reference 44.

Only 20% of manufacturers had no recruitment problems, and there were particular difficulties recruiting skilled and female labour. In the case of the less skilled it was more a question of the quality rather than the availability.

Over half the firms in this study were affected by the typical inner area problems of parking, access and public transport, although as with most studies, their importance in terms of continued operation in the area is not clear. Of particular note is the relative occurrence of "vandalism and crime", which was not specifically asked in the questionnaire. Considered in conjunction with "surroundings" it indicates that firms place considerable weight on their environment, a factor noted in the Leeds and Bradford studies (12, 48).

Firms in the Lambeth study frequently quoted inadequate public transport (particularly east-west routes), which made the journey to work difficult and restricted labour catchment areas. Improved public transport was also quoted by 47% of firms surveyed in the Docklands area as what was required to help overcome shortages of certain types of labour (7) and a study of 88 London based firms (31) primarily designed to identify the factors affecting relocation raised the issue of public transport availability, especially for manual workers. Even for small catchment areas, transport problems for workers were reported by 40% of all firms in this study. By far the most frequent (30% of all firms, 50% of the large firms) was concern with poor bus services, and fares were considered less important than level of service and reliability.

Studies by GLC to investigate possible area control by the issue of free permits (26) involved interviews with 78 firms operating in central London. The survey did not cover aspects of present location other than congestion. The extent to which these firms were affected by congestion is indicated by the following responses to specific questions (Table 3).

Table 3 EFFECT OF CONGESTION - CENTRAL LONDON
(Number of firms)

	adversely affected	marginally affected	not affected	no reply
servicing premises by others	7	10	41	20
goods deliveries to premises	9	13	32	24
distribution of goods and services	32	8	16	22
employee access - bus	32	7	12	27
- car	23	7	16	32
visitor access - bus	6	4	13	55
- car	16	9	21	32

source: reference 26.

It is clear that firms perceive congestion associated with their existing site to be a problem as regards their own operations or employee access, but are largely unaware of, or indifferent to, the access problems of those servicing, visiting or delivering to their premises. As would be expected, when asked which road users would benefit from reduced congestion, the greatest gain was seen for "distribution of our goods and services", and nearly all of those firms which were adversely affected by existing congestion levels felt that they would benefit from reduced congestion. About half the firms, 38, said it was important to them if congestion could be reduced, and a further 19 thought it was marginal.

Some indication of the relative importance of congestion in terms of other problems is given by the replies in Table 4.

Table 4 RELATIVE IMPORTANCE OF CONGESTION - LONDON
(Number and percentage of firms replying)

	yes	no
Can congestion compare with other problems eg. rates, rents	17 (22%)	42 (58%)
Are the benefits of reduced congestion realisable in financial terms	27 (35%)	32 (41%)
Are there "other problems" caused by congestion eg. inability to attract staff of the right calibre	18 (23%)	33 (42%)

Source: reference 26.

In response to what sorts of solutions might help those affected by congestion, firms considered the following factors:

	<u>no. of firms</u>
better/more reliable public transport	14
new roads	16
cheaper public transport	15
more off-street parking	12
ban cars	11
more traffic management	8
better enforcement	7
less on-street parking	7
park and ride	7
fewer bus lanes	9

which, in spite of a number of contradictions (eg. "better public transport" and "fewer bus lanes") does give an indication of where firms perceive problems and possible solutions. In agreement with other studies, inadequate public transport is identified as a problem, although in this case firms see improvements in service/reliability and lower fares as about equally important. Employee surveys in central London indicated that, apart from needing a car for business, the main reasons for using a car for the journey to work were

- public transport service too poor
- too many changes
- cheaper by car.

A recent study for the Lorries and the Environment Committee (37), concerned specifically with the problems of urban deliveries surveyed manufacturers, wholesalers and retailers to determine their assessment of delivery problems. Half the respondents raised three major problems:

- the lack of adequate on-street parking near the delivery point
- rear access blocked by parked vehicles
- delays caused by queueing of vehicles waiting to deliver.

Other important problems of operating in the area were:

- local authority restrictions on delivery times
- similar restrictions imposed by receivers
- on-street parking restrictions
- inadequate or obstructive buildings at reception points
- inadequate loading facilities
- delays due to administrative procedures.

Vehicle simulation techniques were used to assess the delivery cost savings associated with the removal of a number of problems. By way of example, complete elimination of congestion would result in a 9.1% cost saving, while improvements to buildings and unloading facilities (ie. the avoidance of physical access problems, so removing restrictions on vehicle size) would reduce costs by 11.6%.

Many of the premises in inner areas are a problem in themselves (49). The site and buildings are often old, with inadequate parking and loading/unloading facilities. In some cases structural unsoundness is a problem and in general firms considered old premises involved high maintenance, fire prevention and modernization costs, and that working conditions for staff were poor (25).

Several studies reveal dissatisfaction with the public sector. 23% of London firms found government policy inflexible and discouraging (eg. IDC's may be a major constraint on local expansion) and 25% expressed dissatisfaction with local authority attitudes and performance (31), the latter being regarded as unhelpful or even discouraging and obstructive (44). Absence of action from the public sector was seen as likely to cause a lack of confidence by firms, and an unwillingness to commit their own funds (49,51), while there was a feeling that when considering traffic management schemes, local authorities paid inadequate attention to the requirements of firms (44).

The results of these studies must be interpreted with some caution, partly because of the nature of the surveys, and partly because firms committed to stay will perceive their site deficiencies differently from those with the possibility of moving. Firms may also more readily identify problems in areas of public sector responsibility eg. transport, than with their own operations but this will largely depend on whether responses are prompted. It does emerge however that apart from the overriding constraints of labour and space, firms consider the transport problems of operating in the inner areas to be a severe burden. Many firms see transport improvements as realizable in financial terms although there is no indication of what the magnitude might be.

3.1.2 What firms like about their present location The reasons why firms were in their present inner area location were investigated in the Hull study (21,36), and are summarized in Table 5. Many of these are historical and so may not be relevant to present day relocation criteria but will indicate to some extent why a firm may wish to continue operations on its present site.

Table 5. REASONS FOR PRESENT LOCATION - HULL
(Number of firms mentioning factor)

	manufacture	transport/ distribution	other (ie local service)	total
Traditional links				
- established in C19	7	5	2	14
- on same site since C19	6	2	0	8
- original functional links	8	1	0	9
- original river use	6	3	0	9
- family/labour tradition	8	3	1	12
River or port dependence today	4	7	0	11
Local suppliers	2	0	0	2
Central to market	0	12	7	19
Radial transport links	0	3	0	3
Local road access	0	1	0	1
Labour supply	2	1	1	4
Local admin. links	0	1	0	1
Site ownership/availability				
- critical in recent location decision	3	5	1	9
"Offensive" industry	5	3	0	8
Total number of firms	9	13	8	30

Source: reference 21.

Traditional links, many of which persist even though they may now be relatively unimportant, are by far the main reason for the location of manufacturing firms whereas a central location with regard to markets and specific transport ties are the major criteria for transport/distribution firms and local services. The fact that the firm owns the site or has long term cheap rental represents a financial advantage in that it probably allows them to bear other costs.

The Bradford study (12) asked firms in an unprompted question what advantages the area offered that were important to their business. Since it was concerned with current operations it avoided the emphasis on traditional factors noted in Hull. The results are shown in Table 6. Access was seen as the major advantage, in this case referring to access to major arterials and motorways rather than the condition of local streets in the study area itself. Proximity to the city centre was also frequently mentioned, although it is not clear from the responses why this is important to manufacturing firms. It may be that this is associated with the market factor, seen in this study as one of the more important advantages of the central location. Unfortunately the results are not disaggregated into manufacturing and services.

Table 6. ADVANTAGES OF PRESENT LOCATION - BRADFORD
(Number and percentage of total firms mentioning factor)

factor	no. of firms	% of all firms
good parking	10	6
good access	78	45
near city centre	35	20
good labour supply	20	11
near other similar traders	16	9
good public transport	3	2
outside centre	6	3
good business market	39	22

Source: reference 12.

Sant (61) surveyed 269 firms in East Anglia to determine advantages and disadvantages of a particular location at a regional level. The initial list of 20 possible advantages was compressed to four major items. The results, by location and by age of firm are shown in Table 7.

Table 7. a) REGIONAL LOCATIONAL ADVANTAGES - BY AREA
(percentage of respondents)

factor	Essex	Norfolk & Suffolk	East Anglia	New and expanded towns
transport	28.3	14.4	22.8	19.4
labour	20.6	32.0	26.9	17.8
site	30.5	30.3	30.5	37.1
other (incl environmental, government factors etc.)	20.4	23.0	21.8	25.8

b) LOCATIONAL ADVANTAGES - BY AGE OF FIRM
(percentage of respondents)

age	transport	labour	site	other
before 1939	24.0	32.1	21.3	22.6
1940-50	21.8	28.6	27.8	21.8
1951-60	22.4	27.6	29.6	20.4
after 1961	18.5	23.2	38.5	19.7

Source: reference 61.

The analysis highlights two important points. There is considerable variation between areas as to what are the important advantages, with site characteristics being a particularly attractive aspect of new and expanded towns. Assessment of advantages also appears to depend on the age of the firm, with site characteristics becoming increasingly important for the newer firms, at the expense of transport and labour. While the results indicate differences between regions, unfortunately they do not show the extent of intra-regional variations.

The need for a central location may be more important for small firms, especially those starting up and requiring close contact with customers and clients (8). They may also find the cheaper and older premises suitable, at least in the initial stages. In general many manufacturers tend to be regionally or nationally orientated and have no obvious requirement for a central location although some need regular face-to-face contact with clients and competitors. Millar and Mellor (55) cite printing, certain food products, engineering firms which produce components, some industries allied to textiles and firms specializing in sub-contract work as having particularly strong linkages, but suggest that these may change over time. An adequate labour supply, especially for those firms employing a large proportion of females (eg. small clothing and textile firms) is an advantage of the inner areas, but increasing car ownership may be reducing the importance of this factor.

