MOTORWAYS AND INDUSTRIAL LOCATION

A STUDY OF INDUSTRIAL PROPERTY DEVELOPMENT WITHIN A CONURBATION

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SUMMARY

Industrial Location Motorways Property Development
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This study examines the impact of motorways on the location of new industrial property developments in urban areas. This is achieved through investigations of manufacturing and warehousing activities within the West Midlands conurbation.

It is argued that recent research underestimates the local impact of motorways, because it concentrates on cost-based assessment. In fact, aspects of the location decision, including perception and personal preference, suggest that motorways do attract industry, and unlike ordinary roads, this attraction is concentrated around their access junctions. In addition, it is demonstrated that the growth of speculative industrial development has resulted in many fundamental location decisions being taken by the property sector and not the firm.

These issues are examined by two complementary research methods. The first is quantitative and based on the regression of land use and planning application data against a motorway access surface. The second is composed of questionnaire surveys of estate agents, developers and local authorities. Together these reveal that new industrial developments exhibit a marked clustering in the immediate vicinity of motorway junctions found in the inner industrial parts of the conurbation. In support of this behaviour, evidence is presented of the significance of frontage and prestige factors. However, in more peripheral locations, including those well served by motorways, evidence of only limited demand was discovered.

These findings demonstrate that the impact of motorways can indeed be significant at the local scale, and these routes may possibly form the focus for a new arrangement of urban industrial location based upon a corridor of motorway access points. The research also spotlights the importance of a previously ignored group of estate agents and developers, and generally supports a behavioural interpretation of location choice. Finally, the study has implications for policy issues and in particular, the West Midlands County Structure Plan.

CONTENTS

CONTENTS IN DETAIL

Page

LIST OF TABLES

APPENDICES

LIST OF FIGURES

APPENDICES

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1.0 INTRODUCTION

1.0.1 RESEARCH PURPOSE

Since the beginning of systematic spatial analysis, theories have been advanced which link the location of activities to accessibility and transport. In a similar way, many researchers have developed models of urban structure based on the assumption that land users locate so as to maximise their access to the urban centre. Many of these theories and models originated during the first half of this century. More recently urban and regional science has sought a less abstract, more realistic approach in an attempt to represent and interpret observed behaviour. In consequence detailed studies of industry have been undertaken which show transport costs to be relatively insignificant to the economics of the firm; while organisational structure and decision making behaviour have become more popular subjects for location research. Now urban form is considered to be less structured by transport systems because of the freedom of individual movement conferred by the automobile. Among researchers, these changes have reduced interest in transport and limited its ascribed importance in the location decision.

During the past three decades the U.K. has invested heavily in its inland transport systems. The construction of the national motorway network and the associated primary road programme introduced new infrastructure on a scale comparable to the laying of the railways in the nineteenth century and the digging of the canals a hundred years earlier. The motorways differed from the existing roads in a number of ways.

Firstly, although they connect urban areas they generally avoid their centres, and consequently at the local scale, they are part-circumferential and not radial. Secondly, it is only possible to join or leave a motorway at a few major junctions and not the many other roads which simply pass under or over the route. Any impacts will consequently be limited to and concentrated at these junctions. Associated with this feature is the effect of the motorway as a barrier to lateral movement, especially within urban areas. Finally, a motorway junction juxtaposes two scale of movement - one at an uninterrupted 60-70 m.p.h., and the other, often an intermittant 30 m.p.h. urban passage. Similarities can be drawn between these features and the railway where access is restricted to stations, and the lines act as a barrier.

Despite the scale of motorway investment and their differences from normal roads, many impact analysts believe that they have little significance for industrial location. Regardless of this view, considerable importance is attached to motorways in industrial promotion and in selling land or properties for industry. This is exemplified in the advertisements used to attract industrialists, where mention of motorways and other nearby transport facilities is ubiquitous. These selling points are applied by the private sector, property developers and estate agents, and the public sector industrial development or promotion units often working within local authorities. Since the war these groups have grown in number, size and influence and now account for a considerable proportion of new property developments, and have a permissive role in many more. The value these decision makers attach to motorways in location choice is sufficient to justify reconsidering their impact on industry.

In advertisements and promotions, emphasis is placed on a location's connections to the rest of its region, to the nation and to overseas. At a more local scale, a property may be described as adjacent to a key motorway junction. The former large national scale of accessibility contrasts with the local urban scale of the latter. It is through the local proximity that access to the larger networks must be obtained. Hence at the local scale it is of value to investigate the existence and extent of a motorway's influence, and this will be a central element of the present research. With many motorways lying on the fringes of urban areas, any attraction they may hold might have significant implications for urban form, possibly by encouraging industrial suburbanisation. If motorways do attract development, then they will provide the basis for an interpretation of at least one urban land use, and this basis will not be dependent on the monocentric assumption at the core of many studies of urban form. This interest in urban form means that the present research will be concerned with the location of new properties rather than the general migration of firms. Furthermore the often discussed issue of whether motorways stimulate economic growth will be irrelevant because the research is more concerned with whether they will reshape the urban form.

The above topics and issues are the starting point for the subject of this thesis. They cover the four strands of industrial location, transport, property development and urban form which will be expanded upon later. In summary this thesis seeks to investigate the influence of motorways at the local level on industrial location as a component of the urban form.

It is acknowledged that many studies of industrial location have been based upon surveys of the firm, and in consequence the present research will avoid this overworked area by undertaking a quantitative analysis of location preferences as revealed by new industrial developments throughout an urban area. To support this primary analysis, groups of developers, estate agents and local authorities will be surveyed in order to assess the importance of their role, the locational criteria they consider significant, and the knowledge they hold of the locational demands and behaviour of the firm.

This thesis examines several topics which in recent years have been avoided or neglected by other writers. Firstly, it re-examines the motorway as a determinant of industrial location. Secondly, it attempts to assess the spatial extent of any locational attraction caused by the motorway. Allied to this, the research seeks to identify the implications of motorways for industrial land use as a component of urban form, and in so doing, to provide a basis for an interpretation of urban structure that need not be monocentric. Finally, the research proposes that property developers, estate agents and local authorities have taken an increasing role in determining new industrial locations, and, therefore, the connection between these actors and the firm will be fully explored.

The research also has policy relevance. It will attempt to show where industrial development pressures are greatest in an urban area, and will, therefore, be of interest to both land use and transport planning. The results may also be interpreted in the light of urban dynamics and the drift away from the inner city to the suburbs and urban fringe where many motorways lie.

Furthermore by assessing the role of actors other than the firm in the industrial development process, groups can be identified, to whom future policies may be addressed.

1.0.2 DEFINITIONS

In this thesis certain terms will be used with a more than usually precise meaning. Unless otherwise specified, when 'industrial location' is mentioned it refers solely to newly developed industrial properties and not to the migration of firms into existing and previously occupied properties. This definition covers a considerable proportion of firms' movements and is of special relevance to the study of changing urban form. The term 'industry' will throughout refer to both manufacturing and warehousing activities. The principal participants in industrial property development are the developer, the estate agent, the local authority and the final occupier. The latter will be called 'the firm', whilst the remaining groups will be known collectively as the 'other actors'. The purchase of land or the building of premises prior to finding an occupier will be called 'speculation'.

Although motorways are the main concern of this research, mention will occasionally be made of 'major transport facilities' and this will cover all large infrastructure such as airports, rail stations, freightliner depots and, of course, motorways. All these have received major investment in recent decades and have a potential attraction for industry. Similarly land uses of a commercial nature such as hotels, hypermarkets and especially offices may be attracted to motorways. Where these forms of transport and location are associated with motorways and industry they will be discussed in the text.

1.0.3 OUTLINE OF THE THESIS

The thesis is laid out in six main parts of which this, the introduction, is the first. It is followed by a research area review of the four theoretical and empirical backgrounds which are brought together in the research - transport, industrial location, property development and urban form. Each review concludes with a summary of the issues it raises for the research to address.

The third section brings together the four strands of the research areas and formulates them into hypothesis. Then the steps taken to design a research method to investigate these hypotheses are detailed. This results in two methodological approaches, one of which is predominantly quantitative, while the other is predominantly qualitative.

These research methods are to be applied to a study area which is the West Midlands conurbation, and the fourth section provides necessary background information on the area's economy, policies, urban structure and transport systems.

Section 5 describes how the two research methods were undertaken and presents their results. This involves a description of building 'access and location' surfaces and the application of regression techniques to their analysis. Two surveys of 'other actors' form the second part of this section.

From the three discrete packages of results contained in Section 5, the concluding section draws to a close in an attempt to answer

the questions posed at the start of the research. Finally, the implications of the findings for location theory, urban form, public policy and further research are discussed.

2.0 THE RESEARCH AREAS

2.1 TRANSPORT

2.2 INDUSTRIAL LOCATION

2.3 PROPERTY DEVELOPMENT

2.4 URBAN FORM

2.1 TRANSPORT

2.1.1 INTRODUCTION

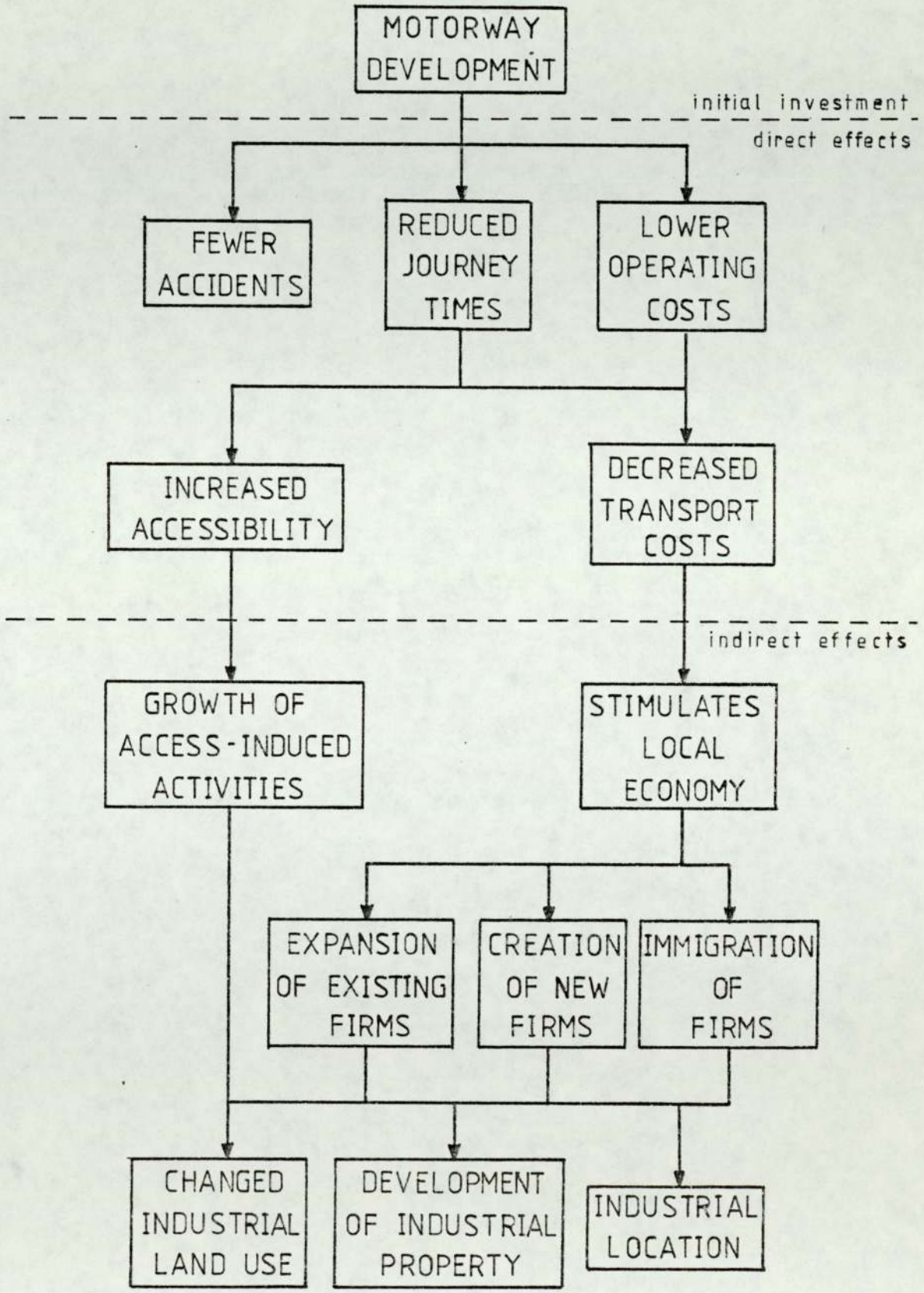
During the post-war period transport in Britain has undergone dramatic changes. Now "motorways thread the country and huge road bridges span the major estuaries; main line railways have been modernised and many electrified; shipping routes have been containerised ... and airports developed to cater for enormous increases in foreign travel" (Williams, A.F., 1978, 386). This chapter reviews how such systems, especially motorways, produce impacts beyond immediate cost savings and quicker journeys. A brief theoretical description of impacts which result from a transport scheme is followed by consideration of the direct and indirect effects which could accrue to industry at a particular location and thereby encourage new development. The majority of evidence quoted comes from economic appraisal exercises applied to a variety of transport investments.

2.1.2 THEORETICAL BACKGROUND

In transport scheme appraisal, impacts may be classified as direct, which follow as the immediate consequence of a scheme, and indirect, which are a consequence of the direct effects. Figure 2.1.1 shows how a motorway investment may result in these impacts .

When a new motorway opens, three direct benefits can be expected - fewer accidents, lower operating costs and reduced journey times. These latter two benefits will result in a net cost reduction which can lead to three alternative results. Firstly, in a free market with perfect competition, these cost savings will be passed on to the consumer, who with additional spending power can increase demand in the local economy.

FIGURE 2.1.1: SELECTED DIRECT AND INDIRECT EFFECTS OF MAJOR TRANSPORT INVESTMENT



This stimulus could lead to the expansion of existing firms, the creation of new enterprises and the attraction of migrant firms. Secondly, as transport is an intermediate good, it may be substituted for other inputs in the production process. Hence a firm's transport cost savings could be reallocated to employ additional units of another factor of production. Demand and supply in the local economy would be stimulated, resulting in the effects quoted above. However in this case the local economy must be under-employed with high transport costs acting as a bottleneck on expansion. Finally, if transport expenditure is maintained by a firm, it will be able to buy more and so transport its good over a wider area gaining additional market and sales. These events will only affect firms in a particular geographic situation, but will result in the same effects described above. Certain activities which employ a high proportion of transport impacts will accrue larger than average benefits.

Transport investment as a stimulus to national and regional economic growth has been widely discussed by development theorists who viewed transport as a key component of social overhead capital, and debated its role as a "leading sector" pushing economies into the "take off" to self sustained growth. Although this research is primarily concerned with less developed nations, it has also been applied to problems of regional inequality in the Western developed countries. Often a government regional policy programme will involve transport schemes in an attempt to improve links between the poorer 'peripheral and remote' regions and the richer 'central' regions. One of the objectives of British government transport policy in the early seventies was "to link the more remote and less prosperous regions with the new national (road) network" (Cullingworth, 1976, 148).

There are two reservations about such a policy. Firstly, a developed economy will already have extensive and efficient transport systems, to which new investment would only create marginal improvements. Secondly, improved connections between rich and poor regions might disadvantage the latter. For instance, high transport costs might have acted as a tarrif protecting industries in the less developed region from fierce competition (Schumacher, 1962, 38). Alternatively, an inter-regional highway might have a "backwash" effect, depleting the poorer region of indigenous investment, and the energetic, ambitious and entrepreneurial in its population (Myrdal, 1957). Indeed, "since most of the problems of depressed areas can be traced to non-transport factors (e.g. labour productivity) improved communications may do more harm than good" (Dept. of Transport, 1977, 205).

2.1.3 EVIDENCE OF DIRECT EFFECTS

The direct effects relevant to this research area are travel time and transport cost reductions. Research into transport cost savings in British industry casts doubts on the scale of potential benefits, principally because of the country's small size and its already well developed transport systems and ubiquitous road network. Although freight transport costs the country approximately £10 billion a year (Dept of Transport, 1978), Edwards has estimated that this only accounts for 9% of the total cost of producing and distributing in British industry (Edwards, 1970, 26). Furthermore a high proportion of this is accounted for by terminal expenses. Another investigation suggested that, for all industries taken together, the difference between transport costs at the most accessible and least accessible locations was as little as 2% (Chisholm and O'Sullivan, 1973). Another factor which limits the potential savings from motorway investment is the relatively low proportion of freight travelling over long distances.