Persistence with the existing location is also associated with a certain degree of inertia on the part of the firm. This may actually be a proxy for the risks and costs of a move, such as the risk of losing a skilled labour force (44). On the other hand many firms feel a genuine loyalty to the area and to local residents and are reluctant to leave voluntarily (48). About 65% of firms in Manchester who were opening up operations outside the city stressed their preference for remaining if suitable sites could be found (55).

3.1.3 Firms' reasons for relocation There is somewhat more information, and it is possible to make an assessment of the major reasons for relocation and to some extent gauge their relative importance. Data is drawn from four main sources:

- (a) Lambeth Inner Area Employers' Study (44) reported case studies of 12 inner area manufacturing firms which had relocated outside inner London (or were considering moving) and asked the main reasons for the relocation decisions.
- (b) A GLC study (31) of 88 manufacturing firms in London who had moved, or had considered moving in the previous three years asked the reasons for the move.

- (c) An unpublished review of 14 previous studies covering a range of cities (8) which identified the primary and subsidiary reasons for relocation for each of the studies. (It does not therefore consider the whole range of relocation factors which these individual studies may have investigated, nor their relative importance).
- (d) A study in Hull of 35 manufacturing and distribution firms which had recently relocated onto peripheral industrial estates (36). 23 of these were transfers from a previous site in Hull, who were asked to allocate 100 points amongst the main factors affecting the relocation according to their relative importance.

The summary results of these studies are shown in Table 8.

Table 8 REASONS FOR RELOCATION

Reason	Lambeth (no. of firms stating reason)	GLC (no. of firms stating reason)	Hull (relative importance of factor)	14 other studies	
				prime	subsidiary
shortage of space	5	50	41%	6	3
shortage of labour	7	19	not asked	4	4
outmoded buildings	3	26	20.7%	1	5
planning/redevelopment	4	14	15.7%	1	8
transport	4	12	5.0%	0	2
rents/rates/tenure	2	13	4.8%	0	4
rationalisation	1	13	12.0%	0	2
other	2	2	0.9%	0	0

Source: references 8,31,36,44.

Growth emerges as the main reason for relocation (42) and in terms of the inner city is a cause for particular concern since in general it is the growth firms which should be retained if at all possible. For three of the surveys in reference 8 growth accounts for about 85% of the moves; lack of room to expand was responsible for 60% of moves in Amsterdam (56); and in all studies it has directly or indirectly been the most important factor.

Growth manifests itself through shortage of space for expansion, shortage of labour, and frequently outmoded or unsuitable premises, which collectively represent a constraint on production (52). Shortage of space and outmoded buildings

are somewhat connected factors. The majority of firms surveyed in Manchester (55) stated that multi-storey premises would not be suitable for their operations. Exceptions were clothing and wholesaling.

Keeble (40) and Townroe (66) identify shortage of space for production machinery (often caused by innovation and changes in production technology), lack of storage and office space, poor facilities for staff and the problem of providing car parking space. In many cases old buildings are not suitable for new uses and are incompatible with rationalisation and modernisation of production using modern technology. Many will ultimately need major and costly repair or renovation, or replacement. Rationalisation and the need for improved efficiency create a need for larger, integrated manufacturing units, often by the consolidation of operations previously carried out at a number of sites. Whether the firm is part of a subsidiary or part of a multi-branch company is likely to be important in relocation, and decisions by the parent company at the national level may be as significant as local site factors.

Labour is the other major reason for relocation. In some cases this may simply be a shortage, whereas in other situations it is more a problem of quality or shortages within particular skills, and is more likely to affect those firms employing a high proportion of skilled labour (refer to Table 2b). Accessibility to a suitable labour catchment area is clearly an important aspect of this factor.

The location of the firm's employees affected some firms' attitudes to moving (39.) Those firms whose employees did not live locally seemed more disposed to move, and their destination was often influenced by where their workers lived. Alternatively labour problems may precipitate a move to an area of better quality labour or where skilled workers are close by.

Transport, to some extent tied to inadequate site, is seldom a major reason for relocation. Some 7% of firms in major conurbations considering relocation thought traffic congestion a major reason for moving, and 14% found it a minor one (38). Only 5 of 250 firms interviewed in West Yorkshire expressed an interest in moving to another site because their present premises were inadequate for the volume of transport activity (72). As a reason for relocating transport does appear as a secondary factor, behind those associated with the site (space, buildings and perhaps rationalisation) and labour, but at

least as important as rates/rents/tenure. However it should be noted that transport is an important element within the general question of labour, especially labour availability, and may be expected to be more important than Table 8 indicates.

The particular problems are largely those which cause firms to dislike their present sites. These include the frequently quoted problems of poor level of service and unreliability of public transport; congestion and delays; lack of parking; problems of access especially for large vehicles (aggravated by on-street parking); difficulty manoeuvring and loading vehicles. In some, but probably not very many cases, the possibilities of bans or controls on large vehicles may be a factor.

Another area largely under public sector control is planning and redevelopment, the importance of which seems to vary somewhat depending on the time and location of the study and the evidence is somewhat conflicting (42). In some cases the effect has been considerable. For example in Manchester 24% of total floorspace and 25% of the jobs in the city were likely to be affected by the combined effect of slum clearance and road proposals (55). Refusal to obtain IDC or ODP's may cause some relocations, and is certainly a nuisance factor while CPO's for redevelopment directly threaten an establishment, and create considerable uncertainty. These controls may lead to expansion through the establishment of a branch office, or it may be more profitable to redevelop the existing site for a different land use. Harris (29) stresses the importance of the policy factor at the metropolitan level.

Other factors include the quality of the area, often seen as steadily deteriorating, and a general feeling of uncertainty of operating in the inner areas (9). Conditions of tenure are important in some cases, with a tendency for inner areas to have a higher proportion of freehold than recent industrial estates where leasehold tenure is common. Molle (56) also suggests that time may be important and reports correlations with establishment of branches and stage in the business cycle.

3.2 Criteria for choice of relocation site

It is appropriate to consider choice of site at the regional and local level since it is evident that each of these is associated with quite different locational criteria.

At the regional level the important factors which firms consider in their choice of new site may be summarised in the following table (Table 9), using the unpublished review of seven studies (8).

Table 9 RELOCATION FACTORS AT THE REGIONAL LEVEL

factor	Number of studies mentioning factor as	
	prime importance	subsidiary importance
labour availability	6	1
government influence	0	5
regional markets	0	3
availability or price of factories	0	5
transport	0	4
social/environment	0	4

Source: reference 8

Consideration of one of these studies (38) in more detail indicates the relative importance of a range of factors (Table 10).

Table 10 RELOCATION FACTORS - ILAG STUDY

	% of firms mentioning factor as		
	major factor	minor factor	outstanding single factor
1. Availability of labour at new location	72	20	20
2. IDC obtainable	48	18	2
3. Availability of government financial inducements	39	7	7
4. Assistance/encouragement from l.a.'s and promoting bodies	36	30	3
5. Access to specified transport fac.	31	20	2
6. Access to markets	30	14	n.a.
7. Good amenities and environment	29	41	1
8. Availability of non-govt. factory	28	5	6
9. Managerial and staffing ties to an earlier location	24	17	n.a.
10. Special characteristics of site	20	17	3
11. Access to suppliers	15	14	n.a.
12. Other factors	12	2	3
13. Availability of industrial and commercial services	3	3	n.a.
14. No outstanding single factor	-	-	38

Source: reference 38.

And a ranking of factors by nine firms which had located into Hull gave the following results (Table 11):

Table 11 REGIONAL RELOCATION FACTORS - HULL

	points	% of total points
markets	310	34.4
personal ties	300	33.3
government incentives etc	165	18.3
labour	85	9.4
access to supplies	35	3.9
transport access	5	0.6

Source: reference 36

In regional terms, labour availability is the single most important factor, being consistently mentioned by most firms interviewed in the various surveys. The exception is the Hull study where markets and personal ties are equally the most important. Government and local authority influence, markets, transport facilities are of somewhat lesser importance, and personal ties and social/environmental considerations will also influence the decision. As would be expected, availability and price of premises is consistently mentioned as important, but seldom the prime factor. The nature of the operation of some firms may be important, in which case it is often the determining factor (eg. availability of potable water etc).

Government influence will be either push or pull. Pull will include public spending on infrastructure and facilities, discriminating pricing policies and specific grants, and advisory services and promotional initiatives. Push factors will operate through various restraint policies (eg. IDC and ODP) whereby expanding firms are forced to relocate away from particular areas (eg. the South East). Irrespective of the success or otherwise of these policies, they are a factor which firms have to consider, and for a reasonable proportion it may be a major factor.

Transport, such as motorway access, is frequently mentioned but is not amongst the top few factors which seem to be particularly important. At the regional level there is now considerable evidence that transport considerations are but one element in the decision of new location. It appears that the

provision of major transport infrastructure is not likely to have a profound impact on the distribution of economic activity and employment opportunities, particularly at this stage in the development of the national transport system (20, 28, 65).

Factors at the local level. Again using the results of 12 studies reviewed by TRRL (8) Table 12 shows the major factors at the local level.

Table 12 RELOCATION FACTORS AT THE LOCAL LEVEL

factor	no. of studies concluding this to be a	
	major factor	subsidiary factor
cost and availability of premises	4	5
accessibility to markets	3	3
accessibility to labour	1	5
site and planning controls	0	4
transport	1	4
social/environment	0	4
accessibility to supplies	0	2

Source: reference 8.

Table 13 shows the primary and secondary factors affecting location in the GLC study of 88 firms. Site requirements and availability were considered separately, and it was concluded that these were the single most important factors. Transport costs were also considered separately in the sense that firms regarded transport costs as they did any other cost, namely, to be minimized where possible. 28 firms saw transport costs as being an important factor, and 4 saw it as a secondary factor.

Table 13 RELOCATION FACTORS - LONDON

factor	no. of firms for which stated factor was:	
	a prime factor	a secondary factor
market	63	1
labour retention/availability	59	1
motorways	18	16
local roads	38	28
rail and/or port and/or airport	20	37
suppliers	4	12
other (incl. housing required, costs, personal/prestige)	53	-

Source: reference 31.

The Hull study of 35 firms which had recently relocated contains more detail on the specific site requirements. Each firm was asked to allocate 100 points between the various factors according to their relative importance (Table 14).

Table 14 CRITERIA FOR SITE SELECTION - HULL

factor	points	% of total points
size of site	865	24.7
advance factory	390	11.1
room for further expansion	30	0.9
industrial use zoning	<u>100</u>	<u>2.9</u>
<u>Total physical</u>	<u>1385</u>	<u>39.6</u>
terms of lease	290	8.3
rent free	40	1.1
freehold	<u>235</u>	<u>6.7</u>
<u>Total financial</u>	<u>565</u>	<u>16.1</u>
availability at critical time	510	14.6
markets	85	2.4
labour	175	5.0
transport access	670	19.1
proximity to parent	110	3.1

Source: reference 36.

Considering the various factors in turn.

Markets - Market access emerges as one of the most important considerations, irrespective of industry group (31), and will frequently determine the general area into which a firm will locate. A number of specific localized criteria will then be applied to determine the actual site. (eg. compare the relative importance of markets at the regional and local level of the Hull study). The relative importance is likely to vary with the type and size of the firm - those requiring regular face-to-face contact, those which have an element of retailing in their operations, and small firms starting up and needing to establish contacts and customers quickly. Market considerations may be less important for the well

established firm (8). The perception of markets is likely to depend also on the size of the urban area and the nature of the move. Presumably firms shifting location in relatively small urban areas feel that their markets will be retained irrespective of their new location, while this may not be the case for London and the South East. Keeble (41) makes the point that markets should not only be seen as the physical exchange of goods, but for many firms contact at senior management level, or with buyers etc. may be more important.

Site/Premises - Most studies agree that this is the single most important factor, and that which ultimately determines where the firm relocates. Firms primarily look for a site of acceptable size, preferably with an existing factory, within certain financial limits and conditions of tenure. These requirements must be qualified by the range of possible sites available at the time of relocation, which in many cases does not appear to be large. Since firms will generally wish to move and restart operations quickly, availability is often the determining factor and in general the search for possible sites does not extend over a long period. In such cases it is likely the site selected will not be optimum (32). Townroe (67) considered the procedure 57 firms used to select their new sites:

- for 17 firms the final choice was the first possible
- 23 firms took the first satisfactory site (the difference here is between a "minimum needs" and a "sub-optimum" choice)
- 17 firms continued to consider alternative sites beyond that which was finally chosen (hence trying in some sense to "optimize").

By far the majority of firms require single storey accommodation (eg. 72% of firms in reference 31), although it is possible that smaller companies will be satisfied with older multi-storied premises. There also seems to be a preference for freehold (50%) or long lease (25%) conditions of tenure (31). Using somewhat limited information, it appears capital availability is more of a problem for the small independent firms (31, 49).

These factors determine which site is finally selected, but it is not clear how the selection process actually operates at the local level. There are two possibilities:

- (a) Optimization of other locational factors fixes a general area into which the firm would wish to locate, and the firm then tries to find an acceptable site at a cost it can afford within that area. This is inferred by the GLC study (31.)

(b) It is more a case of the limits or constraints imposed by other criteria which must be met, and then an optimization of the available sites in terms of physical characteristics and costs. This is suggested by the Hull study (36).

Appropriate public policies may depend to some extent on which process is operating, and there is a case for further research in this area.

Labour (Availability/Retention). With the exception of Hull, all studies indicate that firms give considerable attention to the labour market at their new location. There are two factors: the retention of all or most of labour following relocation; and the availability (or supply) of labour at the new location in terms of skill categories and quality, or particular labour problems which the firm wishes to overcome by appropriate choice of new site.

A breakdown of the London survey (31) shows the relative importance of these factors, by size of firm, for those firms indicating labour to be of prime importance.

Table 15 LABOUR FACTORS - LONDON
 (number of firms)

	firm size			
	20 or less	21 - 100	100+	total
labour retention	17	14	8	39
labour availability	-	12	8	20
Total firms for which labour was of prime importance	17	26	16	59
Total number of firms in sample	34	33	21	88

Source: reference 31.

This suggests that retention is particularly important for small firms. Retention is also distributed through the range of activities of the firms, being somewhat more important for those firms requiring skilled workers such as engineering and printing. It appears that the desire to retain the existing labour force determines to a large extent the distance firms are prepared to move, and there may well be a trade-off between market and labour factors, as suggested by Table 16.

Table 16. DISTANCE AND RELOCATION FACTORS - LONDON

acceptable relocation distance (miles)	number of firms	number of firms mentioning factor as prime importance		
		market	labour retention	labour availability
up to 2	22	11	17	2
up to 4	10	10	6	1
up to 10	15	10	7	4
up to 20	9	7	3	2
over 20	32	26	6	12

Source: reference 31.

As distance increases, the importance of labour retention decreases and labour availability becomes more significant.

Transport The review of previous studies (8) concludes that transport cost is not a major determinant, although 28 of the London firms (ie. 32% of the sample) considered it an important factor to the extent that it should be kept to a minimum. 24 of these firms also considered the market important, and there is clearly a close relationship between the two, as there is with transport and labour. Apart from costs, firms will have certain access requirements. Access, but not necessarily proximity, to motorways is an important factor however a large number of firms saw local access roads as the main transport need, partly because they provide access to motorways, ports etc. and partly because of the existing access difficulties in the vicinity of their present site. Much of the previous work has tended to neglect the position of local access roads, partly because it has been more concerned with location at the regional or national level. However the Hull study clearly indicates the relative importance of transport at the local level (36) (0.6% of the decision to move to Hull c.f. 19.1% of the choice of actual site). There is little indication as to what levels of access are thought to be satisfactory.

Because of the nature of their activities some firms will have particular transport requirements which will at least determine the general area of the site eg. need for proximity to port or airport. Often this may only mean that they have to be within a certain acceptable travel time of that facility.

Transport must be presumed to have an indirect effect also, eg. on the retention and availability of staff (where public transport will be important) and on markets and a much lesser extent supplies. When considering their labour catchment areas 30 of the 88 London firms felt they needed to be close to the homes of manual workers and for there to be good public transport links. Most of the other firms expected no significant change in catchment because of the short distance of the move. Some firms expected to improve their transport situation (for employees) following a move.

Other Factors. The studies show that access to suppliers is not a major determinant, and to some extent this helps to explain the general lack of interest by firms in the traffic problems of suppliers noted earlier. It appears that many of the linkages with suppliers are now more for convenience than necessity (8, 36), and in those instances where they may be of some significance it applies more to the small and medium firms than to large firms (31). Other factors which may have more or less influence at the local level include:

- Local planning especially by zoning and redevelopment initiatives (eg. industrial estates, redevelopment of existing areas for industrial use, urban renewal). While many firms are critical of both central and local government, and slow planning procedures in particular, few firms appeared to consider public policies a positive influence on decision-making.
- Social/environmental factors are a consideration, though not of major significance. They are more important for existing firms, especially the long established, and for firms considering relocation at the regional level. It is difficult to establish the effect of these factors on, say, the retention of staff.
- Local facilities may be important for questions of labour retention.
- Personal ties. The Hull and ILAG studies suggest this can have considerable influence, but it is difficult to judge its effect at the local level. There is some indication (48) that firms feel an affinity for their existing area, while the behaviouralists quote the influence of the preferences of senior management in the choice of location.

- In the case of branch firms the proximity to the parent company may be important.
- Housing was quite often mentioned by firms in London (31) but nearly always by those companies locating away from London yet still somewhere in the South East.
- The costs of relocating, which vary considerably with the individual company.

3.3 The mobility of firms

The contention that particular industries are more likely to relocate, for example those industries which are growing more rapidly than others, does not seem to be supported by the evidence. Studies in Nottingham and West Midlands (29) showed little relation between employment growth and propensity to move by SIC and concluded that "the need to move falls on all firms (by SIC) fairly equally". It is likely that mobility will depend very much more on the specific activity of the firm. For example, within SIC XVIII printers have proved to be less mobile and paper manufacturers more mobile than consideration of the aggregate SIC group would suggest. Printers need face-to-face contact, whereas paper manufacturers have a much more regionally based market and need large storage areas (40).

Reference 8, using rather inconclusive evidence from previous studies, tentatively suggests that the following industries may be more or less mobile than their growth rates would suggest:

less mobile industries

food, drink, tobacco, paper,
printing, publishing, bricks,
pottery, metal manufacture,
many services (presumably
local services)

more mobile industries

mechanical and electrical engineering
motor vehicles, some chemical industry
some wholesaling, some firms with a
high proportion of female labour.

Whether particular firms move or not seems to depend much more on the economic position of that particular firm rather than the industry with which it is grouped. Furthermore the observed mobility is likely to depend very much on the area studied, the stage of redevelopment, and the state of the industry at that time.

Attempts to relate mobility to the size of the firm are equally inconclusive. There is slight evidence (32) that the proportion of moves within small firms is greater than large firms, but for West Midlands the most mobile group was the 25-99 size range. This is however directly contradicted by Keeble (40) who found large firms (175 plus) more likely to move, and by Gripaios (27) who came to a similar conclusion after statistical testing of 359 inner London firms. The financial resources of large firms was put forward as one reason for their ability to move. The Hull study results (36) suggest that the heavier traffic generators may be less mobile, but the supporting evidence is not strong.

The only conclusion which can be drawn is that there are a number of factors which are important in causing firms to move. Firms (and not necessarily industries) characterized by those factors will be more likely to relocate than others. Of these factors the most important are the growth of the firm and the need to expand.

3.4 Firms likely to have particular problems

The fact that the results of most studies are presented in aggregate form, or at best on a broad industry basis, makes it difficult to identify firms which are likely to suffer particular problems except in the economic sense of being part of an industry which is suffering long term decline. In many cases this will depend on the study area and does not necessarily imply that an individual firm will be in difficulties.