Table 2.1.1 shows that approximately two thirds of road goods are carried less than 50 kilometres or 31 miles. Another study by Edwards estimated that transport costs in the wholesale trades amounted to nearly 22% of gross margin (Edwards, 1969, 276). It must be noted that Edwards' calculations were made prior to the substantial rises in oil prices which have occurred throughout the seventies. Government statistics have estimated that the 40% rise in petroleum prices which occurred between the middle of 1973 and early 1974, led to an increase in road haulage operating costs of approximately 5%, which raised all costs up to the wholesale stage by 0.3% (NEDO, 1974, 12). It is therefore reasonable to assume that if transport costs rise faster than the cost of other factors of production, the potential savings from relocation may rise in real terms.

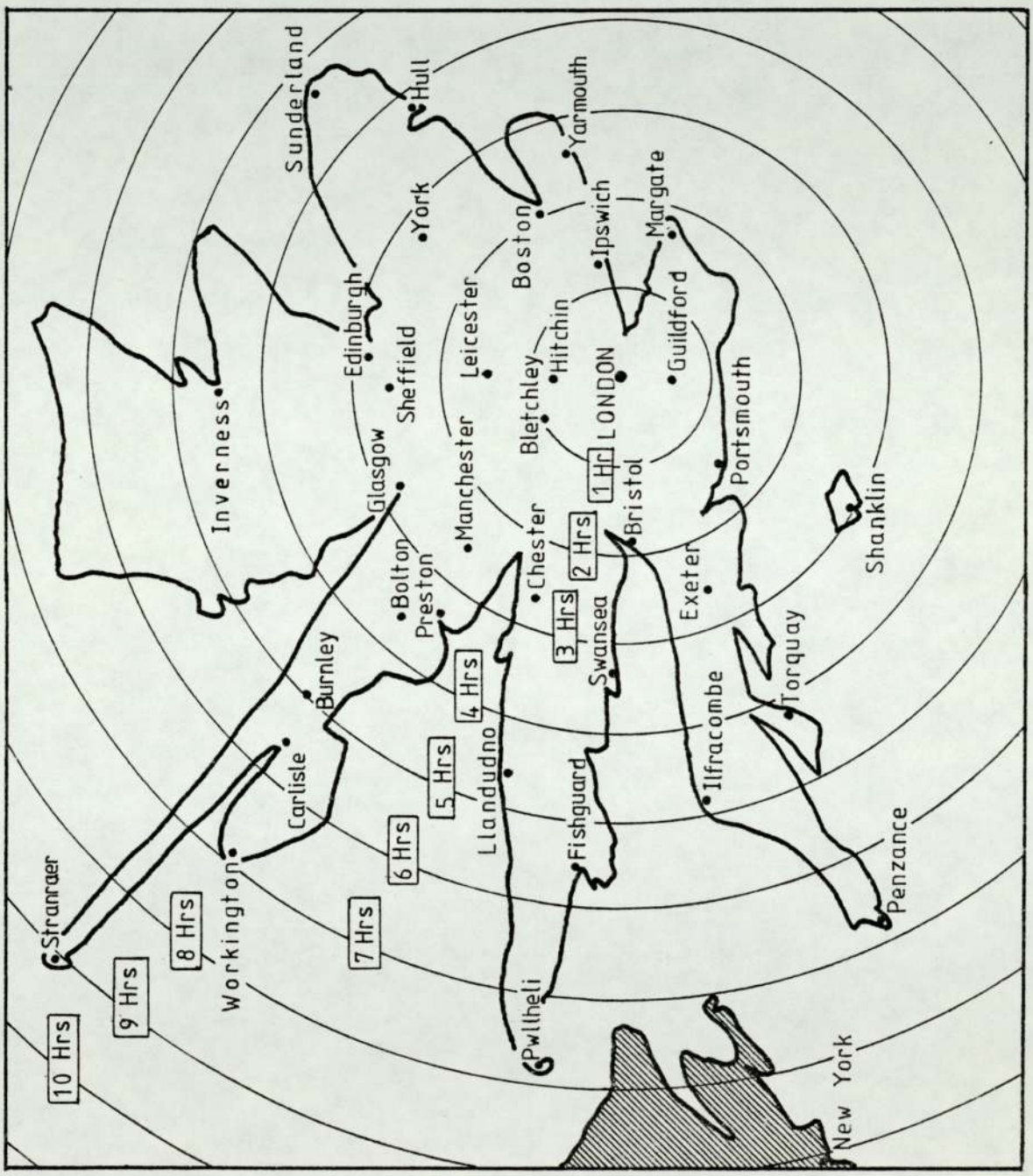
Travel time reductions due to transport investment have been considerable over the larger inter-urban and inter-regional distances. However travel times to local or rural destinations have been far less dramatically reduced because only major settlements can justify motorways, rail links and airports. Public transport cuts in these areas can even reduce their accessibility. Lloyd and Dicken (1977, 193) describe this contrast as a time-space divergence over smaller distances, which is due to the "differential impact of transport innovations". This is illustrated by the travel times from London shown on figure 2.1.2. Burnley, a town 25 miles north of Manchester, is approximately twice the time distance from London, whereas Pwllheli in North Wales appears almost as far from London as New York or Montreal. The locational implication of this phenomenon appears to be that proximity to major transport facilities at the local scale is becoming more important for those who need access to the national and international scales.

TABLE 2.1.1: ROAD GOODS LIFTED BY LENGTH OF HAUL 1977

Length of Haul	VOLUME	
	(Million tonnes)	%
Less than 25km	623	43.8
25-50km	290	20.4
50-100km	219	15.4
100-200km	159	11.2
200-300km	72	5.1
Over 300km	58	4.1
TOTAL	1,422	100.0

Source: Transport Statistics Great Britain, 1967-1977 table 83d, HMSO

FIGURE 2.1.2: TRAVEL TIMES FROM LONDON TO SELECTED CITIES



Source: Richard Natkiel for New Society, London; printed in Lloyd and Dicken, 1977, Figure 5.32

The travel times shown on figure 2.1.2 are the result of decades of transport innovations including macadamized roads and railways. It incorporates the effects of recent motorway construction, but not separately. A short investigation was therefore undertaken to ascertain the impact of motorways on inter-regional journey times over the last twenty years (Haywood, 1978). The exercise measured changes in road travel times between the major cities of the standard regions of Britain, and hence their relative 'accessibilities'. Using average speed data for different road types, journey times were calculated from each city, or node, to all others, on the national road networks in existence in 1958 (before motorway construction), and in 1975 (at the end of the first phase of 1000 miles of motorways). During the seventeen year period travel times fell on average by 50%, though this was partly due to technical advances in vehicle design which allowed faster speeds to be achieved on existing roads. Table 2.1.2 compares the 'inter-regional accessibility' of the cities sampled, and standardises the results around an "access value" of 100 for Birmingham. A low "access value" denotes good accessibility and vice versa. Cardiff and Glasgow represent regions which are not directly comparable with the rest of the sample. The results show no substantial changes between 1958 and 1975. However the peripheral cities of Norwich and Newcastle, with little nearby motorway, have fared worse than the rest of the sample, whereas London and Exeter have improved their position most. The gap between the four most 'accessible' nodes has narrowed, and they now rank as Nottingham, Birmingham and Manchester and Leeds.

Attempts to identify the most accessible points on the motorway and rail networks have been reported by Williams (Williams, A.F., 1977).

TABLE 2.1.2: INTER-REGIONAL ROAD ACCESSIBILITY 1958-1975

NODES	ACCESS VALUES*		
	1958	1975	Change
Birmingham	100(2)	100(2)	
Exeter	181(9)	172(9)	-9
Leeds	109(4)	106(4)	-3
London	138(5)	128(5)	-10
Manchester	103(3)	100(2)	-3
Newcastle	149(6)	156(7)	+7
Norwich	154(8)	168(8)	+14
Nottingham	97(1)	99(1)	+2
Cardiff	150(7)	149(6)	-1
Glasgow	217(10)	212(10)	-5

*NOTE: Access values in each year are standardised around a value of '100' for Birmingham. The greater the access value, the poorer the accessibility. Figures in parenthesis indicate the rank of each node in terms of greatest access.

Source: Haywood, 1978

They are based on network connectivity analysis incorporating a journey time component. The results of the motorway study are presented in table 2.1.3 which compares the 1000 mile network of the early seventies, with the proposed 2000 mile network of the mid-eighties. In both networks the most accessible nodes lie in the Midlands - the M1/M6 interchange, Birmingham and Nottingham for the 1000 mile system, and Birmingham, M1/M6 and Derby for the 2000 mile system. These results in general agree with the inter-regional access ratings in table 2.1.2. A separate analysis of the inter city passenger rail networks identifies Birmingham as the most accessible node in terms of 'total travel time', followed by London, Manchester, Sheffield and Liverpool.

2.1.4 EVIDENCE OF INDIRECT EFFECTS

The indirect effects of major road schemes are debatable. One authority has remarked that "the theory is ill-developed and evidence only scanty. It is extremely difficult to dissociate the effects of trunk road construction from general effects of increasing wealth, or to make valid adjustments for land use planning policies ... (we) therefore recommend that the Departments of Transport and Environment strengthen their research effort in this area" (Dept of Transport, 1977, 20.16).

Numerous investigations of indirect impacts from transport projects have been undertaken in the United States. A study by Ball and Teitz (1958) of a circumferential highway around Boston revealed that large tracts of roadside land were purchased for industrial use as soon as the right-of-way was announced. Subsequently, land values rose from $50-100 an acre to $2,000-5,000 an acre, and over forty plants costing $100 million were under construction before the route opened.

TABLE 2.1.3: RELATIVE ACCESSIBILITY RANKINGS - PRESENT AND FUTURE MOTORWAY NODES

1,000 Mile Network Valued Path (Time)	Motorway Linked Node	2,000 mile Network Valued Path (Time)
19	1. Carlisle	35
21	2. Newcastle-Upon-Tyne	34
17	3. Darlington	31
	4. Blackpool	24
12	5. Preston	20
11	6. Bradford	15
9	7. Leeds	16
	8. M62/A1	12
	9. Hull	25
8	10.Huddersfield	14
	11.Liverpool	21
10	12.Warrington	8
14	13.Manchester	13
	14.Scunthorpe	19
7	15.Doncaster	10
6	16.Sheffield	11
	17.M56/M6	4
	18.Birkenhead	23
13	19.Stoke on Trent	9
3	20.Nottingham	5
	21.Derby	3
	22.Telford	17
2	23.Birmingham	1
5	24.Leicester	6
4	25.Coventry	7
1	26.M6/M1	2
	27.Cambridge	32
15	28.M50/M5	18
	29.Oxford	22
	30.Aylesbury	26
18	31.London	28
16	32.Bristol	27
20	33.Cardiff	30
	34.Swansea	36
	35.Exeter	37
	36.Southampton	33
	37.Portsmouth	39
	38.Gatwick Airport	29
	39.Folkestone	38

Source: Williams, A.F., 1977, Table 1.

Of 141 new plants adjoining the highway in 1957, a quarter came from Boston's old congested industrial suburbs, a quarter were new companies, and less than 7% came from outside the region. The researchers concluded that the broad carriageways and widely spaced access points of the highway stimulated industrial rather than residential development. In addition they felt that intersections of circumferential and radial highways would be in greatest demand for locations. At the outer urban locations the lower street and traffic densities would give "a larger area of accessibility to the expressway" than could be obtained for the same cost in the centre. Also, as the service charges for the land would be lower, "the margin allowable to distribution costs should be greater for the outlying distributor than the inlying distributor" (ibid, 599). Interestingly, twenty years later another study of the Boston area was published which concluded that "highway access is an important determinant of employment location, but the advantage of locations closer to expressways has lessened as expressways have become more ubiquitous" (Hanushek and Song, 1978, 521).

Wheat (1969) investigated the impact of the Interstate highways on a large group of US cities and found that these freeways "bolster manufacturing growth in regions where travel on regular highways is especially impeded by heavy traffic, frequent towns, numerous hills and curves ... In (such) regions, transport sensitive industry is attracted mostly to cities above 16,000 in population or with air services" (ibid, 3). According to Wheat "the relationship of growth to distance - to - freeway is described by a probability curve (bell-shaped) peaking at zero miles and with a standard deviation of roughly five miles. Benefits do not accrue to cities located more than about ten miles from the nearest freeway" (ibid, 30).

Struyk and James (1975) concentrated their investigation on urban or 'intrametropolitan' industrial location. They suggest that in cities "where congestion is relatively high and the highway system comparatively underdeveloped, the strength of major highways as a locational determinant is amply evident". However, "where the highway system has been extensively developed ... (or) where ... the level of congestion is relatively low, the apparent influence of major highways has been much less pronounced" (ibid, 94). Struyk and James also comment that airports appear to have a "significant positive effect" on industrial location (ibid), and Bean (1972, 19) quotes evidence of rising rentals and growth in hotel, office, warehouse and light industrial activities due to airport expansion.

Although similar studies of the American experience are widespread, they are not necessarily comparable to the case of Britain. The US is a much larger country, requiring far more time, trouble and cost to transport goods and people across its bulk. Consequently, transport plays a considerably larger role in the internal economy, and new transport investments present greater opportunities to accrue benefits. In addition the US has been more dependent on domestic air and motor transport for far longer than Britain. Therefore, while the indirect benefits of major road schemes appear considerable in the US, they may be far less significant in this country.

In Britain the case for transport investment having an indirect benefit for economic growth and industrial location was strongly proposed throughout the main planning stages of the present motorway network. The 1969 Green Paper, "Roads for the Future", stated that:

> "A national highway strategy must be considered in the light of the important contribution it can make to national and regional economic growth.

> Wherever major routes are built they provide an economic stimulus to the areas through which they pass and to those distant areas brought into closer contact with the nation's main economic centres. Greater accessibility, reduced transport costs, improved reliability of delivery and service, reduced storage and depot needs all increase the ability of any area to successfully develop its economic activities and make it more attractive to industry and business. In particular, roads can substantially reinforce the major measures the Govern -ment are already taking to ensure a better balance in economic development throughout the country".
>
> (Min. of Transport, 1969, para 17).

However, since the early seventies increasing doubts have been cast on the amount of indirect benefits accruing from transport schemes. The source of many of these doubts is the limited potential for transport cost savings which has been discussed earlier.

Several studies have attempted to detail the full economic impact of transport schemes. Perhaps the most striking improvement in accessiblity due to one project, was brought about by the Severn Bridge, connecting South Wales via the M4 to Bristol and London. However, a study by Cleary and Thomas (1973) found that this had only a negligible effect on industrial location, although this research was completed not long after the motorway opened and so its conclusions might be premature.

Probably the most comprehensive of these impact investigations was made by Dodgson (1974) into the effects of the M62 Transpennine motorway. By correlating employment growth with explanatory variables, Dodgson developed a model which related accessibility in terms of transport costs to areal employment growth rates.

He found that the greatest reduction in the total costs of manufacturing and distribution in his study area due to the M62, was 0.33%. He then made tentative estimates of the total number of jobs likely to result from the motorway and arrived at a maximum of 2,900 jobs per annum in a working population of 3.4 million. Dodgson concluded that this was a very small addition, and that the "effectiveness of transport policy in stimulating regional growth may be somewhat limited and uncertain in relation to other more direct policy measures" (ibid, 88).

An alternative approach to the study of indirect impacts was taken by Schiller (1979) who studied the influence of motorways on industrial rents. He compared data for the period 1968 to 1978 over a national sample of locations, some of which lay away from the motorways, others were within ten miles of motorway junctions. Results showed that "there is no evidence to support the view that the proximity of a motorway results in faster rental growth than would have happened without the motorway" (ibid, 3). However, investigation of individual rental points showed that in nearly 75% of cases, a motorway opening which significantly affects a town's accessibility will result in a two year period of faster than average rental growth, followed by two years slower than average growth. These results contrast with the US example quoted earlier from Ball and Teitz's study (1958). However, Schiller emphasises that rental growth reflects an excess of demand over supply. The fluctuations in rents observed by Schiller may be interpreted as an increased demand for industrial premises around a new motorway which eventually results in an increased supply and then a return to equilibrium.

Among transport impact analysts, however, more evidence indicates negligible indirect effects.

Peaker (1976) investigated the Outer London circumferential road and his findings supported Dodgson's conclusions. He wrote "secondary (indirect) benefits from new roads by way of accelerated employment growth are negligible. The important implication of the mounting weight of evidence to this effect is that direct estimates of traffic benefits cover all such benefits necessary to the overall evaluation of new road proposals. The secondary benefits ... are, in the UK, negligible in practice" (ibid, 13).

Partly in response to these criticisms of a 'benefit' used in motorway scheme appraisals, the government set up the Leitch Committee. Their report paid particular attention to this subject:

> "In only relatively few cases will the quality of the trunk road network be a predominant factor in decisions on industrial location ... it is only when more immediate requirements, such as the availability of a skilled labour force with a good industrial record, have been met that (the industrialist) is likely to allow marginal changes in transport infrastructure to determine his location".
>
> "At national and regional levels ... all the evidence points to the conclusion that improvements to the trunk road system can only have a limited effect on industrial location and growth".
>
> (Dept of Transport, 1977, 20.19, Appendix G, para 18).