It is also not clear which size of firm to concentrate on. While smaller firms may be more susceptible to economic conditions and larger plants have an ability to survive longer, the large firms are much more important in terms of overall employment, as well as having indirect effects on associated activities. The loss of the smaller firms is more difficult to assess. It has been suggested (51) that their inventiveness and entrepreneurial talent may be a considerable intangible benefit and that they have "the potential to provide the initiative, flexibility, effort and enterprise which is needed to stimulate the inner areas" (57).

3.5 Some Conclusions

Looking at the transport implications of industrial location as three rather distinct issues:

- advantages/disadvantages of present location
- reasons for relocation
- choice of new site

would appear to be justified since not only are different aspects and problems of transport associated with each, but it facilitates a comparison between transport and a range of other factors that apply to each of these three issues. It is also easier to put transport in the context of one of the central themes of the White Paper (59): to preserve and facilitate growth of existing firms, and to attract new industry.

Firms operating in the inner city perceive local transport problems as one of the main disadvantages of the area, alongside those of space constraints, inadequate premises, and labour constraints (of which access to suitable labour catchments is an important element). The physical and social environment is also frequently quoted as a source of concern. There are, however, a number of advantages of a central location, and there is evidence that firms, especially the long established, feel a particular affinity for the local area and its residents and are reluctant to leave voluntarily.

Previous surveys indicate that the transport problems listed in Table 17 are important to firms in the inner city. Because much of this work has been attitudinal in nature no attempt is made at this stage to judge the importance of these problems either in relation to other problems associated with the area or their consequences for the operation of the firm. The list is tentative, one of the objectives of the current project being to expand, clarify and evaluate these problems.

Growth, which manifests itself as shortage of space,

shortage of labour and inadequate site and buildings is the single most important reason for relocation. Transport is not often a primary reason, but is frequently quoted as a contributory factor, and has a significant influence on shortage of labour. Planning and redevelopment issues may be important depending on time and local situations. Molle sums up the current state of knowledge :

The review of the literature on industrial migration has shown that a number of aspects are well evidenced, but that the knowledge on the quantitative importance of the different factors that influence migration remains far from satisfactory. (56)

Table 17 TRANSPORT PROBLEM OF INNER CITY FIRMS

Nature of problem	likely effect
<p><u>For Employees</u></p> <ul style="list-style-type: none"> - insufficient or expensive car parking both on and off street - congestion on local streets, affecting both car drivers and public transport users. - inadequate public transport, in particular inadequate services to some areas, low level of service, unreliability, transfers and cost. 	<ul style="list-style-type: none"> - lost time - additional cost - frustration and absenteeism - adverse effect on recruitment and retention of suitable staff
<p><u>For deliveries and visits to and from the firm</u></p> <ul style="list-style-type: none"> - congestion, caused by both parked and moving vehicles - lack of parking space, both on and off street, for goods vehicles - difficult access to premises along narrow twisting and badly maintained streets often not adequately signposted - indirect routeing - inadequate on-street loading zones - inadequate loading/unloading facilities and buildings - inadequate manoeuvring space on local streets and within premises - restrictions by local authorities or clients on delivery times, loading zones etc and lack of concern for firms by local authorities when designing traffic management schemes. 	<ul style="list-style-type: none"> - lost time by delays and queueing on local streets and at delivery points - lost time because of extra travel distances - additional delivery costs - restrictions on size of vehicle - delays in vital deliveries - additional stockpiling costs - missed appointments - lost sales and goodwill

It is appropriate to consider the criteria for choice of relocation site at both the regional and local level. Much of the previous work has been concerned with the former and has tended to disregard the importance of local access. At the regional level labour availability appears to be the most important criterion, but markets, government influence, personal preferences, environmental assessment and in a general context the availability of sites also influence the decision. Transport is a factor when considering both markets and labour.

In many respects criteria at the local level are more important because in many cases firms do not move very far and because local authorities can have a significant influence over factors such as the supply of land and premises, provision of services etc. The determining criterion in a firm's choice of location is almost invariably the availability and cost of suitable premises. Markets and labour (availability and/or retention), both with transport implications, are also primary factors. Transport is consistently mentioned as important, the main criteria being local streets and access (rather than proximity) to motorways and perhaps specialized transport facilities such as ports etc.

Because of either the aggregation, inadequacy, or contradictory nature of the data, no definite conclusions can be drawn as to whether particular firms are likely to be more mobile than others and whether particular firms are likely to have special problems.

In developing a methodology for the present project, a number of observations can be made:

- Many of the problems of existing sites are very localized, suggesting that a disaggregated approach is appropriate. Adopting the individual firm as the unit for detailed analysis would avoid many of the difficulties associated with more aggregated studies.
- There is at present a lack of quantitative information as to the cost to the firm of its transport (and other) problems. Because of this it is not possible to assess the absolute or relative importance of these problems, or the benefits accruing to the firm from possible solutions.

- There is no indication whether the transport problems of inner city firms are more severe than those of firms located elsewhere in the same urban area.
- The relative importance of various factors does depend on where and when the study was carried out.
- Many previous studies have used attitudinal surveys to identify problems or factors. The perception of problems will depend very much on the interview technique and questionnaire design, particularly with regard to prompting and listing of possible problems or factors.

4. TRANSPORT COSTS

4.1 The costs to industry

It is useful to consider briefly the magnitude of transport costs in relation to the total costs of the firm since it is reasonable to assume that, other things being equal, the larger proportion transport costs are of total costs, the more important it will be as a location factor. It may also provide a guide as to the order of magnitude of benefits which may be obtained through transport improvements. An initial problem in the literature is the variability in reporting of costs, making direct comparisons difficult.

Costs are frequently related to the total costs of producing and distributing manufactured goods by considering the net output of the sector as a whole. As Brown (7) points out, when considering costs to individual firms, gross output will be a more relevant production quantity, which has the effect of reducing the proportion of costs attributable to transport considerably. A system of uniform delivered prices for supplies may also mean that the firm is only directly aware of the transport costs of outgoing products. This may help to explain the fact that the problems of suppliers do not appear to be well appreciated.

Given these conditions, the following studies have reported on transport costs:

Edwards (22). Transport costs represented 9% of the total costs of producing and distributing manufactured goods (1963 data) for the sector as a whole. This did not include intermediate selling. For the firms themselves, the value was estimated at 3.5% of their total sales value.

Brown (7) quotes values of transport costs for metal manufacture and engineering as about 3% of the value of product.

Dawson (18) Transport costs were 3% of total production costs (1968 data).

Hayden (31) Transport costs for manufacturing firms ranged from under 1% up to 8% of total cost. It was 10% for one firm with a field service.

Boyland (6) On average transport costs were 7.3% of final costs for manufacturers (ie. % of value of net output).

Gray and Leake (24) quote transport costs ranging from 5.4% to 1.5% of net output, depending on the industry.

Edwards (22) calculated total transport costs as a percentage of net output for industry based on SIC groupings, and ranked these groups according to the relative importance of transport costs (Table 18).

Table 18 TRANSPORT COSTS BY INDUSTRY GROUPING

industry group	transport costs as % of net output		actual transport costs incurred - ranking from high cost to low cost	
	value(%)	ranking	cost/ton	cost/ton mile
mining and quarrying	26.15	1	14	12
bricks, pottery etc.	15.40	2	13	12
food, drink, tobacco	13.94	3	9	8
timber, furniture etc.	8.77	4	2	2
chemicals and allied	7.03	5	11	11
construction	6.67	6	n.a.	n.a.
metal manufacture	6.64	7	12	12
paper, printing etc	5.73	8	6	2
metal goods n.e.s.	4.97	9	5	10
other manufacturing	4.46	10	7	8
leather, leather goods, fur	4.23	11) 10) 1
textiles	3.34	12		
gas, electricity, water	2.74	13	n.a.	n.a.
engineering and elect.goods	2.68	14	3	5
clothing and footwear	2.42	15	4	5
vehicles	2.16	16	1	2
shipbuilding	1.22	17	8	7

Source: reference 22

Edwards suggests that high transport costs in relation to net output may be due to either:

- average transport costs but low value added
- high transport costs but average value added,

and to determine those industries where actual transport costs as such are high (irrespective of net output) it is necessary to compare the transport costs per ton and per ton mile. Both are required because different industries may be characterized by different lengths of haul. These are ranked in descending order in Table 18 above.

Edwards notes that timber and furniture, engineering and electrical goods, vehicles, and clothing and footwear are associated with high transport costs, whether measured per ton or per ton mile. The latter three of these industries are among the lowest cost groups in relation to net output and hence their high actual transport costs are modified by high value added. Conversely chemicals and allied industries, metal manufacture, building materials, and mining and quarrying have low actual transport costs but rank relatively high when net output is considered because of the low value added. The implication is that the actual transport costs faced by the industry, although relatively cheap, may still be important because it is not "cheap" in relation to the low value of the industry's output.

4.2 Cost disaggregation

Perhaps of more importance than total cost variations between industries, is the variation in transport costs according to the composition of the vehicle fleet. As would be expected both standing and running costs increase with vehicle size, but are more than offset by greater carrying capacity so that unit costs fall rapidly as vehicle size increases, as indicated in Tables 19 and 20. The implications are clear, since in the long term vehicle fleet composition is one aspect of operations over which the firm has control. This must be balanced against the relatively high proportion of total transport costs which may be grouped together as terminal costs, and which are incurred irrespective of location or the distances travelled by the vehicle fleet. These may possibly be of the order of 70% (7).

Table 19 COMPARATIVE COST OF TRANSPORTING 20 TON IN DIFFERENT SIZED VEHICLES
(assuming a full load).