These conclusions were accepted in the 1978 White Paper. "Policy for Roads", although the Departments of Transport persisted in supporting the case for road projects to help solve the shortage of new jobs and investment in the assisted areas.

The publication of the Leitch Report's conclusions was greeted with considerable surprise among those responsible for determining the location of new industrial properties and investments.

The trade journal, "Retail and Distribution Management", considered the conclusions so important that they reprinted the key appendix in its entirety with the following preamble:

> "One of the most significant sections of the report relates to the effects of trunk road construction on economic growth, the widely held view that construction engenders economic growth is rejected ... Because of its serious implications for distribution, we are reproducing here ... "
>
> (Retail and Distribution Management, 1978)

Similarly, Schiller (1979), working with a leading firm of London Estate Agents, introduces his report as follows:

> "It is a widely held view that it is desirable for industrial estates to be near motorways. Advertisements for industrial property and for towns trying to attract industry commonly emphasise that there is a motorway nearby. Evidence of the effect of motorways on industrial development has been very limited and to throw light on this question the Leitch Committee commissioned a study. This study causes surprise by finding no evidence that new trunk roads and motorways have a stimulating effect ... ".

The Leitch Report itself notes that the significance of indirect effects is widely accepted, and this view was put to the Committee "strongly by several of the Economic Planning Councils, the M42 Support Group and the Department (of Transport) itself" (Dept of Transport, 1977, 20.17).

Such a widespread 'misunderstanding' among the distribution industry, the property sector, the Department of Transport and others is surprising. Indeed, as these bodies are often responsible for those ultimate indirect benefits, it is likely that many new industrial locations have occurred adjacent to motorway junctions.

In fact, according to Turton (1978, 454):

> "new motorway focal points ... have ... been created in rural areas and have attracted industrialists and road transport operators. One such point exists east of Rugby, at Calthorpe, where the M1, M6 and A5 intersect, and several large depots have been established. Had planning permission not been withheld it would also have been the site of a privately developed new town, to be built for £35,000,000 as Britain's first motorway-orientated growth point. The existence of the M4/M5/A38 interchange north of Bristol was a major factor influencing the ambitious Prestbury Project for a new Severnside port close to Avonmouth, whilst the appraisal made by the West Yorkshire planners of the potential for industrial growth at the M62/A1 intersection near Pontefract is also typical of the significance attached to such major junctions".

The pressures around the M4/M5/A38 intersection for hotels, housing, hypermarket, warehouses and lorry parks have been compared by others to the potential of the National Exhibition Centre adjacent to the M42/M6, Birmingham Airport and Birmingham International rail station.

If these developments represent a widespread number of location decisions to site near to motorways and other major transport facilities, then in the light of the Leitch Report, two possibilities may explain them. Firstly, these locations may have been chosen in a search for the most economic site using inadequate information, and believing motorways fulfilled this requirement the decisions were made erroneously. Secondly, these locations may present real advantages which are either intangible or beyond the scope of economic assessment. These points are explored within the context of decision making in the second research area, Section 2.2. However, some comments can usefully be made here.

Firstly, Leitch and the supporting studies seek to measure indirect impacts almost exclusively through freight transport cost savings. However, freight movement also depends on various non-cost factors, such as speed for perishable and urgent goods, reliability and security for valuables, and a greater certainty of journey times - "the more valuable with tighter restrictions on drivers' hours" (Dept of Transport, 1978, para 10). Furthermore, both lorries and cars benefit from the route and destination finding ease of motorway travel. Perhaps it is the importance of executive transport which is most overlooked by Leitch. Businessmen value time savings and ease of travel more highly than their basic transport costs, and they also appreciate good access to rail and air terminals. As executives hold the responsibility for location choice, their personal requirements must not be overlooked.

Secondly, although motorways are generally seen to facilitate inter-regional travel, they are also used for short trips within a city, conurbation or region. Examples may be found in the West Midlands or Greater Manchester. If these short distance benefits are considered, then the potential number of firms affected by a motorway would increase greatly.

2.1.5 SUMMARY OF ISSUES

The transport research area revolves around the problem of attempting to estimate the indirect benefits accruing from motorways and similar large investments, insofar as they contribute to new industrial location. Various types of impact have been described including the direct time and cost savings from which indirect effects result. In addition the view of several UK authorities, that indirect effects are negligible, has been quoted.

However this conclusion is open to doubt because of its sole reliance on transport cost criteria. Consequently, in addressing the research area, the present study is seeking a new insight into an almost closed question, and searching for a valid, though not a cost-based form of impact assessment.

Several issues in this research area are of particular importance for later hypothesis formulation. For example, motorways differ markedly from other roads because they incorporate "the provision of specially designed interchanges at reasonably long intervals and the elimination of all other accesses" (Drake, 1969, 21-22). This means that their use can only be achieved through a relatively small number of major junctions, and that once on a motorway, the user's journey is not interrupted by other junctions until he wishes to leave. Therefore, access and usable frontages are concentrated and restricted to a few spatial nodes, similar to stations on a rail line. By contrast, normal roads allow 'ribbon' or 'strip' access and frontage. The development potential of these motorway nodes is a central question this study investigates.

Other important issues, which have already been mentioned, include the convergence of time-space between major cities on the motorway network or benefitting from comparable large investments. This phenomenon is accompanied by a relative time-space divergence between such cities and their hinterlands, where no such investment has occurred. Consequently, it is suggested that firms may tend to seek locations nearer to the motorway networks at the local, urban scale. In addition, the value the executive decision maker assigns to the non-cost transport benefits of speed, reliability and ease must be considered specially significant in terms of location impacts.

The spatial extent of any indirect effects on location is also a relevant issue for the research. One US study, quoted above, concluded that a bell-shaped probability curve, which peaks at the point of highway access and has a five mile standard deviation, best represents the distance decay of locational impact.

2.2 INDUSTRIAL LOCATION

2.2.1 INTRODUCTION

When a firm seeks to move into newly built premises, it can either acquire and develop a site itself or move into a factory or warehouse built by a developer. In this latter case a two tier location decision is made - firstly and fundamentally by the property developer, secondly and superficially by the firm. This chapter reviews research on location decision-making by the firm. However as decision processes have similarities in all organisations, much of this review may also be applied to the property sector. A description of theoretical approaches is followed by reports of empirical work, with particular attention focussed on behaviour and perception. As the vast majority of research covers factory location, only slight reference is made to warehousing.

2.2.2 THEORETICAL APPROACHES

Over the past 100 years researchers have sought to explain the spatial organisation of industry and identify its optimal locations. Probably the most familiar early work is Alfred Weber's least cost theory (1929). Weber's model attempted to determine optimum location for a firm where its transport costs for raw materials and produce were minimised. This required the assumption of perfect competition, spatially fixed demand and transport costs, and punctiform markets. Later, Hotelling (1929) and Palander (1935) introduced the concept of locational interdependance between firms competing for market area. This concentrates on duopolists producing in a spatially homogenous environment, with market boundaries predetermined by price levels which derive from production and transport costs. Losch (1954) maintained this interest in market areas when he proposed that on an isotrophic plain, identical firms would control hexagonal territories.

However, Losch also realised that profit maximisation was the economically logical criterion on which to select an optimum location. Both Greenhut (1952, 1956) and Isard (1956) were able to advance this approach, and both regarded transport as a major determinant of location choice.

Whilst traditional location theory, its sympathies with classical economics, was slowly working towards a profit maximising model of location, serious doubts were being cast on the assumption that decision makers were so motivated. Simon (1965) suggested that instead of 'optimising' and 'maximising', managers were 'satisficers'. In other words, decision makers undertook a sequential examination of options available to them and selected the first satisfactory one. This new satisficing theory also proposed that a risky decision would be avoided despite a potentially high resulting profit. In terms of location a firm would identify thresholds above which sales or profits must remain and below which costs must stay, and when a site fulfilling these criteria was found the firm would locate. Closely associated with this approach is Smith's view that firms will be prepared to locate at any number of sub-optimal points which lie within the "spatial margins of profitability" (Smith, D.M., 1966, 1971). Due to uncertain future events and an inability to know cost structures and potential profit at all possible locations, Smith argues that sub-optimising is the only feasible strategy for the firm to adopt.

New approaches to industrial location theory have moved even further from its classical origins. The 'behavioural school' point out that in addition to risk, uncertainty and limited knowledge, decisions are also affected by irrationality, personal preference and other non-economic factors.

The traditional approach to location theory may be seen as a concern with the external environment of raw materials, transport costs, labour, linkages and markets. In effect, decisions are made in an environment internal to the firm and the individual, where perceptions of the outside world are distorted, choice is influenced by the personalities of decision makers, and the entire process is modified by the organisation's structures and rules.

2.2.3 ORGANISATIONS AND DECISION MAKING

Cyert and March's "Behavioural Theory of the Firm" (1963, 27) describes organisations as coalitions of participants with conflicting goals and values, who reach common ground through discussion, bargaining and learning processes. These learning processes involve goal identification and a feedback from each decision to test the usefulness of the methods used, so improving every subsequent decision. However, location choice occurs very infrequently in most companies and even in the largest it is unlikely that an executive will go through the experience more than once (Townroe, 1970, 54). In the face of inexperience and uncertainty the firm will postpone a location choice until urgency forces a 'reactive decision', which due to the absence of a learning process, will only be taken by senior managers. In smaller and younger companies which are dominated by an owner/manager, he alone would take the decision. It has been suggested that larger firms are more planning orientated and show "far less locational conservatism" (Lloyd and Dicken, 1977, 372, 375-6). In consequence location decisions are placed in a planning horizon after associated with group rationalisation and integration. Large multi-plant firms are able to impose location decisions from above onto their branches, hence making the choice more objective than if left to the migrants themselves.

These general points are supported by the results of behavioural surveys. The key factor in initiating a location search has been identified as the internal growth of the firm (Loasby, 1967; Smith, 1971), often aggravated for small firms by lease termination and redevelopment schemes. These causes will in many cases be afflicted by a production crisis, previous delays or unawareness of the problem, leading to an urgent need to move. Hence ready-built premises will be sought for immediate occupation and where new property is required it will generally be found on an industrial estate. Hill writes that because of external economies "an estate is an ideal location for a small firm to establish itself and grow" (1977, 64-65). The spatial extent and frequency of search and movement from the original site will be subject to distance decay, especially for smaller firms.

According to Cooper, location search and selection appears to "require a qualitatively different approach to that directed towards solving other types of problems ... a firm's previous experience of investment decision making is likely to have little relevance in the location situation" (1975, 83). Cooper's survey found that managing directors themselves relied on their personal knowledge and expertise and where this was inadequate they consulted externally. Nearly 70% of firms surveyed used personal observation (including driving around streets looking for "To Let" boards and visiting sites), coupled with information from estate agents and public bodies (ibid, 85). Townroe found that only the larger firms would employ outside specialists and consultants (1971, 68), and Lloyd and Dicken suggest that the difference between the large enterprise and the single plant firm is "not so much one of relevant locational experience as of possessing the resources to employ specialists" (1977, 382).

Survey based research has also shown the limited significance and awareness of costs in the location decision. Keeble notes that "the need for proximity to customers (and) suppliers ... does not normally arise because of high transport costs. Rather it reflects such more intangible but none the less vital considerations as the importance of frequent, face-to-face contacts, speed of service in obtaining orders ... reductions in the size and hence cost of stocks of materials or components needed on the firm's own premises, more efficient use of limited managerial time and so on" (1974, 14). When it comes to the selling price or rent asked for a possible property, Cooper writes that "the price of the buildings merely has to fall within a certain range, although cheapness is always welcomed. More important is the availability of room for further expansion on the chosen site" (1975, 42).

Eversley has commented that "comparatively few managers know anything about their cost structures"(1965, 105), and Cook states that "even amongst those managers who spoke (to him) of cost there were several who lacked the information to assess the cost of their decisions" (1967, 329). In the light of these remarks it is interesting to consider the motives and appraisal techniques which lie behind location decision making. Cooper (1975, 87-89) asked his sample of firms whether they chose a profit maximising location - a question which might be expected to bias replies to the affirmative - and found that only 40% did. Townroe (1971, 65,70) discovered that discounted cash flow techniques were used in the location choice of 59% of surveyed companies employing over 500 workers, but only in 30% of smaller firms. A similar split occurred between publicly and privately owned firms (57%/21%).

Although firms themselves are attributed with behaviour and motives, they are composed of individuals.

This truth is a major limitation on many approaches to location theory. Even at the apex of decision making it is unclear who directs a company because of the diverse interests of the shareholders, the board and the managing director. Needleman and Scott (1964, 159) observe that the executive will "not be concerned with maximising the profits of the company but with other goals like increasing his own welfare or satisfaction". When it comes to location, many believe that an "entrepreneur may obtain non-pecuniary satisfaction from working and living in a particular area, and may locate his plant there if the 'psychic income' derived from the site outweighs the profits sacrificed through not locating at the maximum profit point" (Richardson, 1976, 94). This 'psychic income' may be derived from a pleasant physical environment and from the availability of social, recreational and cultural facilities. In some circumstances these are a more concrete benefit for the firm because they facilitate the transfer and recruitment of key staff. Gould and White have suggested that in a developed economy with a growing quaternary sector, firms are "no longer tied to traditional location factors ... but are free to choose locations according to such things as recreational facilities, quality of schooling and a pollution-free atmosphere" (1974, 176). The positive value of such benefits is illustrated in Newby's study of businessmen's attitudes to the South West (1971, 196-7).

2.2.4 PERCEPTION

'Psychic income' is closely related to the perception of distance and locational preference. Pred's early attempt at a behavioural location theory (1967) placed the decision maker in a matrix where he was constrained by the availability of appropriate information on one axis, and by his ability to use that information on the other.

This latter constraint can be interpreted as the process of perception, which as Forgus (1968) explains, either blocks the transmission or modifies the message. Perception can affect both individuals and organisations. In the case of individuals, research into mental maps and cognitive distance has its closest associations with spatial perception and decision making theories. Studies have investigated perception at the major national and international scale, and at the local urban scale. For the former, Stea (1969) suggests that the individual's cognition of distance and spatial relations is influenced by seven factors: the relative attractiveness of points viewed as origins and goals, non-commutative barriers, the kind and number of barriers separating points, the familiarity with certain trips, the magnitude of geographic distance, the attractiveness of the connecting path, and the familiarity with certain areas. Studies at this scale have shown that residential desirability decreases rapidly with distance from the subjects' homes, although high preferences are attached to familiar and popular holiday areas (Gould and White, 1968, 1974).

At the local scale, individuals' images of urban space centre around the routes they follow, termed "paths", and termini and waymarks, such as statues, impressive buildings or railway staions, termed "nodes" (Lynch 1960, Briggs, 1973). These points of reference are often large objects which intrude into the urban space. Similar notice is taken of barriers to movement such as rivers or railway tracks, beyond which spatial knowledge is limited. Within the city Lowrey has attempted to compare perceived distance with the actual physical distance between his subjects and various urban stimuli. These stimuli included a bus and rail terminal and an expressway interchange. Lowrey's results forced him to conclude that "in spite of possible environmental influences, such as urban topography, barriers, neighbourhood effects and travel time, the judgements were closely

related to geographic distances" (Lowrey, 1973, 353).

In the case of major transport facilities, their users will have perceptions of access to the facilities at the local scale, and of the access the facility provides at the national scale. Within the city, features such as motorways are massive intrusions, most noticeable for their size, but also for their impact as barriers. They may alter the spatial perceptions of both their users and non-users. The executive who speeds along a motorway with ease, and then leaves to follow a congested urban road with its frustrations and frequent halts might perceive his new speed as far slower than the actual reduction. Consequently time spent travelling along the motorway would in relative terms, be valued less than time spent travelling off the motorway, and destinations adjoining the route would be preferable to those only a marginal distance away. Telford has used such an argument in its campaign to obtain the M54 link to the national motorway network, and so attract migrant firms".* Conversely it may be argued that travel time seems to pass faster on an urban road with its plentiful distractions, than on a motorway where stimuli are absent and a driver becomes bored.

2.2.5 EMPIRICAL LOCATION RESEARCH

Empirical research into industrial location has suggested that a "dual population" of moving firms exists (Keeble, 1971, 1976). Over short, intra-regional distances, industrial movement is dominated by small firms often transferring completely from conurbation centres to suburbs and overspill communities. This is closely related to the processes described in the "Urban Form" research area, section 2.3.

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*Evidence gained from a West Midlands Regional Studies Association seminar at the University of Aston in Birmingham with Mr Bob Tilmouth, Commercial Director of Telford New Town, present. April 1977.

Over longer distances, movement often occurs through the establishment of new branch plants of larger firms, who are frequently guided by Government regional policy to the depressed parts of the country.

Studies of inter-regional movement are particularly common, possibly because of their regional policy relevance, and have frequently been undertaken using surveys of individual firms. A central concern of these studies has been to evaluate the determinants of location choice. Table 2.2.1 lists six major location factors in the order of importance discovered by one of the most comprehensive of these investigations. Transport and access factors score in the middle and lower part of the list, whilst greatest importance is attributed to labour supply. The study found this factor to have more significance for firms than labour costs, and similar evidence tends to support the limited relevance of cost factors. Despite studying an area with very low wages in the US, McLaughlin and Robock (1947,67) found that greater importance was attached to labour attitudes. Cameron and Reid (1966, 23) discovered that poor labour relations discouraged employers from locating in Scotland, regardless of labour rates.

Despite the relatively low ranking of 'transport facilities' in table 2.2.1, other studies have testified to their importance. Norcliffe (1970) suggests that transport and accessibility have gained importance as average plant size has risen. The concentration of production in a single or limited number of units serving the entire national market, it has been argued, leads to increased location in the most accessible part of the country. These forces will result in developments such as the huge Whitbread brewery adjacent to the M1 at Luton (Riley, 1973, 153-4).

TABLE 2.2.1: THE MAJOR DETERMINANTS OF LOCATION CHOICE

Factor	% of companies mentioning factor	Number of companies mentioning factor as first or second most important factor
Supply of Trainable Labour	80	21
Local Authority Co-Operation	58	6
Accessibility to Main Markets	44	12
Ready-Built Factory	38	11
Transport Facilities for Goods	37	1
Accessibility to Suppliers	32	6

Source: Cameron and Clark, 1966, 164, Table 8.3

Alternatively, the greater accessibility resulting from transport investment may enable producers in one corner of the country to supply its entire population. Loasby, working with a sample of firms who had relocated from Birmingham to South Wales, found that half disliked their new location; mainly because of the "inferiority of South Wales as a distributing centre, partly because it is in one corner of the national market, whereas Birmingham is near the centre, and partly because of poor transport facilities" (Loasby, 1961, 309). It would be interesting to know whether these opinions changed in response to the subsequent construction of the Severn Bridge, and the M4 and M5/M50 motorways. Another study, by Morley and Townroe (1974, 20) discovered that for their sample of firms moving to Northern England, 'accessibility/transport considerations' were mentioned more frequently than any other factor except government grants. Estall and Buchanan quote a study conducted in the North East which claimed that "82% of the manufacturing firms which had moved in between 1960 and 1970 regarded the new (motorway and trunk) road system as a significant factor ... in bringing them to the area" (1973, 39). Finally, an international investigation of overseas plant location among US firms revealed that, particularly in Europe, little attention was paid to labour supply, and "overall, the most influential elements in siting decision were access to markets and transportation" (Bass, etal, 1977, 50).

Although considerable effort has been applied to evaluating the determinants of location, little interest has been shown in the distance over which firms can benefit from these determinants. The question of localisation of influence has particular significance for motorways and similar facilities, which are inter-regional systems. Hoare (1973) has attempted to define the 'sphere of influence' of certain location factors.

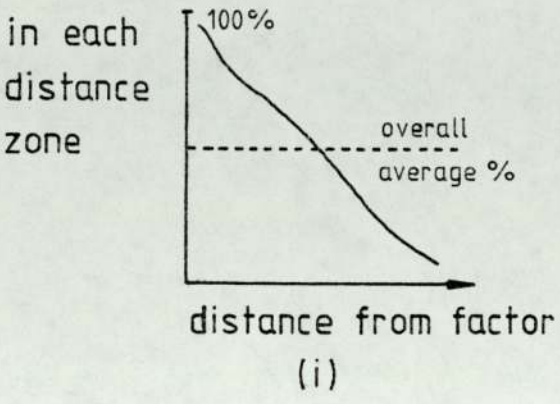
Hoare identified seven 'location-specific' factors within London, including three types of transport facility - the docks, the international airport and the main railway termini. By a comparison of the importance firms attached to these, with their proximity to them he postulated three possible spatial patterns:
(i) the proportion of firms valuing a factor would decline with distance from it; (ii) the proportions would remain fixed; and (iii) close proximity would deter location, but a high proportion of firms would be found in the near distance. These alternatives, together with Hoare's actual results for the transport facilities, are shown in figure 2.2.1. Hoare was forced to conclude that his 'spheres of influence' were relatively unimportant in explaining location, although he admits the severe data problems and resulting doubtful assumptions which afflicted his study. His sample of unselected firms in an established urban area would be located according to historical, chance and individual factors which might easily disguise any 'spheres of influence'. Another study, however, in the US was able to conclude that a major highway's influence on urban manufacturing growth was described by "a probability curve (bell-shaped) peaking at zero miles and with a standard deviation of roughly five miles" (Wheat, 1969, 30). A further study by Hoare (1971) found that of manufacturing and office firms located within eight miles of Heathrow Airport, 7% of the former and 33% of the latter had been influenced in their location choice by the facility.

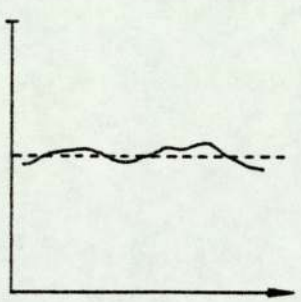
2.2.6 WAREHOUSES

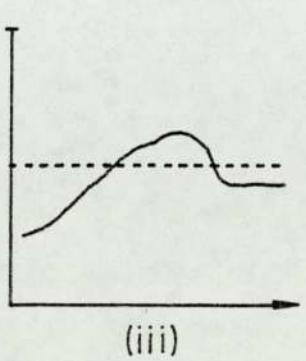
Those properties collectively known as warehouses appear to vary greatly in their size, age and the use to which they are put. A survey by Bream and Galer (1974, 14) found that 36% of warehouses sampled "were not purpose built ... contrary to the first principle of good warehousing".

FIGURE 2.2.1: HOARE'S'SPHERES OF INFLUENCE' OF LOCATION FACTORS

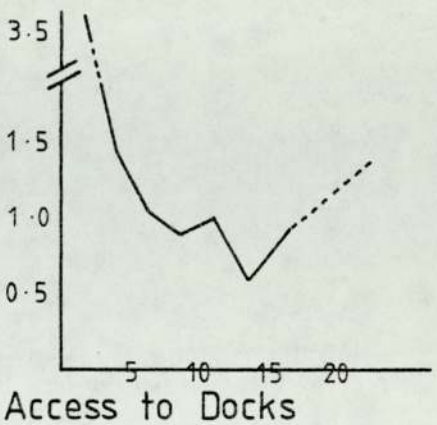
a) HYPOTHETICAL

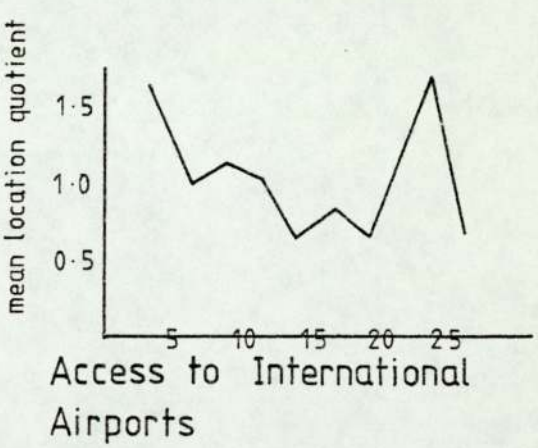


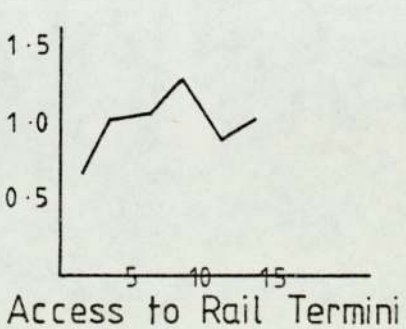




b) ACTUAL







Source: Hoare, 1973

This property sector has experienced considerable growth due to the internal reorganisations which many distributors undertook in the sixties and seventies. Warehouses may be divided into four categories depending on the degree of service required, costs, supplies and management control:

(i) warehouses centralised into large storage and haulage operations closely associated with the production plant,

(ii) warehouses centralised independently of production plants and serving nation or region,

(iii)decentralised smaller warehouses located in the market areas;

(iv) decentralised 'cash and carry' warehouses whose customers undertake their own transport and distribution of goods.

(Hertfordshire, C.C., 1977, 2.6).

Transport costs in the distributive trades form a higher proportion of total costs than in manufacturing industries (see 2.1.3 above), and in consequence location choice for large scale warehouses is more often decided by sophisticated techniques of analysis (for examples see Economic Development Committee ..., 1967; Townroe, 1976; and issues of "Retail and Distribution Management"). Market and communciations factors, especially motorways and ports, seem to hold particular locational significance, with growth in Hertfordshire occurring "particularly along the main communications corridors". The site itself must offer large, accessible premises with uncongested local roads, and be purpose built for warehousing, often on an industrial estate and near a head office (Hertfordshire, C.C., 1977, 3.1-3.2; Hill, 1977, 43).

2.2.7 SUMMARY OF ISSUES

The industrial location research area has described theoretical approaches to the subject, the way in which decisions are made,

and the factors which are considered important. A central purpose of this review is to examine issues in order, at a later stage, to develop a hypothesis which in the absence of distinct cost advantages, explains why firms might locate around motorway junctions. Evidence has been presented which shows transport costs to have no great significance for location. Now, regardless of costs, a motorway may be valued because it provides a rapid, reliable and secure route for urgent, perishable, valuable or secure cargoes. Furthermore, additional benefits will have particular importance for the executive decision maker, such as fast and trouble free travel for personnel, efficient contacts with customers and suppliers, and access to cultural and recreational facilities.

While all of the above may encourage industrial location they do not help to determine, directly, the spatial extent of a motorway's influence. This may be diffused or concentrated depending on several other factors. For example, a firm may obtain prestige and image advantages and free advertising when it selects a site fronting onto a major road by a motorway junction. For a property company such a site would command considerable attention, so helping to let or sell units. Also, a motorway within an urban area imposes a considerable physical bulk, acts as a barrier to local movement, and juxtaposes local with national scales of accessibility. Such effects are certain to change an individual's spatial perceptions, and may lead businessmen to view motorways as a magnet for industrial location. Both these factors would result in a definite concentration of firms around a junction.

Another key point referred to in this chapter has been the issue of location choice.

For several reasons this is often an urgent decision and therefore the firm requires a built property, ready to move into. In the search for such premises it will rely on advice given by estate agents and various public bodies. In consequence, the firm's location choice is partly in the hands of the development sector who build speculative factories and warehouses, and who advise firms of which ones to move into.

The interest of the student of industrial location in transport factors has waned in recent years with the development of the 'behavioural approach'. Classical theory, with its basis in normative economics, is an abstraction from reality, and "very little progress has been made in (its) ... direct application to real world situations" (Smith, 1971, 275). The popularity of 'behavioural' theories and studies stems from this failure. Critics of classical theory point to its preoccupation with cost factors, and its inability to accept decision makers as uninformed and irrational, pursuing individual objectives in a spatial environment distorted by perception. Transport factors have been traditionally incorporated in location theory, which has been particularly criticised by recent writers who point to their insignficance in the cost structures of British industry (Keeble, 1974, 7). However, the essence of the 'behavioural approach' is that locations are not chosen because of money costs, but because of a host of other factors, amongst which are the costs which executives believe affect the decision. In such situations "the actual relationship ... is irrelevant. The relationship which is relevant is the relationship which executives believe holds true" (Starbuck, 1965, 457). Therefore, transport factors could well be significant in location, in spite of their recent neglect, due to the insights which behavioural studies have provided.

To summarise, this research area reconsiders the relationship between transport and industrial location. It also pays attention to intra-urban location choice which has attracted limited interest, and to warehouse location and spheres of influence which have been largely ignored.

2.3 PROPERTY DEVELOPMENT

2.3.1 INTRODUCTION

One of the contentions of this thesis is that the importance of the firm in location choice has become subordinated by a post-war growth of property companies who undertake the fundamental tasks of siting and developing new industrial premises. Despite a journalistic interest in property tycoons, little serious research has been directed at this issue. However, it was first noted as long ago as 1939 when Hoyt recognised the dominant influence of "real estate promoters" on urban land patterns (1939, 114), while more recently Form identified four "organisational congeries" which "dominate the land market and determine indirectly the use to which land is put" (1954, 318). Form considered real estate and the building business to be the most important of his groups, followed by local government agencies, individual home owners and the larger industries, businesses and utilities. In Britain the local authorities have also acted to limit the firm's range of location choice by, firstly the operation of comprehensive planning machinery, and secondly their own direct involvement in development. This chapter will describe the role of both private and public sector actors in the development process and how their importance has grown. The state of the post-war industrial property market is then briefly reviewed, and finally estimates are made of the significance of these groups in the firm's industrial location decision.

Property development may be undertaken either by the eventual user of the property, for example the firm, or by another actor, generally a private developer or local authority.

Use of the term "developer" will hereafter refer to one of these other actors. The term "speculative development" will be used to describe any development which is initiated before an occupier has been found.

2.3.2 THE DEVELOPER

Cadman and Austin-Crowe (1978, 3) have divided the property development process into four stages - evaluation, preparation, implementation and disposal - the moving force behind which is the property developer. He will base his decision to undertake a project on an evaluation of market and financial considerations and at this initial stage will choose a location and review the spatial attributes of the site. In order to prepare the site, further assessments are made of its marketability, a costing is undertaken, finance and planning permission are obtained, a price or rent is agreed, the land purchased and the building contract signed. Generally, the developer acquires land to add to his land bank, where it might lie for several years prior to implementing a scheme, until it has been fully prepared, or market conditions are right. Then the project will be implemented by various contractors and construction companies which the developer will supervise. The completed property will finally be disposed of into the hands of a tenant or buyer. In the first case the developer will choose to either retain ownership as an investment, or sell to another organisation to realise his gain. In operation, this simple sequential process is more complex, with some stages running concurrently or reversed, roles confused and procedures flexible. One of the developer's aims throughout is to reduce his risk by continual re-evaluation, putting off commitments and pre-letting. The developer's task involves negotiating with and managing a development team of financiers, architects, agents, valuers, quantity surveyors, engineers, contractors and planners.

Throughout the process "the prime objective of a property company (developer) ... is to make a direct financial profit from the process of development" in the same way that a manufacturer combines materials and processes into a saleable product (Cadman and Austin-Crowe, 1978,10).

> "(The developers' tasks) amount in sum to a distinct expertise at the core of which are judgement of the need for accommodation in a particular location including the assessment of the particular requirements of prospective occupants, identification of the way in which the need may best be met, and knowledge of the means of fulfilling the need".
>
> (Dept of Environment, 1975, 7.5)

According to Massey and Catalano (1978, 130-131), the property developers grew out of two initially distinct groups - the public property companies who emerged in the 1860's to become corporate landlords but rarely undertook development, and the entrepreneurs of the inter and post-war years who eventually took on a corporate form. Marriott (1967, Appendix 1) shows that these entrepreneurs were mainly estate agents who initially became involved in shop and office development. After the Second World War the property sector changed dramatically partly in response to the destruction of the building stock and lack of building activity during the war, but also due to a growing population and economy. Post-war shortages and legislative constraints had ended by the mid fifties and, spurred on by growing institutional investment, property development experienced a boom. Before the war only 25 property companies were quoted on the Stock Exchange, whereas in 1965 there were over 150, a third of whom having paid up capital of over a million pounds (Lean and Goodall, 1966, 92). With the new potential for development gain the major construction companies made a "massive entry" into the development role (Massey and Catalano, 1978, 109).

By the mid sixties the post-war boom was fading due to a combination of falling demand, rising interest rates and a change in taxation. Development was curtailed and the industry consolidated its position. During this period financial institutions, in particular the pension funds, and insurance companies, became steadily more involved in property development and ownership. (By the mid seventies their role began to coalesce with that of the developers whose share captial they began to acquire.) The low yields on property during that period did not discourage the pension funds and insurance companies who bought for long term capital appreciation more than rent return. A relaxation of credit and an expansionist monetary policy introduced in 1970 encouraged a resumption of development backed by short and medium term loans. However in 1972 business rents were frozen and market confidence shaken. 1973-74 saw asset values fall, lending restrictions and rising interest rates. The sector found itself in serious financial difficulties and complete collapse was only narrowly averted by outside intervention. It has been written that "1974 turned out to be a year when the property market largely disappeared" (Gower Economic Publications, 1975, ix). The market remained oversupplied and depressed during the mid seventies and then slowly recovered particularly among certain property types.