(a) over 100 miles (200 mile return)

vehicle	number required	mileage	cost (£)	cost/ton (£)	index	fuel consumed (galls)
20 tons artic.	1	200	46.51	2.33	100	25
10 tons rigid	2	400	58.60	2.93	126	36
5 tons rigid	4	800	99.76	4.98	214	47
3½ tons rigid	6	1200	111.66	5.58	239	63

(b) over 5 miles (10 miles return)

vehicle	number required	mileage	cost (£)	cost/ton (£)	index	fuel consumed (galls)
20 tons artic.	1	10	26.40	1.32	100	1.2
10 tons rigid	2	20	29.54	1.48	112	1.8
5 tons rigid	4	40	48.76	2.44	185	2.9
3½ tons rigid	6	60	62.64	3.13	238	3.2

Source: A.J. West reported in Boyland (6).

Table 20 TRANSPORT EXPENDITURE 1975

vehicle size GVW (tons)	goods moved tonne kms (10 ⁹)	estimated expenditure less tax (£10 ⁹)	average expenditure per tonne km (pence)
<3.5	2.9	3.1	107
3.5 - 8.5	3.5	0.9	26
8.5 - 16.0	21.3	2.0	9.4
16.0 - 24.0	14.6	0.7	4.8
>24.0	49.5	1.4	2.8
Total	91.8	8.1	

Source: reference 54

4.3 Firms' perception of costs

There is evidence that many firms are unaware of the size and relative importance of their transport costs, and that very few carry out any systematic study of their transport operations. A recent London warehouse survey found that in general company records were inadequate for analysis purposes (64). The results of two surveys of firms' appreciation of their transport costs are presented in Table 21.

Table 21

(a) KNOWLEDGE OF OPERATING COSTS BY FIRMS OPERATING THEIR OWN VEHICLE FLEETS (1969)

	% of firms
No more than general knowledge of total costs of fleet	49
Some broad estimates available of average cost per ton	13
Detailed costing of certain vehicles or groups of vehicles or selected traffic flows	20
Detailed and up-to-date information of fleet operating costs	18
Total	100

(b) KNOWLEDGE OF OPERATING COSTS BY FIRMS OPERATING THEIR OWN VEHICLE FLEETS (1953)

	% of firms with less than 200 employees	% of firms with more than 200 employees
No accurate information on actual costs	46	14
Knowledge of overall costs from accounts	52	28
Knowledge of overall ton-mile costs	-	30
Knowledge of particular ton-mile costs or certain services	2	13
Operating costs of each vehicle related to traffic carried	-	15
Total	100	100

Source: Report on Traffic Costs and Charges of Freight Transport in Great Britain by A.A. Walters & C.S. Sharp (Birmingham University 1953), and The Allocation of Freight Traffic - A Survey by C.S. Sharp (Ministry of Transport, London 1970) - reported in reference 19.

It appears that cost is not the main consideration in the transport operations of firms (7). In studies in Swindon (34), only 3 out of 52 transport operators gave minimization of transport costs as their prime objective. Cost minimization is a secondary objective, to be aimed for within the constraints imposed by the necessity of providing a certain level of service

to customers (13). The important elements of this level of service include:

- certainty of delivery time
- speed of delivery
- reliability
- security and freedom from loss and damage

The results of 12 studies on the reasons for choice of mode of transport are summarized in Table 22 (19). In 5 of the 7 studies where "certainty of delivery time" was asked, it was the most important factor, and in the remaining 2 it was the second most important. Speed, although still very important, ranked behind certainty of delivery time. When asked why speed was important the majority of shippers said it was important to "meet customer's requirements" and not to "keep their own stock levels low" or achieve a "speedier turn around of vehicles". That is, speed is required in order to offer a direct benefit to customers and is not seen in terms of cost savings for the shippers themselves.

Table 22 REASONS FOR CHOOSING MODE OF TRANSPORT BY INDUSTRY, ACCORDING TO IMPORTANCE

	EMVID (Industry)	EMVID (Commerce)	Institute of Transport Munster (Glebe)	Institute of Transport Munster (May)	BDI (Bonn)	IHK (Bonn)	IHK (Osnabruck)	Ministry of Transport (Austria)	E.E.C.	Institute of Transport, Cologne (Industry)	Institute of Transport, Cologne (Commerce)	Institute of Transport, Cologne (Experts)
Certainty of delivery time	-	-	2	-	1	1	1	-	-	1	1	2
Charge	2	1	3	4	3	3	2	3	1	2	3	1
Speed	1	2	1	1	-	-	-	2	2	3	4	4
No transshipment	5	-	-	-	-	-	-	-	-	4	5	3
Immediate possibility of substitution	-	-	-	-	-	-	-	1	-	5	2	11
Safety	3	3	6	-	6	4	3	6	4	6	9	6
Regularity	-	-	-	-	-	-	-	3	7	7	7	-
Service to customer	-	-	-	-	2	2	-	9	-	8	6	7
Packing costs	-	4	5	2	5	5	4	7	-	9	11	8
Consignment size	4	3	-	-	-	-	-	-	6	10	10	5
Location of firm	-	-	-	-	-	-	-	4	5	11	12	12
Length of haul	6	-	-	-	-	-	-	-	-	12	8	9
Advertising	-	-	-	-	8	7	6	5	-	13	13	13
Transshipment costs	-	-	4	3	4	3	3	-	-	-	-	-
Empty running	-	-	5	-	7	6	5	-	-	-	-	-
Cash on delivery	-	-	-	-	9	8	7	8	-	-	-	14

Source: reference 19.

5. INDUSTRIAL TRAFFIC GENERATION

5.1 General characteristics

The incidence of transport problems will depend largely on the scale and relative importance of the transport aspects of the firm's operation. A considerable amount of work has been done on industrial traffic generation, and it is possible to draw general conclusions as to the trip generation rates of different activities. Total traffic associated with the firm is then dependent on its principal activity, size, and any particular operating procedures adopted by the firm itself. It is not clear however if there is a relationship between the traffic generation rate of the firm, and the transport problems suffered by that firm, and as mentioned in Section 3.4 very little can be concluded as to which types of firms are likely to be more affected than others. There is, of course, the largely unproven hypothesis that firms with a large amount of goods vehicle activity suffer greater transport problems.

Most studies of industrial trip generation have developed trip rates in terms of the number of vehicle trips per unit size of the firm for particular industry groups such as SIC, MLH, or intuitive groupings suggested by the principal activity of the firms. A review of these may be found in Gray and Leake (24). Relationships have been developed using simple or multiple regression with vehicle trip generation rate as the dependent variable and variables such as employment, site area, floor area etc. as independent variables. Leake and Gray (47) have shown that the number of vehicles operated by the firm can also be a significant variable. Statistically significant relationships have been obtained although the range within any particular industry group is large, mainly reflecting differences in the activities of individual firms.

In most cases a linear mathematical relationship has been used however Starkie (63), investigating manufacturing industry, found a logarithmic function more appropriate and concluded that this was the result of economies of scale in trip generation. Watson (70) also found log-linear somewhat better than linear and Redding (60) shows trip rates in the electrical and clothing industries decreasing with the size of the firm but used simple linear regression of total trips against total employment (and area) to explain overall generation. For certain types of movement a parabolic function has explained generation rates better than linear relationships (46). Decreasing trip rate with increasing size of firm may be due to the increased use of heavy vehicles by large firms, at least in the case of warehousing (64).

Comparisons between studies (2) indicate that the relationships are stable, at least in the short term. However in the longer term technological changes may alter the relationship between production and measures of area, employment and employment mix. Even in the short term fluctuations in economic activity are likely to affect production levels, and hence traffic generation, to a greater extent than employment and more particularly area. Furthermore there is some evidence that the gross measure of size (eg. total employment or floor and site area) may not be as satisfactory as disaggregated measures such as office employment etc. (47) Data on the latter is of course less readily available and more difficult to predict.

Most studies have considered vehicle trips without regard to the size of the vehicle. Carrying capacity per trip varies with vehicle size and there is evidence that consignment size varies between major industrial groupings (30). Watson (70) argues that it is important to distinguish between the generation of shipments (consignments), and vehicle trips, with consignments being the more appropriate measure of generation, with actual vehicle trips being determined through a loading sub-model. Commodity classification can take account of much of the variability in consignment size, as indicated below.

	% consignments < 22 lbs	% consignments > 1 ton
engineering & elect. equipment	49%	4%
steel	2%	33%

source: reference 19.

Recent work by TRRL (2, 3) has incorporated gross vehicle weight (GVW) as a measure of vehicle size in trip generation analysis. This is likely to be an important consideration because of the relative and growing importance of heavy vehicles in terms of tons delivered to the manufacturing and commerce/haulage sectors. Vehicles greater than 16 tons GVW are 10% of the total commercial vehicle fleet, but handle 67% of total goods movements, with the heaviest 5% carrying 54% of the traffic. (54) Consideration of the vehicle mix is also likely to be important because of the particular local problems of operating heavy vehicles in inner areas, and the fact that many types of area control attempt to restrict heavy vehicles in one way or another.

The general conclusions of the various studies may be summarized:

- Linear relationships are appropriate for most activities.
- A functional grouping of firms may lead to better results than, say SIC.
- Irrespective of the grouping, within-group variation is quite large, reflecting both different activities within the group and differences in the operational characteristics of individual firms. If possible activities with widely different inputs and outputs should not be grouped together.
- Employment, site area, or floor area of the firm are the most common independent variables. For some activities the explanatory power depends on which is chosen (eg. site area appears most suitable for haulage and warehousing) while for others it is relatively insensitive to choice of variable. In general aggregate measures have been satisfactory, but there may be exceptions, and in any case it may be more difficult to explain or rationalize the relationship.
- Regarding the size of firm, Leake and Gray (47) suggest that the reasons for the high constant terms in the linear equations may be (a) non-linearity when dealing with small firms,
(b) a minimum level of vehicle activity associated with servicing small firms.

There is also evidence that trip rates decrease with increasing size of firm, while the proportion of heavy vehicles increases.

- Allowance for different categories of vehicles improves the understanding of the relationships and the uses to which they can be put.
- In addition to actual trip rates, the following will also be important considerations:
 - (a) size of individual consignments
 - (b) load in relation to size of vehicle
 - (c) distribution of origins and destinations
 - (d) daily distribution of trips
 - (e) non goods vehicle trips associated with the operation of the firm.