The growth of the developer's role has, by and large, followed the fluctuations of the market in the post-war period, with an underlying trend for outside bodies to become involved and the whole sector to become increasingly significant in terms of new development. Therefore, the developer is primarily a post-war institution. "The great need for new buildings after the Second World War and the subsequent increasing demand for commercial and industrial accommodation greatly increased the opportunities for such companies" (Dept of Environment, 1975, 7.3).

2.3.3 THE ESTATE AGENT

The role of the agent in the development process is to "identify potential occupiers and implement the disposal to them of the completed development" (Cadman and Austin-Crowe, 1978, 202). Sometimes a property company has internal agents; alternatively it will employ the services of an estate agent. The estate agent is a source of specialist knowledge on the market and for this reason is often involved from the earliest stages of a project. Local agency firms will have a detailed knowledge of their district and its peculiarities, whereas national firms have more direct and frequent contact with important potential customers. Therefore many schemes have a joint agency between a national London firm and a local firm. When a developer agrees to pay commission to an estate agent to find a tenant or buyer, the customer found is called an "applicant". Conversely when an agent is retained by a prospective tenant or buyer, then the customer is called a "client", and the agent is unable to accept the developer's commission.

The estate agent's work includes the identification of potential occupiers and their requirements, assessing market trends and conditions, setting the price or rent, defining and operating a marketing strategy, and negotiating the sale or lease. These tasks enable the agent to provide details of which locations would be most suitable for different property types. Furthermore, in his selling role the agent hopes to persuade potential occupiers that his property is in the most suitable location for their needs. The estate agent's involvement in the market for second hand properties gives him a wider appreciation of customer needs than most other actors in the development process.

It is suggested by Massey and Catalano (1978, 132) that the origins of estate agency lie in the vacuum caused by the break up of the great estates in the second half of the nineteenth century. Marriott (1967, 9) describes it as a "relatively young business" with "commercial estate agents only (coming) into their own between the wars" when the national firms of today began to grow. However, the importance of the estate agent in assessing the market and finding occupiers for new developments is integral to that of the developer, and consequently is especially significant during the market's growth and fluctuations in the post-war period.

This chapter only describes the developer and estate agent in the private sector because other groups have a limited influence on location decisions.

2.3.4. THE PUBLIC PLANNING SYSTEM

The present statutory planning system in Britan dates from the 1947 Town and Country Planning Act, under which almost all property development was controlled by requiring planning permission. In addition, 'development plans' were to be prepared by all parts of the country in order to outline the manner in which each area was to be developed or conserved - a requirement which amounted to land use zoning. Since 1947, the two most important changes that have been made to the system were the 1968 Town and Country Planning Act and the 1972 Local Government (Reorganisation) Act. This legislation replaced the 'development plan' and introduced a two tier system of local government which came into effect in 1974. The new county councils became responsible for producing 'structure plans' which state the broad social, economic and physical planning strategies for their counties. The new district councils became responsible for a detailed determination of policy and land use stated in 'local

plans', which are required to fit into the 'structure plan' strategy. Except in special circumstances, planning applications are decided at the lower tier. Unfortunately approved plans have taken many years to produce, and consequently, decisions on planning applications are made in the absence of up to date policy statements.

Plan making and development control have a substantial impact on a developer's operations. The zoning of land into use classes strictly defines the types of activity considered suitable for each zone, and any non-conforming uses may be forced to move by a discontinuance order. However, as Cullingworth has written "it needs to be stressed that British planning legislation does not assume ... that existing non-conforming uses must disappear if planning policy is to be made effective" (1976, 106-7). Recently, greater tolerance has been shown to such uses and they have been seen to confer advantages when they reduce the need for urban travel. Furthermore it has become not uncommon for a development to be permitted outside its use zone, and this may reflect changing circumstances since the original plan was devised. For example, in response to the government's industrial strategy, Circular 71/77 encouraged local authorities to do everything reasonably possible to encourage and foster the growth of industry, and suggested that local planning applications should have regard for the desirability of encouraging mixed industrial development (Dept of Environment, 1977).

Planning applications are often made after a series of informal consultations between developers and planning officers. If a developer wishes to test a planning authority's attitude further on a proposal before going to the expense of a detailed planning application, he may submit an application in outline only.

When deciding on a planning application the authority assesses whether the proposed scheme is in harmony with its written plans and stated policies, and whether it would be appropriate to the neighbourhood. Other factors taken into account might include the amount of additional traffic generated, the opinion of local residents and amenity groups, pollution, architectural merits and considerations of planning case law. If the authority decides to grant permission it may attach any number of conditions, one of which is always that the project must be commenced within five years of the date permission was granted. If an applicant wishes to contest a local authority's decision an appeal may be made to the Secretary of State for the Environment.

A proposed development may also be affected by a number of statutory requirements other than the Town and Country Planning Acts. In some parts of the country, for example, manufacturing or office developments above a certain size have had to obtain an Industrial Development Certificate or Office Development Permit as part of central government regional policy. In addition developers have to reach agreement with Highways and Water Authorities, and ensure that their schemes conform to the building regulations, fire regulations, Factories Acts and Public Health Acts.

2.3.5 LOCAL AUTHORITY INDUSTRIAL DEVELOPMENT AND PROMOTION

Local authorities often devote considerable attention to the economic health of their localities. They generally aim to provide more jobs for their inhabitants, and many have appointed industrial development officers (IDOs) to achieve this end. Initially policies were aimed at attracting outside firms to locate within the authorities' boundaries. However, economic troubles have drastically reduced the amount of

this 'mobile industry', although evidence shows that these promotional activities still attract considerable budgets, often financing overseas searches (Forester, 1979). Table 2.3.1 shows the percentage of local authorities involved in a selection of industrial development activities identified by a recent survey (Falk, 1979). By such involvement IDOs attempt to strengthen and diversify their authorities' indigenous employment base. This survey also showed that authorities are strongly in favour of aiding and attracting manufacturing and small firms, because of their relatively better employment potential and physical size in comparison with warehousing and distribution activities, which are actively discouraged by 10% of authorities (ibid, table 4). Local authority initiatives may be divided between direct property development and promotion.

Cadman and Austin-Crowe (1978, 12) point out that during the nineteenth and twentieth centuries public authorities have greatly increased their involvement with property development. However, "until recently most public authority activity has been directly related to and ancillary to their statutory duties, as for example housing authority, highway authority, and the like. It is only in recent years that there has been a considerable increase in the activities of public authorities in property development as a self-contained enterprise" (ibid). Local authorities allocate land for industrial use in their written plans and will generally provide serviced sites and access infrastructure. Fewer authorities become involved in the speculative development of property, although this is undertaken by other public bodies such as the new town development corporations.

It has been suggested that the management of a speculative scheme by a local authority differs from private sector development only in having many of its actors working 'in house' (Cadman and Austin-Crowe,

TABLE 2.3.1: LOCAL AUTHORITY INVOLVEMENT IN SELECTED INDUSTRIAL DEVELOPMENT ACTIVITIES

Development Activity	% of Authorities
Register of vacant land/buildings	83
Organising exhibitions/publicity	77
Publicising vacant property	74
Advertising to attract industry	70
Building new small units	57
Developing industrial estates	53
Converting existing buildings	32

Source: Falk, 1979, Tables 5 and 7.

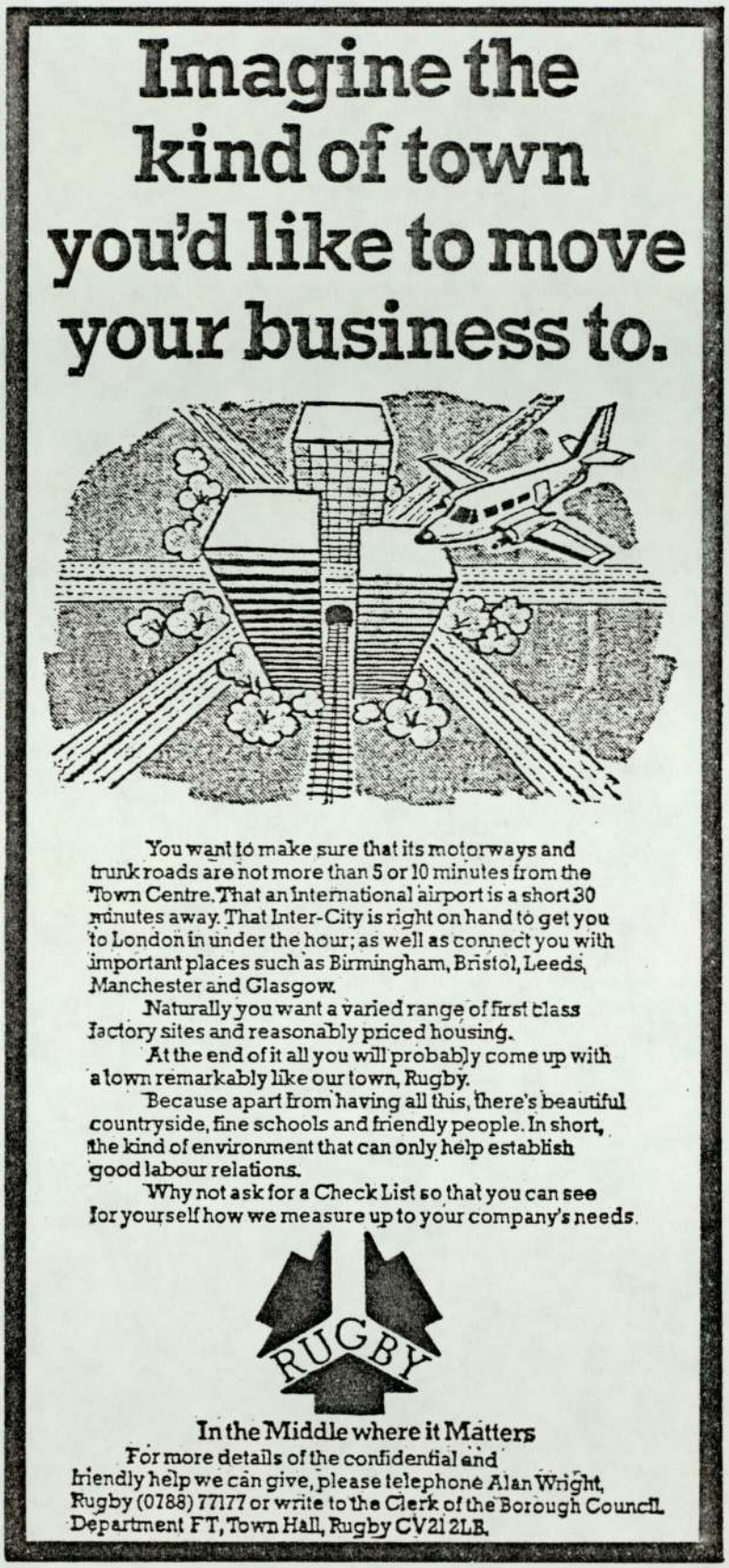
1978, 213). The key actors are often to be found within the estates departments. However, it has been noted elsewhere that "much of local authority factory building does not yield genuinely commercial rates of return", in spite of which it may be an effective means of drawing private sector attention to profitable gaps in supply, such as small factory units (JURUE, 1979(i), 3.30, 3.33-3.34).

Local authority promotion of its area and attempts to find occupiers for vacant land and premises, is very similar to the estate agents' marketing task. Cadman and Austin-Crowe highlight the differences: "public authorities will often think in terms of a continuous ongoing promotional programme extending over several years, whereas the developer will usually be concerned with a much shorter promotional programme concentrated on a particular development" (1978, 136). Promotion by the private sector would normally only include the erection of siteboards, preparing a brochure and advertising in the press. Local authority activities might extend to mailshots, exhibitions, seminars and overseas visits. A prominent and common ingredient of this publicity is an endorsement of the property's, or area's good national and international accessibility, especially to the motorway network. Referring to the West Midlands, Carter gives examples of conflicting claims,

> " 'Where all roads meet' - the Gravelly Hill Interchange is symbolic for many, but other West Midlands locations are asserted in the promotional literature. Thus we read 'New M54 to put Telford at Heart of Motorway Network', Redditch advertises that it is as at 'The Hub of England' and Dudley is 'Ideally placed in the centre of the transport network' ".
>
> (Carter, 1977, 371).

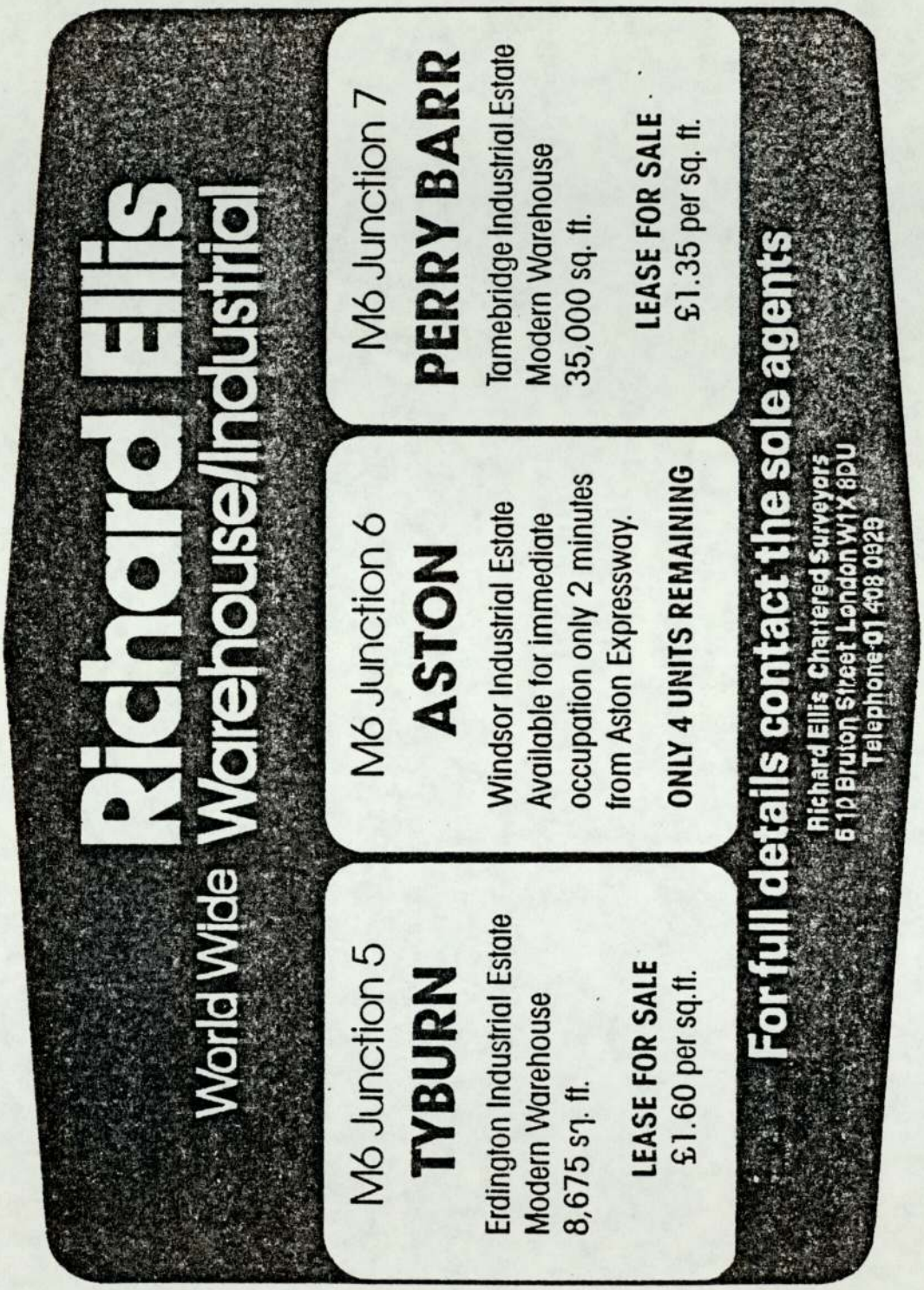
Advertisements typical of this approach are shown in figures 2.3.1 and 2.3.2. The widespread incidence of this theme in the publicity tends to infer that motorway connections are a necessary condition for a successful industrial location.

FIGURE 2.3.1: EXAMPLE OF LOCAL AUTHORITY PUBLICITY



Source: Courtesy of Rugby Borough Council.

FIGURE 2.3.2: EXAMPLE OF PRIVATE SECTOR PUBLICITY



Source: Richard Ellis, Chartered Surveyors.

Additional points of interest to an industrialist include the quantity and quality of local labour, the availability of housing, opportunities for shopping, leisure and recreation, local supplies and markets, and financial assistance. A potential occupier would be interested in the provision of services to the site, access to the site, loading facilities, eaves' heights, details of freehold or leasehold, the price or rent, and the property's general appearance.

The significance of local authority promotion in attracting industry was indicated by a study of the South West:

> "The image of the South West which the local authorities attempt to create is somewhat different from that held by such industry as has moved into the region. The attitudes adopted by the local authorities are, to some extent, a reflection of the advertising media through which they are expressed. The specific image which they create, of living in a holiday area, affects the attitudes adopted by the businessman. The growing advertising budget shows that local authorities have realised the need to create a particular image for industrialists ...
> The fact that so many firms experienced so many problems reveals the extent to which this image, based on what is essentially background information, has influenced an economic decision".
>
> (Newby, 1971, 198).

2.3.6 THE INDUSTRIAL PROPERTY MARKET

This chapter has already detailed some of the changes which have occurred in the post-war development sector. However, individual categories of property especially industrials, have not been discussed. Private speculative development concentrated on shops and residential projects between the wars, switching after 1945 to city centre re-constructions, provincial shop redevelopment and office development. With a rapidly growing tertiary sector and an increasing desire on the part of firms to rent their accommodation, offices offered the

greatest potential for development gain. The profitability of the London-orientated office market remained through the consolidations of the late sixties, until the collapse in 1974 and subsequent oversupply ended many development activities.

Until recent years, most industrial firms tended to develop their own properties. However, the scope for investment opportunities in this sector of the market began to be appreciated in the sixties. An Economist Intelligence Unit report in 1964 stated that "the potential for this type of development is great ... Although to some extent the development of factories is a specialised activity there is no reason why property development companies should not extend their field of activity to include a greater percentage of industrial developments in their portfolios" (1964, 82). By 1975 another survey reported that "investment in industrial building now forms a major sector within the property market" (Gower Economic Publications, 1975, 97). The recent considerable growth in industrial development has been partly the result of poor opportunities in the office sector following 1974. Four years later, reports spoke of "substantial growth anticipated in institutional funds flowing into property (which) will underpin capital values ... of industrials in particular" (Henley Centre, 1978, 5). At the same time a Financial Times poll of chartered surveyors and investing institutions revealed that modern factory and warehouse rents were felt to be rising more than office and secondary shop rents, and only less than prime regional shop rents (10th November, 1978).

The growth of speculative industrial development is associated with an increasing number of firms renting their own premises. Although most of British industry owns the land on which it operates, this is due to the special and highly fixed nature of capital in the traditional,

large scale, heavy and basic industries (Massey and Catalano, 1978, 106-7). Growth in recent years has been in the light manufacturing and distribution sectors. The older industrial properties "differ from ... the more general purpose factories of, for example, trading estates which have much more generalisable characteristics. It is indeed these latter which are more frequently operated on a rental basis" (ibid). Indeed, "development in the sector is now almost exclusively confined to industrial estates" and it is "the post-war period (that) has seen the rapid expansion of industrial estates ... the majority of which are developed on a speculative basis mainly by the private sector" (Gower Economic Publications, 1975, 90, 95). Industrial estates accommodate mostly light industry and warehousing, although in response to rising office costs industrialists are looking to locate as many sales and administrative staff as possible within industrial complexes on these estates. Industrial units are built to allow further expansion on the estate, and plots of land may be available. Generally speculative units are multipurpose and provide floorspace from 5,000 to 50,000 sq. ft. If developers have been able to pre-let or pre-sell units prior to construction starting, these might be purpose built for a particular buyer, or with special features (designed not to restrict future lettings) for particular tenants. However, Cadman and Austin-Crowe point out that "most companies seeking space are aiming to move within a matter of three or four months and are not particularly attracted to a scheme which has only just started and will not be available for a much longer time" (1978, 164). Warehouse units are often a most attractive investment because their structure will last longer than a manufacturing unit. The public policy change from urban redevelopment to renovation especially through industrial improvement areas has encouraged some developers to initiate schemes to refurbish older properties.

Private developers are also now concentrating more on the provision of nursery units, under 5,000 sq ft, for small businesses.

2.3.7 THE IMPORTANCE OF ACTORS IN THE DEVELOPMENT PROCESS

This chapter has reviewed the considerable growth in speculative industrial property development and the associated roles of developer, estate agent and local authority. However no assessment has been made of the proportion of new development that is speculative, nor in the context of wider research, the proportion of firms' location decisions accounted for by new property.

Lean and Goodall answered the first point by stating "it is seldom the case that the person who is going to use the real property ... will be the person who develops it" (1966, 91). However, two years earlier, the Economist Intelligence Unit had estimated that "as a proportion of total private investment expenditure in buildings and works, investment by property companies has risen from 4.4 per cent in 1959 to 7.3 per cent in 1963" (1964, 27). Although this is an increase of two thirds, the percentage is rather insignificant overall. The report goes on to note that these figures, derived from a macro-economic analysis, are incomplete and imprecise, and indicates that they may underestimate the true position. Indeed, the property developer cannot speculate in the extensions and additions to existing premises, included in these statistics. It might be expected that since the early sixties the role of the industrial developer has grown. A more recent, survey-based study was able to estimate that "approximately one third of new industrial floorspace is provided by the industrial development industry on the open market, one third takes the form of extensions to existing properties and one third consists of direct investment by manufacturing industry itself" (JURUE, 1980(i) Appendix 4.6). From these results it can be concluded

that approximately half of all new location decisions which are not tied to an existing property, are undertaken by developers. This is supported by the observation that most new developments of independent units are confined to industrial estates, which are predominantly speculative ventures. Hence the location of these new developments is fundamentally the responsibility of the developer. Unusually large or specialist projects are not often accommodated on industrial estates, and in these categories developers have far less importance.

Evidence of the proportion of firms locating in new properties is provided in an analysis by JURUE who studied three categories of stock on the market (1980(i) 4.4.2)* Results showed that new properties accounted for 38.8% of floorspace, secondhand properties accounted for 46.7% and refurbished properties accounted for 14.5% (see figure 2.3.3). New stock accounted for 75% of the total floorspace of premises under 5,000 sq ft in size. Although other studies support these figures, they do not necessarily give an accurate representation of occupation patterns because they must be judged in the light of turnover or 'flow'. Evidence suggests that the turnover of new properties is higher than old ones because the latter include certain premises, the nature or condition of which engenders no demand. Therefore it appears that more than 39% of locations chosen by firms are in new properties. If half of these properties are built speculatively by developers, then approximately 20% of all location decisions made by firms (excluding in situ expansion) have been taken at an earlier, more fundamental stage by an industrial property developer.

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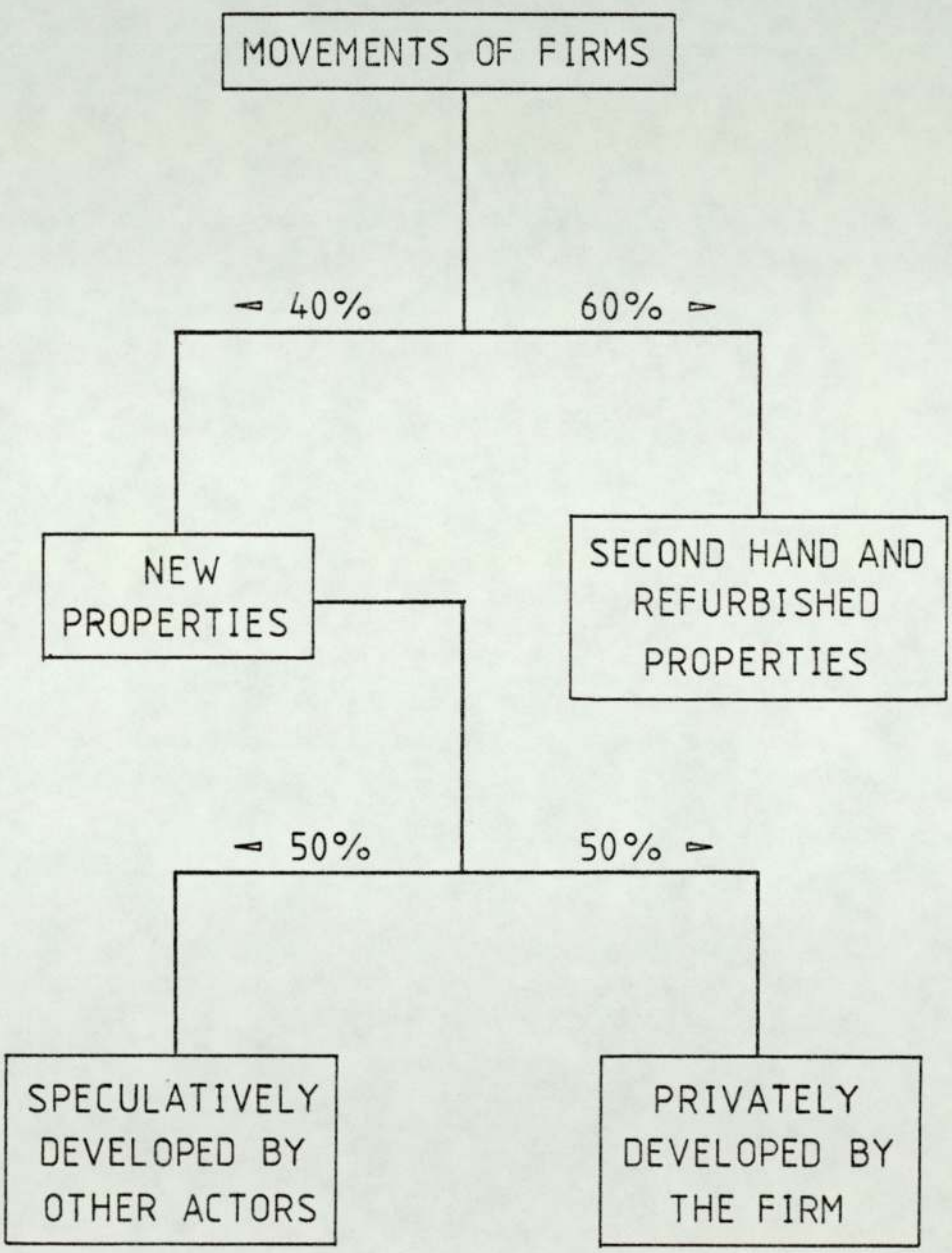
*It should be noted that these results may reflect the state of the market at the time of survey, and are therefore liable to change should the market improve or go into decline.

FIGURE 2.3.3: THE SIGNIFICANCE OF SPECULATIVE INDUSTRIAL DEVELOPMENT



It might appear that the scope for independent location decision making by either firm or developer is severely curtailed by the operation of a comprehensive land use planning system. If this were the case the form of new industrial land use patterns would be in the hands of the planning departments. However, evidence suggests that this is not so. Firstly, if land allocations for industrial use exceed demand, then choice will be exercised over which sites to develop within the allocations. Secondly, rigorous land use zoning is no longer practical and sites are frequently developed for uses, for which their neighbourhood is not zoned. An illustration of this is found in Carter's study of the West Midlands conurbation which discovered that of all land going into industrial use between 1964 and 1975 approximately half was outside industrial zones (1977, 141). Planning is therefore only one influence on location acting alongside the activities of the development sector and the requirements of the final user.

2.3.8 SUMMARY OF ISSUES

This research area review has investigated actors other than the firm who are involved in the industrial property development and location process. It has shown that over the post-war years, the proportion of speculative development has grown to a substantial level, and hence private sector developers and estate agents have taken an increasingly important role in determining where new factories and warehouses will be located. Similarly, a public planning system now influences all development decisions and local authorities themselves have recently become involved in speculative property development and promotion efforts in order to engender a healthy industrial base. Evidence has been presented to show that speculation accounts for half of all new industrial projects, excluding extensions. Consequently the independence of the firm in new location choice must have drastically diminished.

In many cases, especially of small and medium sized properties, it is reasonable to divide location decisions into the 'fundamental' made by developers who site and build a scheme, and the 'superficial' made by firms who choose between existing developed premises.

Industrial location research has paid almost no attention to these 'other actors' in the location decision. In view of the degree of involvement of these actors, it is felt essential that they should be included in investigations of new factory and warehouse location. In the case of the present research they are especially significant because of the considerable promotional emphasis given by both public and private sector actors, to accessibility and motorways. If motorways affect the location decisions of developers, then inevitably they must affect the locations of the occupiers of their developments.

The industrial property sector, while accepting the extent of their involvement in new development, would probably state that they only supply what the market requires; any other action would not attract demand and they would go out of business. Hence, they would argue firms still determine new industrial location, albeit indirectly. If this were the case, then these 'other actors' would be a reliable source of information on firms' locational requirements, which had been gathered over many years. However, as section 2.2 has shown the locational requirements of firms are very difficult to assess, even by the firms themselves, and it is therefore quite possible that attractive sites may simply be created by promotion and the availability of suitably built units. In this case developers would be the key decision makers in a large proportion of location choices.

The information presented in this chapter is, therefore, to be used to approach the study of industrial location from a novel though very valid viewpoint.

2.4 URBAN FORM

2.4.1 INTRODUCTION

Investigations into industrial location within the city cannot be divorced from the overall form of the urban area, because the factors which determine its location are affected by, and themselves influence,urban structure. This chapter will therefore discuss research on urban form which relates to the subject of this thesis.

Chance and historical factors play a strong role in the location choice of the multitude of various land users concentrated into cities, and this results in land use patterns peculiar to individual towns, suburbs and neighbourhoods. Despite this complexity, writers have attempted to impose some descriptive and explanatory order on urban form. The adoption of limited and sometimes arbitrary land use classifications, and a belief in the universality and omnipotence of market forces have enabled several theories and models to be developed. These and the dynamics of urban change will now be discussed, before particular attention is focussed on the place of industry in these processes.

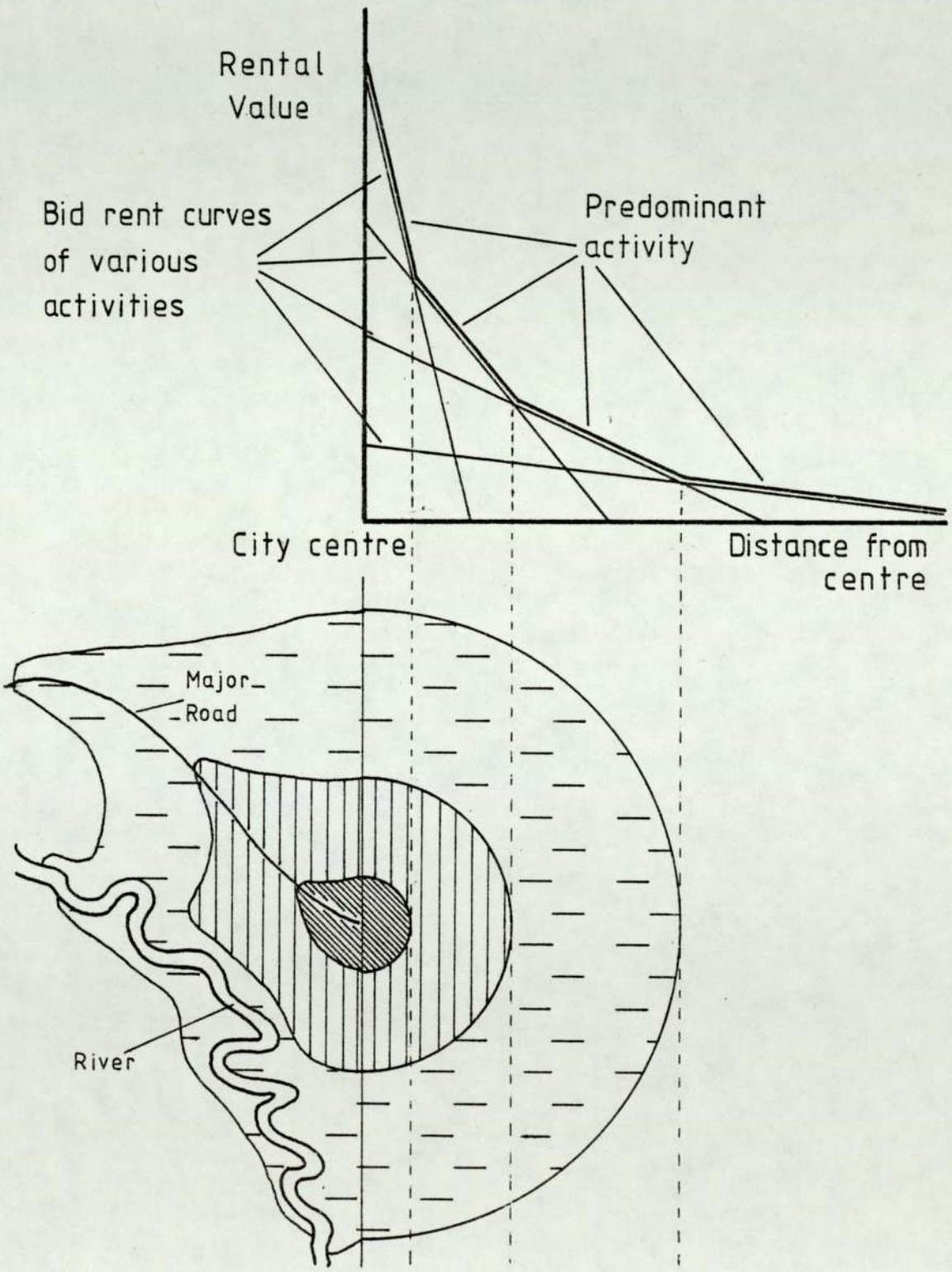
2.4.2 THEORETICAL APPROACHES

The earliest and most economically complete concept of urban form is the concentric ring model which Burgess (1925, 1929) applied to the city of Chicago in the twenties. He argued that a growing city expanded radially from its centre in a series of five concentric zones - the central business district, the zone in transition (factories and a declining residential area), the zone of working men's houses, the residential zone, and the commuters' zone. As Carter (1972) points out, this approach is "explicitly inductive

and presumably intuitively derived from observation". However, a theoretical basis for the model lies in the economics of urban rent found in the work of Hurd (1924) and Haig (1926). This assumes that the city exists to provide its inhabitants with convenient access to their needs (work, shops, education, etc.) and that this accessibility is maximised at the centre. Accessibility is therefore the main determinant of a site's utility and consequently its rental value. Accordingly, both accessibility and rents are greatest at the centre and fall away with distance. Different activities will pay different rents for the same sites in relation to the utility they derive from them, and this produces a different bid rent curve for each activity. The form of the bid rent curve is determined by a trade off made by each activity between high rents and minimal transport costs at the centre, and low rents but substantial transport costs at the margin. As figure 2.4.1 shows, the steeper the slope of an activity's bid rent curve, the greater will be the importance attached to minimising transport costs. The highest bidding activity at a location will then become the predominant land use in that part of the city. On an isotropic plane, the boundaries between adjacent land uses would take the form of concentric rings around the city centre. In a more realistic setting, the geometry will be distorted and drawn out along the routeways and compressed by natural barriers such as lakes.