5.2 Trip generation by industry

In general manufacturing is associated with low trip rates in relation to other industries and services (Tables 23, 24, and 25).

Table 23. DAILY TRIP ATTRACTION RATES (per employee)

	manufact.	constr.	utilities	transport	retail	w'sale	services
light goods vehicles	.024	.076	.059	.060	.145	.148	.058
heavy goods vehicles	.024	.085	.065	.108	.091	.197	.025

Source: reference 72

Table 24 VOLUME OF GOODS FLOW BY TYPE OF FIRM
(Tons per week input and output combined)

	manufact.	transport/ distribution	other (eg.local services)	all types
average per employee	3.6	16.3	6.2	6.9
average per hectare of site area	253	1189	359	491

Source: reference 36

Table 25 TRAFFIC GENERATION COEFFICIENTS
(Numbers and GVW of vehicles per week)

	manufact.	transport/ distribution	other (eg. local services)	all types
average goods vehicle trips per employee	0.6	3.8	2.4	1.5
average goods vehicle trips per hectare of site area	40	258	141	106
average GVW of traffic per employee	7	36	26	14
average GVW of traffic per hectare of site area	479	2421	1489	1066

Source: reference 36

As part of the West Yorkshire Transportation Studies (72), trip generation rates per employee were examined for various industries, which were then grouped, as high, medium or low generators. These are compared in Table 26 with studies of a more limited range of industries by Skellern (62) and Starkie (63) which, given the inherent variability in generation rates, show reasonable agreement. The ranking also shows general similarity with the ranking of industries according to their transport costs.

Table 26 RANKING OF TRIP GENERATION RATES (per employee)

source	high generators	medium generators	low generators
West Yorkshire Transportation Studies (72)	mining, quarrying bricks and cement bakeries, drink construction distributive trades - wholesaling transp. & comm.	chemicals & allied tractors paper, printing & publishing glass & pottery metal goods not otherwise spec. timber food - except bakeries & tobacco	metal manufact. eng. & elect. goods textiles clothing & footwear furniture leather, leather goods and fur other manufact. industries
Skellern (62)	petroleum distrib. distributive trades food	chemicals textiles timber	electrical engineering
Starkie (63)	food, drink, tobacco building manuf. ready mixed concrete	paper, board, cardboard	chemicals, timber fittings printing publishing precision eng. clothing

Millar and Mellon (55) on the other hand analysed manufacturing industry groups on the basis of floorspace. The values and ranking are shown in Table 27.

Table 27 DAILY MANUFACTURING TRIP GENERATION RATES (per thousand sq. feet)

industry group	goods vehicles		visitors cars	
	rate	ranking	rate	ranking
construction	1.57	1	0.76	1
metal goods n.e.s.	1.41	2	0.22	10
wholesale distribution	1.27	3	0.68	4
vehicles	1.16	4	0.72	2
bricks, pottery, glass and cement	1.03	5	0.65	5
leather, leather goods, fur	0.97	6	0.70	3
timber, furniture etc.	0.72	7	0.38	8
clothing and footwear	0.69	8	0.50	6
food, drink, tobacco	0.56	9	0.18	13
paper, printing and publishing	0.53	10	0.40	7
textiles	0.41	11	0.22	9
engineering and elect. goods	0.33	12	0.19	12
other manufact. industry	0.32	13	0.20	11
chemical and allied	0.23	14	0.08	14
metal manufacture	0.15	15	0.06	15

Source: reference 55.

An unpublished analysis of a pilot study of 182 firms in Hull (2) used a functional grouping of firms according to the nature of their principal activity, in an attempt to avoid the large spread of values characteristic of some SIC groups (notably XXII and XXIII). All non-food manufacturers were considered as one group. To account for the size of goods vehicles, trips were weighted according to the GVW of the vehicle making the trip. Daily GVW weighted trip generation rates were calculated and are shown in Table 28. The values quoted should be regarded as tentative, subject to the results of more extensive studies. As with other studies, considerable variance was noted within each group. Because of the industry grouping and weighting, results are not directly comparable with other values reported here.

Table 28 DAILY GVW WEIGHTED TRIP ENDS
(ie. arrivals and departures times GVW of vehicle involved)

functional group	per employee		per hectare site area	
	value	ranking	value	ranking
haulier	35.81	1	1898	4
dealing in building materials	28.16	2*	500	14
fuel distributors	27.91	3	1143	11*
dealing in food products	18.27	4	10217	1
waste disposal	16.50	5	4099	2
animal feedstuffs and grain milling	15.44	6	1699	7
dealing in other materials	15.35	7*	1340	9
warehousing	12.54	8*	857	12
wholesalers	7.58	9	1890	5
retailers and retail distribution	6.28	10	2786	3
building services	6.26	11*	1366	8*
builders	6.01	12	1809	6
bakers	3.84	13	1269	10
all non-food manufacturers	2.87	14*	530	13*
food processors	1.51	15	388	16
printers	0.76	16	421	15

* the standard deviation expressed as a percentage of the mean was particularly high for these groups. Source: reference 2.

Both the number of vehicle trips, and the size of the vehicles involved, can be expected to influence the extent of a firm's transport problem. The data presented in this section allows an assessment to be made of the relative traffic intensity both within manufacturing and also associated service industries. All the studies however indicate that within any particular grouping of firms there are likely to be large variations in goods vehicle activity, depending partly on differences in the principal activities of the firms and partly on characteristics of the operations of the firms themselves.

6. JOURNEY TO WORK

Firms identify the recruitment and retention of suitable labour as a major factor causing them to relocate, and perhaps as the most important criterion in the choice of the new site. For firms in inner areas, employee access and associated problems are perceived as being at least as important as problems with goods vehicle operation (refer to Chapter 3).

The general pattern of labour catchment areas is largely as would be expected with manufacturing drawing labour from relatively small areas. The unskilled, semi-skilled and many clerical workers have short travel distances and rely to a large extent on public transport. The skilled and professional/managerial groups travel longer distances and use a car to a greater extent, and there is a growing tendency for the more highly paid semi-skilled manual workers to commute longer distances also. Females tend to work locally more than men.

A sample of 88 London manufacturing firms revealed the following catchment areas (Table 29)

Table 29 CATCHMENT AREA OF MOST WORKERS - LONDON

catchment area	large	medium	small	total firms
up to 2 miles	9	22	22	53
up to 4 miles	6	1	3	10
up to 10 miles	4	8	5	17
more than 10 miles	-	2	4	6
not known	2	-	-	2
Total firms	21	33	34	88

Source: reference 31

And the Lambeth study (44) provides additional information on which groups of employees lived locally - defined as a 3-4 mile radius. (Table 30)

Table 30 HOME LOCATION OF EMPLOYEES - LAMBETH

home location of employees	manufact.	service	total
most/all local	1	4	5
manual & clerical local; senior & managerial not	10	3	13
manual local; non-manual not less skilled & clerical local; skilled and senior not	3	-	3
less skilled only local	4	-	4
clerical only local	1	1	2
few/none local	2	3	5
	5	1	6

Source: reference 44.

Of the inner area resident labour force, one of its main characteristics is the proportion who work locally (9). Presumably this is partly caused by their low level of car ownership in relation to the whole of the urban area. In the case of Liverpool this is two-thirds that of the city as a whole, dropping to one quarter on inner council estates. The Lambeth studies reach the same conclusions (44) with only 1 in 7 residents having a car available for the journey to work and quoting public transport availability and cost as restricting the range of job choice for local residents. The percentage of work trips by car for local residents was about half the London average, and had not increased significantly over the last 5 years (43).

The most frequently occurring problem of access to work is the poor level of service, unreliability, and cost of public transport (particularly bus). Cost was generally mentioned less often than the other two factors, and the conclusion is that any improvement in services between residential and industrial areas would benefit firms and employees. Brown (7) quotes results indicating a high correlation between firms with problems of labour recruitment and high labour turnover and those with a high percentage of employees using public transport for the journey to work. This corresponded closely with firms complaining about poor public transport. Conversely, low labour turnover was associated with firms having a high proportion of employees walking and cycling to work.

There is little quantitative information on parking and its effect on the journey to work for manufacturing employees, but problems of employee parking are frequently mentioned in the attitudinal surveys. An indication of the influence of parking conditions and availability can be gauged from a survey of offices in London (68). There was a strong correlation between parking availability and the proportion of journey to work trips by car; areas with free on-street parking having about 60% more car trips than areas where there was a total restriction on on-street parking. This had implications for the time of the journey to work, since for equivalent distances, travel by car was considerably faster than by public transport (15.3 mph compared with 5.37 mph average).

7. THE IMPACT OF TRAFFIC CONTROL MEASURES

A large amount of the quantified work done at the level of the firm has been concerned with the evaluation of various control measures. The most extensive has been that carried out by TRRL. Among other things the consequences for commercial vehicle operators of controls which would cause alterations or restrictions to their normal operations were considered.

It is useful to review briefly one form of control, namely restriction on vehicle weight, since to some extent the results indicate the relative importance of goods movements and deliveries, and the alternatives open to operators faced with the possibility of this type of restriction. As such it provides an indication of the degree of flexibility in their operations, their ability to adapt to a changed traffic environment, and the likely level of any cost penalties.

In addition, the Heavy Commercial Vehicles (Controls and Regulations) Act of 1973, the Dykes Act (35) required local authorities to prepare lorry plans which for the first time allowed the denial of access to lorries on amenity grounds. This has usually led to local controls on vehicle weight at particular locations (zones or individual roads), rather than county wide lorry routeing (23). The process is on-going and closely associated with traffic management in general so that controls, probably of a relatively minor nature, are likely to be a feature of urban traffic control in the future.