Two other models of urban structure are well known, though both are primarily descriptive and lack theoretical rigour. Homer Hoyt's work on US cities (1939) led him to suggest that re-locations migrated outwards from the city centre along a tranpsort route beside which lay the original site. Therefore similar land uses would be found in sectors radiating from the urban centre.

FIGURE 2.4.1: THE CONCENTRIC MODEL OF URBAN FORM



The industrial sector would probably be sandwiched between sectors of low quality housing in order to provide labour and protect the environment of the higher quality residential sectors. The multiple nuclei concept associated with Harris and Ullman (1945) depicts a city which, besides its central business district, contains other nuclei either repelled from one another or linked by mutual dependence. Typical nuclei might include suburban business or shopping centres, outlying heavy industry, light industrial estates, and cultural or financial centres. This concept may be extended to describe cities and conurbations made up of older towns and villages which have coalesced through growth.

2.4.3 DYNAMICS OF URBAN FORM

City form is dynamic; it changes in response to social, political and technological developments. However, all the above models reflect rather static views of certain cities at certain times in their growth. Bourne (1971, 70) feels that recent changes in urban structure have altered both the basic assumptions and the expected outcomes of these classical models". Referring in particular to the concentric and sector concepts he writes that they "predate the major impact of the automobile, the post war booms in population growth, housing construction, shopping facilities and in social and industrial mobility". Furthermore their validity is questioned by non-homogeneity within zones, the consequent artificiality of zonal boundaries and their reliance on monocentric settlements. Despite this reputation, the concentric form of analysis continues to be adopted by many researchers investigating urban location (e.g. Cameron, 1973, JURUE, 1977); perhaps due to the lack of any better approach.

Many writers have interpreted developing urban form in terms of

changing accessibility due to transport innovation. They would argue that the early city was a dense core of crowded workplaces and dwellings, because travel was restricted to the 'foot or hoof'. Blumenfeld (1971, 63) suggests that in this period cities were limited to a radius of three miles and took a broadly circular form. Gradually this constraint on urban growth was lifted by the development of public transport during the mid and late nineteenth century. Evidence shows that London extended its radius by only a fraction of a mile during the first forty years of that century, while in the following thirty years it doubled to over seven miles (Clark, 1951). The innovations of the omnibus and suburban and underground railways speeded movement within the city, allowing workers to live further from its centre and their workplace; whilst the siting of the major termini in the city centre increased its dominance over the dependent urban areas. A major physical impact from public transport was felt at the urban periphery through a differential improvement in accessibility along the path of bus routes and around the rail stations. Hoyt's review of these changes caused him to observe the axial pattern of growth along suburban railroads in the 1920s, and Chicago's "starfish extensions of settlement along the principal highways and street car lines" (1964, 92).

After the twenties, Hoyt discovered that interstitial growth had provided housing for a population which had gained the freedom of personal movement through the automobile. "The automobile and the resultant belt highways encircling American cities have opened up large regions beyond existing settled areas", resulting in "greater flexibility in urban growth patterns" (ibid, 93). According to Blumenfeld (1961, 231) this marked the end of that 'transitory phenomenon' the concentrated big city. The widespread

use of motor vehicles appears to have added an amorphous outer shell to the still visible earlier structure of the city. Although highway construction has encouraged this development, major roads are not thought to dictate a certain physical form for the city because their users are free to travel along feeder routes to reach any roadside destination.

Although evidence so far presented has been based on US experience it may be applied with similar relevance to the UK where the use of motor vehicles has only become widespread in the post-war years. Over this period complex changes have influenced the nature of the British city. The nation has experienced a comprehensive town and country planning system and been subjected to an exceptionally high rate of economic and population growth which has only slowed during the seventies. This post-war affluence led to a growing demand for improved, larger and preferably owner-occupied housing, and produced a great increase in automobile ownership. These two factors enabled many people to move into new housing at the urban periphery where space was available. With car transport they could live further from the city and their workplace and were not tied to bus or rail routes. Therefore the post-war decades saw a considerable decentralisation of population from the large urban inner areas, which led subsequently to industrial decentralisation. These locational shifts were encouraged by large scale slum clearance and urban redevelopment programmes.

In the face of potentially massive urban sprawl, planning policies of urban containment and overspill were initiated. Around the major conurbations green belts and new towns were designated with the object

of limiting the size of cities and directing the growth they could not accommodate to independent planned communities. Migrants from the inner areas to the suburbs and the new towns tended to be the more able and ambitious in the population - often the white collar and skilled blue collar workers who could aspire to owner occupancy and a private car. Left behind in the inner cities, various minority groups, such as the aged, the unemployed and immigrants, gathered similar neighbours around themselves in the vacated, cheap rented properties, and thereby formed concentrations of social deprivation. Meanwhile profitable city centre office development had produced a considerable rise in central area land values which raised the price of inner city land beyond a level where most industrial or residential development was economic. In consequence, new developments ceased and the inner city declined further into structural obsolescence.

During the seventies the economic problems of the nation have exacerbated the difficulties of the inner areas and their multiply deprived inhabitants, and so placed increasing burdens on the urban local authorities. Recent government policies have addressed the 'inner city problem', and the refurbishment of existing premises has been encouraged. The seventies have also seen a decline in population growth rates which has undermined part of the containment and overspill policies and caused target populations for many new towns to be revised downwards.

2.4.4 INDUSTRY IN THE CITY

A land use survey within one conurbation showed the largest land use category to be "residential" covering 60-70% of all developed land.

The second largest developed land use was "industrial" covering 12% of all developed land (West Midlands C.C, 1978(i), Table 25). These uses should not be viewed in isolation, but instead as two of many complementary activities found in cities, between which flow people, goods, money and information. Consequently the location of industry is unavoidably connected to the location of every other urban activity, and it is therefore not surprising that changes in urban structure are reflected in the patterns of industry in the city.

Pred (1964) has suggested that the advent of steam power was initially responsible for drawing industry into the towns. By the nineteenth century - "an age when wholesaling and manufacturing were more closely associated than they are today" (ibid, 383) - the introduction of railways encouraged industry to group around the rail terminals in the inner city, where local distribution costs could be minimised and market area extended. Indeed, at the end of that century, rail transport was so dominant that Weber contended that highways no longer had "any independent locational significance at all; their function (was) rather that of a subsidiary of the railway system" (1929, 86-87). According to Pred, the railways by increasing market area, enabled some firms to accrue sizeable scale economies and so substantially increase plant size. This growth together with rising land costs at the city centre encouraged some firms to migrate to locations at or beyond the urban fringe. However, because workers were still unable to travel over long distances to work, the need to build company housing was generally attendant on a move to the suburbs, and this deterred all but a few firms such as Cadbury at Bourneville.

It was the development of an extensive and efficient public transport

system and the arrival of the automobile which finally helped manufacturers out of their traditional inner area sites, which had become increasingly congested and obsolete. More spacious decentralised sites offered manufacturers the opportunity to reorganise outdated production systems in efficient single storey factories.

> "In both the United Kingdom and North America, the advent of the automobile brought about a sorting process which left only certain specialised types of industry in the inner city ... Traditional linkages to railway termini, stockyards, docks and other central city break-of-bulk points had kept much manufacturing industry tightly located. The new medium of transport, however, with its greater flexibility and tendency to favour the outer less-congested parts of cities began the shift to the urban periphery".
>
> (Lloyd and Dicken, 1-77, 295).

Transport innovation, therefore, seems to have been as closely associated with industrial patterns in the city as with overall urban form.

In the UK over the post-war period urban industrial location has been characterised by growing decentralisation, particularly to sites on industrial estates. Evidence (Edge, 1973, 126) shows that some of the principal advantages obtained from inner area locations are cheap, rented accommodation often in small units in parts of old, rundown premises. Firms leave these sites for various reasons. Firstly they allow very little room for expansion because where land shortages are absent, inflated land values make industrial property development uneconomic. Hence growing companies must move outwards to find new premises. Secondly, many firms are forced out because of lease termination or compulsory purchase.

Urban redevelopment has had the greatest impact on small firms. When such firms move they can seldom afford the high rents of newer premises in the suburbs and are therefore faced with closure unless they can find a similarly old and delapidated building offering a comparably low rent. The result of urban renewal has tended to affect whole inner areas with the removal of these cheap properties, leaving few places for the displaced firm to go. It has been argued that such a policy has removed the industrial 'seedbed' where small firms can start with few resources, and grow into the large companies of tomorrow (Edge, 1973). Industrial decentralisation beyond the suburbs to the new towns is encouraged by various special incentives. However, the extra distance involved discourages many firms, especially the smaller ones.

The industrial or trading estate has become a conspicuous feature of decentralised development in the past few decades. Although the first British estate was built at Trafford Park in 1896 and others followed, notably the Slough Estate in the twenties, most estates are relatively recent in origin. The 1947 Town and Country Planning Act which began a system of land use zoning, also sought to remove non-conforming uses. Hence industrial estates formed an ideal method of development in line with the principles of the Act. The location of many estates in decentralised positions is due to the availability of land in these places and the operation of the planning system during their development. The advantages offered by an industrial estate are varied, especially as the estates themselves differ in what they offer. Hill (1977) has described how firms appreciated room for expansion, ease of access along purpose-built and uncongested roads to reach loading bays, parking space, and the economies of shared services such as security. Inter-firm

linkages were considered a negligible benefit, while problems arose due to rush hour congestion, competition for labour, and labour access to firms on the far side of large estates.

2.4.5 SUMMARY OF ISSUES

It is widely held that cities exist to provide contact and access between individuals and organisations, for example between customers and suppliers, or between workers and employers. The character of this contact is determined by the state of transport and communications technology, which, it has been suggested, helps to shape urban form. Hence, the early tightly bound concentric settlements grew along the axial routes provided by road and rail public transport, until the automobile offered mobility to all and enabled an amorphous spread of development. Easy access to the suburbs then drew industry away from the congested inner city to suburban and greenfield estates. This process coincided with urban containment and overspill policies, which many believe exacerbated the problems of inner city decay.

Despite a consensus that the automobile is partly responsible for the present form of cities, this does not extend to the view that modern highways impose a definite shape on patterns of urban location. This is because motor vehicles are free to move anywhere on a ubiquitous road network. However, over the past twenty years in Britain a new type of highway system has been constructed. These motorways differ from conventional roads by limiting access onto and off themselves to a few major intersections, while other roads simply cross their path without connecting. Even the major intersections do not disturb the main flow of the motorway because they are grade separated. Hence, the motorway can be compared to a railway line with access restricted to stations where through passengers need not change trains. Although other routes are being

upgraded to incorporate certain features of motorways, the basic distinction remains between the type of road which existed twenty years ago, and the modern motorway.

In relation to the city, motorways connect major urban areas but do not radiate from their centres. Only a few urban motorways such as the A38(M) in Birmingham or the M32 in Bristol, actually connect the national network to city centres, and these are mostly spurs. Generally the network skirts around the periphery of urban areas where feeder routes provide connections to the local road systems. In terms of urban location, the motorway is likely to be found in the suburbs or on the urban fringe. Like the commercial airport, it is located where the large demands it makes on land and its environmental disruption are traded off as push factors against the pull factor of the transport services it provides.

The motorway, therefore, will often present a corridor of access points or intersections lying around the urban centre. As the motorway differs from the generally ubiquitous road network and does not allow free movement off and onto its path except at key junctions, it may possibly provide a locational attraction. In this case the implications for the study of urban form must be recognised. Firstly, the assumption that the automobile produces formless urban growth must be modified. Secondly, the role of the motorway in the process of decentralisation from the inner city should be examined. Finally, if a motorway can act as a locational magnet passing through the outer parts of an urban area, this factor can be incorporated in models of urban form without the assumptions of a monocentric settlement which the concentric and sector theories require.

3.0 HYPOTHESES AND METHODOLOGY

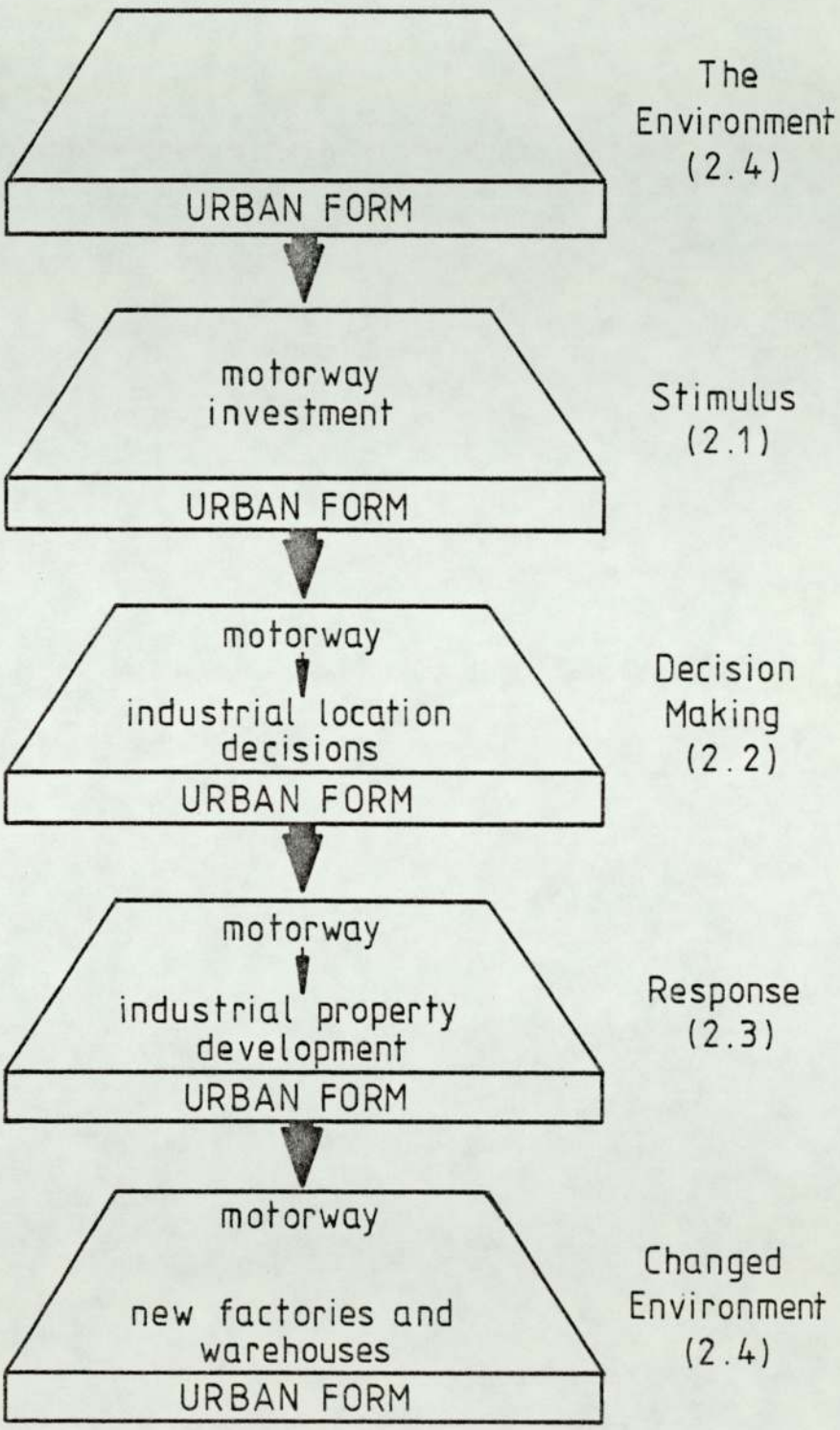
This section draws together the components of the four separate research areas and combines them into hypotheses. In order to test these hypotheses, two complementary research methods are then formed. Only broad questions of research design are presented here; more detailed operational considerations are discussed in section 5.0.