The results of a number of studies are summarily reported in the following section. The type of control, its effect, the reaction of firms to the control measures, and the methodology used for evaluation are briefly discussed. No attempt is made to report on the environmental consequences, nor to assess the effectiveness or desirability of the various controls. Other forms of control such as parking, road pricing etc. have not been considered. With the exception of Windsor, all studies refer to possible controls rather than implemented schemes.

7.1 Effects of controls and reaction of firms

Hertfordshire (11)

Control: Control on four GVW limits, designation of three alternative lorry networks, and two alternative rules allowing vehicles to enter and leave the network ("free access" by any road available, "fixed access" by the shortest time route). The study area was the middle section of the county bounded by the M1 and A1.

Method: Survey of existing commercial vehicle movements and hence O-D matrix, re-routeing of affected vehicles by assignment techniques. Costs calculated from changes in journey distances and speeds.

Reaction: It was assumed that affected vehicles would re-route in compliance with the controls.

Results: Changes in congestion costs to road users in general were considered to be too small to warrant analysis. Goods transport costs shown in Table 31 are financial costs to all operators net of any transfer payments, at 1975 prices.

Table 31 ADDITIONAL ANNUAL GOODS TRANSPORT COSTS - HERTFORDSHIRE (£)

weight limit GVW.	free access rule			fixed access rule		
	fine network	medium network	coarse network	fine network	medium network	coarse network
7.5	90,000	280,000	120,000	90,000	780,000	970,000
11	80,000	260,000	110,000	80,000	620,000	740,000
16	50,000	140,000	70,000	50,000	250,000	280,000
24	40,000	80,000	50,000	40,000	140,000	140,000

Source: reference 11

Swindon (5)

Control: Total ban on vehicles over 3 tons ULW in town centre (vehicles carrying building materials exempt).

Method: Data on goods vehicle operations from 48 firms. Computer based model to revise the operations of vehicle fleets due to the change in vehicle size.

Reaction: It was assumed that operators would continue to use existing depots, maintain existing levels of service to customers (eg. same frequency of delivery) and change to vehicles just under 3 tons ULW.

Results: The results at 1973 prices are shown in Table 32.

Table 32 TOWN CENTRE RESTRICTION - SWINDON

	before	after
<u>on vehicles</u> (average values):		
gross weight of vehicles used (tons)	12.3	6.6
transport costs ie. standing & running costs (£/ton)	7.2	10.4
daily freight vehicle - mileage in Swindon	2500	3400
<u>on vehicle fleets</u> (average values):		
no. of vehicles in fleet	16	23
weekly vehicle-mileage of whole fleet	9600	15600
fuel consumption of whole fleet (galls/week)	740	920

Source: reference 5.

Swindon (14)

Control: "No entry except for access" for nine GVW limits and four alternative control areas.

Method: Computer based model to identify and re-route affected vehicles and estimate total costs to all operators and total congestion costs for the town.

Reaction: It was assumed that affected vehicles would re-route.

Results: The changes produced by the more promising control measures are shown in Table 32. There were larger changes for the "large intermediate area" because as the control area was reduced in size, more vehicles became affected by the restrictions. The reason is because of the way in which the "except for access" works. "Although the total number of movements by vehicles above the weight limit must decrease as the control area is reduced in size, some of the remaining movements change from being exempt from the control to being subject to it as origins and destinations cease to be within the control area" (14). For example for the 8.5 tons GVW limit 590 journeys per day are affected for the whole town control area (20% of all journeys by vehicles above the limit in the control area) compared with 950 journeys in the large intermediate area (50% of all journeys).

Table 33 NO ENTRY EXCEPT FOR ACCESS - SWINDON

control area	weight limit GVW	daily reduction in vehicle miles of travel		annual cost (£)	
		on shopping streets	on residential streets	to operators	to the community
whole town	8.5	150	1700	25000	8000
	16	70	860	14500	4500
	24	40	420	6000	500
large intermediate area	8.5	300	1700	75500	44000

(Community costs are net difference between operators and congestion costs)

Source: reference 14.

Swindon (15)

Control: "No entry" (24 hour and peak period only) for a range of vehicle weights and three different control areas.

Method: Computer based model; re-routeing affected vehicles if possible, if not selecting an option according to likely operator response estimated from interviews.

Reaction: Re-routeing if possible. If not, replacement journeys chosen from one of the following options:

- use smaller vehicles (for the whole trip)
- use transshipment (located just outside the control area)

and the additional alternatives for peak period control:

- reschedule
- reschedule with more vehicles.

The effect of transshipment was negligible and most operators would not choose this option, which had a high cost penalty.

Results: Table 34 summarizes the results in terms of total journeys affected and total cost changes, estimated for the whole of the study area. For peak period controls, congestion was reduced during these periods and increased during the off-peak.

Table 34 NO ENTRY - SWINDON

control measure	weight limit GVW	no. of affected journeys /day	total changes in costs (£/day)	
			operators	congestion
no entry - 24 hours	11	1520	4410	-6
	16	660	1220	-21
	24	280	320	-15
no entry - peak period	8.5	840	1118	-105
	16	290	280	-55

Source: reference 15

Windsor (10)

Control: Selected roads in the Windsor area protected by restricting vehicles over 5 tons ULW on short (50 metre) sections. Exemption for certain vehicles.

Method: Classified vehicle counts, speed measurements, compliance surveys, O-D interviews used to estimate change in routeing and hence distance and time changes. Changes in operators' costs calculated from these, at June 1978 prices.

Reaction: Affected operators were forced to re-route.

Results: For an average 12 hour weekday there was a reduction of about 1200 heavy goods vehicles crossing the main Windsor cordon, that is, about 30% in the total number of goods vehicles over 1½ tons ULW and 2½% in total traffic. Except for one survey site, violation rates ranged from 13-32%, averaging 23%. From the changes in routes, the following changes at four selected sites were estimated, assuming full compliance (Table 35). This

represents a total cost increase to all operators for an average week of £10,200 (with full compliance).

Table 35 GOODS VEHICLES RESTRICTIONS - WINDSOR

	site 11	site 13	site 14	site 16
mean distance increase/affected vehicle (miles)	2.3	4.4	4.0	3.1
mean time increase /affected vehicle (mins)	2.9	6.7	7.0	3.9
mean cost increase/affected vehicle (£)	0.58	1.20	1.26	0.70
Total 12 hour daily cost increase (£)	295	210	980	85

Source: reference 10

Hull (21)

Control: GVW limits as detailed below. The study area was an inner urban area with mixed land use immediately north of the city centre.

Method: Interviews with 30 firms in the study area to determine their likely response to the possible controls.

Results: There are problems with interviewee response to hypothetical situations, although in order to gauge the feasibility and relative attractiveness of alternative options which may be open to firms faced with possible controls there may not be any other method available. It would have been more helpful however to have placed the subjective responses in the context of the likely costs to the firms of the controls suggested. The control measures and the reaction of firms is shown in Table 36.

Table 36 EFFECT OF CONTROL MEASURE - HULL

control measure	effect and reaction of firms
"no entry except for access" over 16 tons GVW in a defined part of the town centre	would not significantly affect firms' operations
"no entry except for access" over 16 tons GVW within the residential part of the study area	firms would re-route vehicles - the alternative routes which would be required were generally acceptable, if less convenient
restriction on vehicle weight or length within the industrial part of the study area eg. a ban on vehicles in excess of 40 feet	firms would consider the following alternatives: - changing to smaller vehicles - setting up transshipment depots outside the control area - 2/3 of firms would probably cease operations in the control area (most would relocate, 6 would consider closing).

Hull (3, 73)

Control: "No entry" (24 hour and peak period only) and "no entry except for access" for four different GVW limits and eight different control areas.

Method: Adaptation to Hull (pop. 350,000) of the computer based models developed during the Swindon studies.

Reaction: In the case of "no entry except for access" it was assumed that all operators would re-route affected vehicles. The reaction to the two "no entry" controls was based on interviews with operators to determine their likely response depending on their particular circumstances. Those alternatives which operators would actually use are listed in Table 38.

Results: The effects taken over the whole of the town in terms of changes in the total distribution costs of all operators and total congestion costs for all road users (1974 prices) are summarized in Tables 37 and 38. Only two of the eight control areas are included viz. town centre and whole of town.

Table 37. NO ENTRY EXCEPT FOR ACCESS - HULL

control area	weight limit, GVW	total no. of veh. journeys affected/day	total daily cost changes (£)	
			operators	congestion
town centre	2	5600 (90%)	560	-50
	8.5	3220 (94%)	401	-77
	16	1340 (98%)	204	-61
	24	850 (98%)	139	-48
whole of town	2	440 (3%)	506	-120
	8.5	350 (4%)	442	-100
	16	175 (7%)	312	-61
	24	100 (7%)	185	-37

(Numbers in brackets are percentage of vehicles over the stated limit within the control area which are affected).

Source: reference 3.

Table 38 NO ENTRY 24 HOURS AND PEAK PERIOD ONLY - HULL

control area	weight limit GVW	reaction	total no. of veh. journeys affected/day	total daily cost changes (£)	
				operators	congestion
no entry - 24 hours, town centre	8.5	re-route	3100	390	25
		smaller vehicles	210	3145	
		tranship	70	725	
		total	3380	4260	
no entry - 24 hours town centre	16	re-route	1230	200	-50
		smaller vehicles	30	210	
		tranship	10	320	
		total	1270	730	
no entry - peak period only town centre	8.5	re-route	1270	120	-20
		reschedule	60	0	
		smaller vehs.	10	140	
		total	1340	260	
		(tranship was not considered a viable alternative)			

Source: reference 3.

Hull (4)

Control: A designated lorry network for the whole town, four GVW limits, access to the network by a "minimum distance" rule. In addition the effects of proposed new roads were considered: Network 1 contained new east-west routes on the southern edge of the town and Network 2 incorporated these plus a northern town centre by-pass.

Method: Adaptation of the computer based Swindon models.

Reaction: Re-routeing of affected vehicles was assumed.

Results: Effects were measured over the whole of the town in terms of changes in commercial vehicle flows and changes in total operators' costs and total congestion costs compared with the 1974 base network (at 1974 prices).

Designated Lorry Network: For a 8.5 tons GVW limit there would be reductions in flows of vehicles over the limit of some 90% on town centre streets and 10-50% on most other non-designated streets. The majority of designated roads would have increases of 10-40%, with one exception where flows would increase eight fold. Inside the central area there would be an increase of 5-10%, since the designated network was finer in this area than the rest of the town.

Total daily cost increases due to re-routeing commercial vehicles onto the designated network are shown in Table 39. The report notes that the cost increases for operators is at least three times that for "no entry except for access" controls (3). This is largely the result of the "minimum distance" access rule, causing many vehicles to be re-routed which would not be required to do so under a "free" access rule.

Table 39 DESIGNATED LORRY NETWORK - HULL

weight limit GVW	total daily increase in operator costs (£)	total daily increase in congestion costs (£)
2	3330	280
8.5	1390	150
16	330	80
24	230	0

Source: reference 4.

Proposed New Roads: The effect of the new roads has been compared with the 1974 base network for the whole of the town (ie. without lorry routeing). With Network 1 there are considerable reductions in commercial vehicle flows in the central area, of the order of 60-80% on some streets and bridges. These flow patterns are essentially unchanged with the introduction of the northern by-pass (Network 2), however there are further reductions in central area commercial vehicle volumes.

Total daily cost savings to operators are about 0.5% of base network costs, but taken over a full year can be considerable. Whether there would be increases in productivity of the firms involved as a result of time savings was not investigated and the results of a study in St. Helens (74) suggest that time savings in general would not lead to productivity increases. Reductions in congestion costs attributable to commercial vehicles as the result of decreased travel times are of the same order of magnitude as operators' savings, and are 15% less than the congestion costs in the base network (Table 40).

Table 40 PROPOSED NEW ROADS - HULL

vehicle category GVW	total daily changes in operators' cost (£)		total daily changes in congestion costs (£)	
	network 1	network 2	network 1	network 2
over 2 ton	-615	-790	-480	-555
over 8.5	-575	-680	-465	-520
over 16	-390	-425	-330	-355
over 24	-255	-270	-245	-260

Source: reference 4.

Greenwich - Lewisham (30)

Controls: The following restrictions on access for GVW limits of 16 and 24 tons, in some cases with exemption on the purchase of a daily permit: lorry routeing in Greater London for vehicles over 16 tons GVW; restrictions on through movements in Inner London and restrictons on access in Inner London.

Method: Because of the complexity of the road network it was not thought practical to use a computer based model such as for the Swindon studies, which considered the effect of controls at the level of the individual vehicle. Samples of trips were manually analysed and then grossed-up, together with traffic assignment techniques.

Reaction: Reaction to various Inner London restrictions were determined from interviews with management of 206 firms in the study area, which consisted of about half of LB's Greenwich and Lewisham. The percentage distribution of reactions to alternative suggested options is shown in Table 41.

Table 41 DISTRIBUTION OF OPTION CHOICES - GREENWICH LEWISHAM (per cent)

option	type of control				
	07.00-18.00 16 tons GVW	07.00-18.00 24 tons GVW	07.00-18.00 24 tons GVW £20 permit	24 hours 16 tons GVW	24 hours 24 tons GVW £30 permit
reschedule 18.00-07.00	45	56	46	-	-
use smaller vehicles	45	34	28	57	35
tranship	1	2	-	3	2
use rail	3	2	2	4	4
use water	-	-	-	-	2
pay for permit	-	-	24	-	45
relocate	1	-	-	5	2
no option (ie. give up affected part of business)	4	6	-	31	10
Total	99	100	100	100	100
Number in sample	75	49	49	77	49

Source: reference 30.

Transshipment was unpopular because of cost and unreliability, while location of the firm often precluded use of rail or water. Cost was the criterion which made relocation of premises unattractive. Rescheduling was attractive if staffing arrangements could be made, and if not smaller vehicles would be used. Of those who could not reschedule, half would purchase a £20 per day exemption permit if that option was available. For 24 hour bans with and without an exemption permit 10% and 30% of firms respectively would discontinue the affected part of the business.

Hauliers in general were less willing than other firms to change to smaller vehicles and preferred rescheduling or purchasing permits. The type of commodity carried also had an effect on the firms' reaction. If this was high value and/or easily divisible, the use of smaller vehicles was more attractive.

Results: The reactions of operators were used to assess the effects of three types of restrictions.

Lorry Routeing: The flows of vehicles over the 16 tons GVW limit would be reduced by about 90% on un-designated roads, and would increase by some 40% on designated roads (1% and 2% respectively of total traffic on these roads). From a sample of trips it was concluded that because of the present circuitous routes taken by commercial vehicles, lorry routeing would not significantly affect distances and times, and hence operating costs would remain essentially unchanged.

Restrictions on Through Movements in Inner London: A 16 tons GVW limit would affect about 7000 trips per day, 11% of all trips over this limit in the area. Re-assignment of the affected vehicles indicated some selected streets would be severely overloaded, while others experienced considerable reductions in volumes (up to 60% in vehicles of the affected class). Because of this vehicles were permitted to use an east-west route through the control area. The restriction was subsequently revised to apply only to vehicles greater than 40 feet long, and only at night. This resulted in a cost increase due to re-routeing of affected vehicles of £0.25 per trip, or a total of £80,000 per year at 1976 prices.

Restrictions on Access in Inner London: A total ban on vehicles over 24 tons GVW was considered, either for the working day or for the full 24 hours. In the case of the latter, operators had the option of purchasing an exemption permit at £30/day so as to help reduce night movements and to allow operators the option of continuing essential operations with heavy vehicles.

The results of the management interviews were used to predict likely reaction.

After allowing for the removal of through trips, the number of trips made by vehicles over 16 tons GVW would not be greatly reduced, and costs would increase considerably. For working day restrictions, average cost per trip would increase by £1.70 and for the 24 hour ban (with permit) the average cost per trip, net of transfer payments, would be £1.50 greater. The effects of the restrictions are shown in Table 42.

Table 42. RESTRICTIONS ON ACCESS - INNER LONDON

control measure	number of trips per day				extra costs (£m per year)	
	day		night		resource (net of transfers)	gross
	>24 tons	16-24 tons	>24 tons	16-24 tons		
present situation	14700	33300	3100	6300	-	-
working day ban on vehicles over 24 tons GVW, 07.00-18.00	-	40500	10400	6300	6.5	6.5
24 hour ban on vehs. over 24 tons GVW, with exemption on purchase of £30/day permit	4300	42400	700	7700	7.0	20.0

Source: reference 30

7.2 Consequences for a single firm

For the types of controls considered, one alternative open to commercial vehicle operators is to change the composition of their fleet. Margason and Corcoran (54) report the results of a study to determine the effect on the distribution system of a company involved in deliveries to a large number of stores within a range of about 100 miles from its depot. The results are summarized in Table 43.

Table 43 EFFECT OF GVW LIMITS ON A SINGLE FIRM

weight limit GVW (tons)	no. of vehicles required	total travel kms/week (thousands)	delivery cost per ton (£)	average no. of visits to each shop/week	total fuel consumption (galls/week)
8.5	135	184	6.60	23	7700
16.0	72	88	4.30	11	4900
24.0	53	59	3.95	8	4200
32.0	45	48	3.80	6	4200

Source: reference 54.

As permitted vehicle size increases, the size of the required fleet decreases with a corresponding reduction in distance travelled per week. Delivery costs decrease rapidly at first, and then taper off. The number of visits required at each shop decreases, but in one sense this may represent a reduction in the level of service, and have consequences in terms of stockholdings, unloading facilities etc. The area required by the operator to park the vehicles is considerably less for the 16, 24 and 32 ton fleets.

The results of the studies provide an order of magnitude of the effect of one basic type of control, the restriction of vehicles above a designated weight. The reaction of operators is varied depending on the nature of their operations and the value of the commodity carried and ranges from simple re-routing, in some cases at very small cost penalty, to the extreme case of considering cessation of operations in the affected area. Intermediate reactions usually involve rescheduling or a change in vehicle fleet with varying costs incurred. Transshipment and use of other modes did not emerge as viable alternatives. Depending on the control, these costs can be considerably greater than the benefits to other road users through reduced congestion. The question of the comparison of these costs with any environmental gains has not been considered here.

The results of the studies depend to a large degree on the study area and so should not be considered out of context. For example, lorry routing was estimated to have little effect on operators' costs in Greater London, whereas in Hull it increased their costs significantly. This was mainly due to the different scale and complexities of the basic road networks.

Unfortunately what the studies do not reveal is the extent to which any costs incurred affect the viability of operators affected by the controls; or if in fact there would be significant changes in the level of service they provide to clients, including frequency of delivery, reliability etc. It is also difficult to assess any changes to the overall productivity of the firms involved, since alterations to their transport operations need to be considered in conjunction with other aspects of the firms' business.

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9. APPENDIX

DESIGNATED DISTRICTS
(England and Wales).

Districts which will contain Special Areas (Partnership Areas)

Newcastle/Gateshead	Lambeth
Manchester/Salford	Hackney/Islington
Liverpool	Docklands (parts of Tower Hamlets
Birmingham	Newham
	Southwark
	Greenwich
	Lewisham)

Districts where there will be Inner Area Programmes (Programme Authority Areas).

Bolton	Nottingham
Bradford*	Oldham
Hammersmith	Sheffield
Kingston upon Hull	South Tyneside
Leeds	Sunderland
Leicester	Wirral
Middlesbrough	Wolverhampton
North Tyneside	

* Bradford is undertaking a comprehensive community programme.

Other Designated Districts.

Barnsley	Rochdale
Blackburn	Rotherham
Brent	St Helens
Doncaster	Sandwell
Ealing	Sefton
Haringey	Wandsworth
Hartlepool	Wigan
Blaenau Gwent	Rhondda
Cardiff	Swansea
Newport.	

Source: Department of the Environment. Inner Urban Areas Act, 1978.
Circular 68/78 2 Nov. 1978 HMSO, London.