3.0.1 THE CONCEPTUAL FRAMEWORK AND DEVELOPMENT OF HYPOTHESES

The research issues reviewed above in the areas of transport, industrial location, property development and urban form, are condensed into a conceptual framework which is presented as a model in figure 3.0.1. Briefly, this shows a central relationship between motorways and industrial location which is played out in an environment called the urban form. A new motorway built within this environment provides a 'stimulus', the results of which have been discussed in the first research area review. According to the model, this 'stimulus' affects the industrial location decision in the second research area. These decisions are made by developers and firms and lead to a 'response' which is evidenced through the development of new factory and warehouse buildings as described in the third research area. The buildings, however, are not necessarily net additions to the urban form, but simply located in different positions to those which would have been selected in the absence of the motorway. The end result of this 'stimulus-response' model is a changed environment as discussed in the urban form research area.

The conceptual framework is supported by evidence presented in the foregoing research areas' review, and will be rationalised into

FIGURE 3.0.1: THE CONCEPTUAL RESEARCH FRAMEWORK

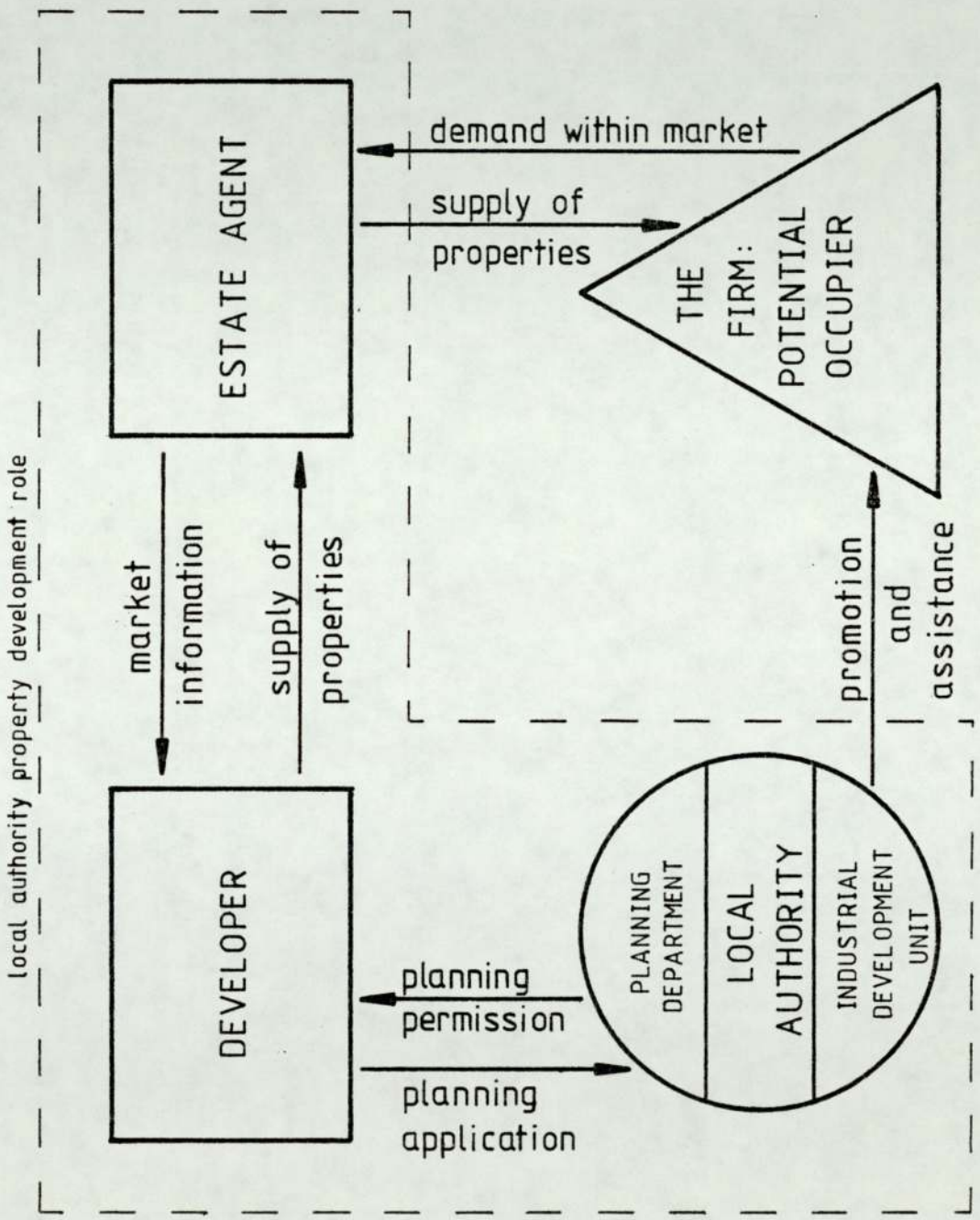


hypotheses. It has been shown that of the key actors involved in the model, the developers, estate agents and local authorities have perhaps greater significance and certainly account for as much new development as the firms. Consequently, the methodology will regard the process presented in the framework as being firstly and fundamentally a location choice by the developer, and secondly and superficially by the firm from sites already developed. In practice, this will not ignore property development by the firm, but will make the issues easier to conceptualise.

Figure 3.0.2 presents the relations between the principal actors in the process. The speculative property developer chooses suitable sites for development from his market information which originates in the perceived locational preferences of the potential occupier. Hence, following a motorway investment, the developer will be influenced in his site choice if he believes the customer to be attracted to property near motorways. The developer may or may not have an agency incorporated into his business with which to interface with the market. The role of the local authority in this model is threefold. Firstly, it has to provide planning permission if the developer's scheme is to proceed. Secondly, it may promote its locality to attract mobile firms, or it may assist local firms to find accommodation. Thirdly, the local authority may become involved in speculative development itself, and undertake the role of developer and sometimes agent (as shown in the figure by the dashed line).

It is postulated that the firm is seen by the other actors to value motorway access, because of the considerable emphasis these actors place on this factor in publicity material and promotions.

FIGURE 3.0.2: RELATIONSHIPS BETWEEN THE PRINCIPAL ACTORS IN THE CONCEPTUAL FRAMEWORK



Various explanations can be suggested for this high valuation in the face of evidence of negligible transport cost benefits. For example, a motorway provides speedy, reliable and simple travel, especially for executives using it for business and leisure trips. However, most important is the salient fact that actual benefits are irrelevant because only perceived benefits influence decisions.

Given that a motorway offers notable perceived benefits, it is proposed that these are localised rather than spread throughout the urban form. It is to be expected that location benefits accruing from a motorway are likely to diminish in scale with distance from that motorway. However, with such intangible benefits the rate of distance decay is highly uncertain. Special factors may be at work to encourage strong local attraction. The advantages of prestige and advertising potential are examples of benefits irrevocably tied to major junction and major road frontage. Also, the reduction of long distance travel times and the relative worsening of local travel times which results from major transport investment as discussed earlier, produces a relative decline of local vis-a-vis inter-regional accessibility. This leads to increased demand for locations close to the major transport facilities in order to maximise the benefits of their use. Furthermore, the psychological impact of motorways on the perception of urban space is likely to be marked. The great physical bulk of motorways, their impact as barriers and the access they offer are certain to draw the decision maker's attention. It is therefore proposed that within the urban scale, motorways act as a magnet for new industrial property development.

Unlike other routes, motorways do not follow radial paths from urban centres and are seldom truely circumferential, but rather pass through

parts of the suburbs and urban fringe. Consequently, if they hold a wholesale though localised attraction for new industrial location, this will result in a pattern of new industrial urban form along a corridor of access point concentrations, leading to an irregular suburbanisation. It is suggested that factory units, with their various requirements for labour and industrial linkages, will be developed in motorway locations near to labour pools and possibly existing industry. Warehouse units employing fewer people but placing a greater emphasis on transport requirements are likely to hold motorway accessibility in higher estimation. Their large space requirements, it is proposed, will encourage them to seek motorway locations on the urban periphery where land costs are lower.

From this discussion, two broadly defined research hypotheses can be developed. Firstly, it is postulated that within urban areas new industrial property developments are attracted to motorways and this attraction is particularly localised around motorway access junctions. Secondly, it is postulated that motorways hold a stronger attraction for warehouses than for factories; although this may vary depending on which part of the city is considered.

3.0.2 DESIGN OF RESEARCH METHODS

The research methods seek to test the hypotheses by determining the existence of correlations and causal relationships between the concepts involved. These are the presence of motorways and the location of new factory and warehouse properties. To operationalise these concepts into a research design requires their transformation into measurable and comparable variables which can be recognised in the chosen form of analysis. Keeble has classified empirical industrial location research into micro-level analysis and macro-level analysis.

> "Micro-level analysis may be defined as investigation of industrial location change by direct data acquisition, usually by questionnaire interviews from samples of manufacturing firms...
>
> "Macro-level analysis ... usually involves the use of aggregate published or unpublished statistics, selected as measuring possible manufacturing change in some form of hypotheses testing statistical analysis or model."
>
> (Keeble, 1976, 4-5)

To establish the most appropriate level for the research methods, the essential design requirements must be identified. Foremost among these is the need to study an entire urban area, so that the full impact of a motorway may be assessed in all constituent neighbourhoods. Furthermore the urban area considered must be of sufficient size and sufficiently industrialised to provide an adequate number of observations. Unfortunately there is no major urban area within Britain which has not experienced some motorway investment, and consequently there was no possibility of incorporating a control group or 'environment' into the design. An equally important design requirement is a valid and accurate measure of location. The research is interested in location choices or decisions, rather than the scale of location as measured in employment or investment. Consequently, the cornerstone of the research design should be a direct and detailed location measure which reflects decisions translated into actual factory and warehouse developments.

If a micro-level approach were used to test the hypotheses, it could take two forms. Firstly a sample survey of occupiers and developers could identify a suitable set of locations and provide evidence of age, size and use. Secondly, a sampling frame could select a scatter of study zones within an urban area, within which an evaluation of building

stock would determine the age of premises and a door-to-door survey would determine the nature of business and occupancy status. Unfortunately, limited resources normally restrict 'micro-level' research methods to relatively small samples carefully selected to represent parent populations. Respondent surveys are also troubled by low response rates, lack of full cooperation, unavailability or retirement of key personnel and memory failure; all of which further reduce usable sample sizes. Furthermore, respondents make mistakes and through post-event rationalisation ascribe importance to issues which have only subsequently become significant. Irrational, non-economic and personal reasons for business behaviour cause subjects to hide behind more acceptable explanations, and where hunches and intuition play a part the respondent may be unaware of the true determinants of choice. Random selection of small study zones within a larger urban environment inevitably presents a less than complete interpretation of urban form, and makes assessing the distance decay of locational attraction particularly difficult. Therefore, these disadvantages combined with a previous reliance on micro-level analysis in the allied study of movement of firms, suggest that a macro-level approach would provide the primary research method with a more significant and fresher insight into the hypotheses.

Macro-level analysis is able to deal in aggregate terms with an entire population. However, it is severely dependent on the quantity, suitability and reliability of secondary data sources. The shortage of spatial measures disaggregated to the detailed levels required in the present research is a major constraint. Furthermore the availability and quality of information varies from one part of the country to another, causing problems of comparison. Consequently,

because considerable time and effort are required to assemble an adequate data base, the research design is restricted to a single urban area - the West Midlands conurbation. Fortunately the conurbation is particularly well suited to the research, having been exposed for many years to the impact of several motorways. Additionally, the large size of the area enables local distortions in spatial advantage, such as cheap, simple site preparation or excellent access to labour, to have a reduced effect on the results. By incorporating a considerable land area and number of developments, a wide range of local conditions are inevitably introduced which act as a 'randomisation control' (Krausz and Miller, 1974,73) to minimise error in results by cancelling out the extreme local distortions. Finally, a conurbation such as West Midlands consisting of various substantial towns enables the monocentric emphasis of earlier urban form research to be avoided. The selection of one study area will make widespread generalisations to a wider environment somewhat dubious in statistical terms. Consequently it is proposed to treat the West Midlands conurbation as a population in its own right for the purposes of this research. This course makes it essential to obtain fully comprehensive measurements in whichever analysis the methodology requires as it is not intended to investigate samples of the study area.

Within the chosen study area, operational measures of motorway proximity and industrial location were required. These would enable comparisons between industrial patterns before and after the motorways were built, and between factory and warehouse locations with respect to motorways. Various alternative proximity measures range from straight line distance, to road distance or road travel time, to transport cost or an accessibility index. Due to the perceived nature of location benefits

described in section 2.0, travel times were thought likely to provide the most accurate measure of the concept of proximity.

The measurement of industrial location presents greater difficulties, partly because of the need for comparisons over time, and between factories and warehouses. In practice it is uncertain when in the planning, construction and use of the motorway any locational impacts would first appear. They may begin very early during construction of the route as developers anticipate future benefits; or they may begin once the motorway opens and the benefits can be realised; or they may begin gradually as the advantages of the motorway are perceived. Consequently a measure was required to represent industrial location patterns in a base period prior to the advent of the motorway, and to represent increments to this base pattern.

These needs present a dilemma because of the availability of data, which will be more fully discussed in section 5.0. In essence, because warehouse growth is a relatively recent phenomenon it cannot be discerned in historical records, and consequently cannot be incorporated in the time series analysis. This role is limited to the patterns of manufacturing location measured through their areal coverage of land. To obtain the most recent identification of comparable factory and warehouse location this measure had to be abandoned in favour of planning application data actually interpreting location decisions by their frequency. Alternative data sources such as directories were both spatially and temporally incomplete, whereas confidentiality made official records inaccessible.

The macro-level analysis is quantitative, and involves the regression and correlation of spatial surfaces representing the various variables.

Each surface is divided into cells for easy comparison. The statistical analysis enables the form of any relationship between location and motorways to be ascertained in terms of the time series comparison of manufacturing location, and the cross sectional comparison between factories and warehouses. However the discovery of any such relationship does not prove a causal link. As Keeble observes, macro-level analysis faces difficulties in "the inferential leap from observed spatial association to possible causal influence" (1976, 5).

In order to ameliorate this weakness, a supporting research method is required. A complementary micro-level design can more effectively investigate the issue of causation, verify the results of the main method, and provide background information. Surveys of the firm are very common in location research and suffer from the difficulties of micro-level analysis described earlier. By contrast, the present research incorporates a questionnaire and interview survey of the widely neglected 'other actors' - the developers, estate agents and local authorities. Whereas obtaining a sufficiently large and truely representative sample of firms would constrain the research, the total population of 'other actors' within the study area is small enough to be fully surveyed. Furthermore, the relatively low number of respondents enables greater attention to be given to each, thereby providing a high quality and rate of response. As developers are continually involved in making location decisions, the survey can evaluate the factors behind their choices and so offer causal links with possible location determinants. Choosing development sites regularly is likely to give a developer a more objective insight into his choice criteria, than the firm making a 'one-off' move. Hence a study of 'other actors' minimises the methodological problems of

post-event rationalisation, memory loss and the absence of key decision makers. The numerous dealings of estate agents with potential occupiers, and local authorities with development proposals offer a unique but neglected body of knowledge about locational preferences among firms which the survey can tap. Finally, the survey can also investigate constraints on development applied by planners, which are liable to influence location patterns in the study area. A questionnaire survey was designed for the estate agents and developers and delivered by post. However the smaller number of local authorities and the more varied nature of the inquiries made to them, necessitated a less formal interview approach.

In summary, two complementary research methods have been developed to test the research hypotheses. Both are presented in figure 3.0.3. The main approach is designed at the 'macro-level' and is quantitative, using statistical regression and correlation to analyse location and motorway proximity data for the chosen conurbation study area. This enables any special association between new factory and warehouse developments and motorway presence to be identified. The second research method differs, in being designed at the 'micro-level' to collect and analyse qualitative information provided by questionnaire and interview surveys of other actors. This method seeks to determine the causal relationships which the results of the first method infer.

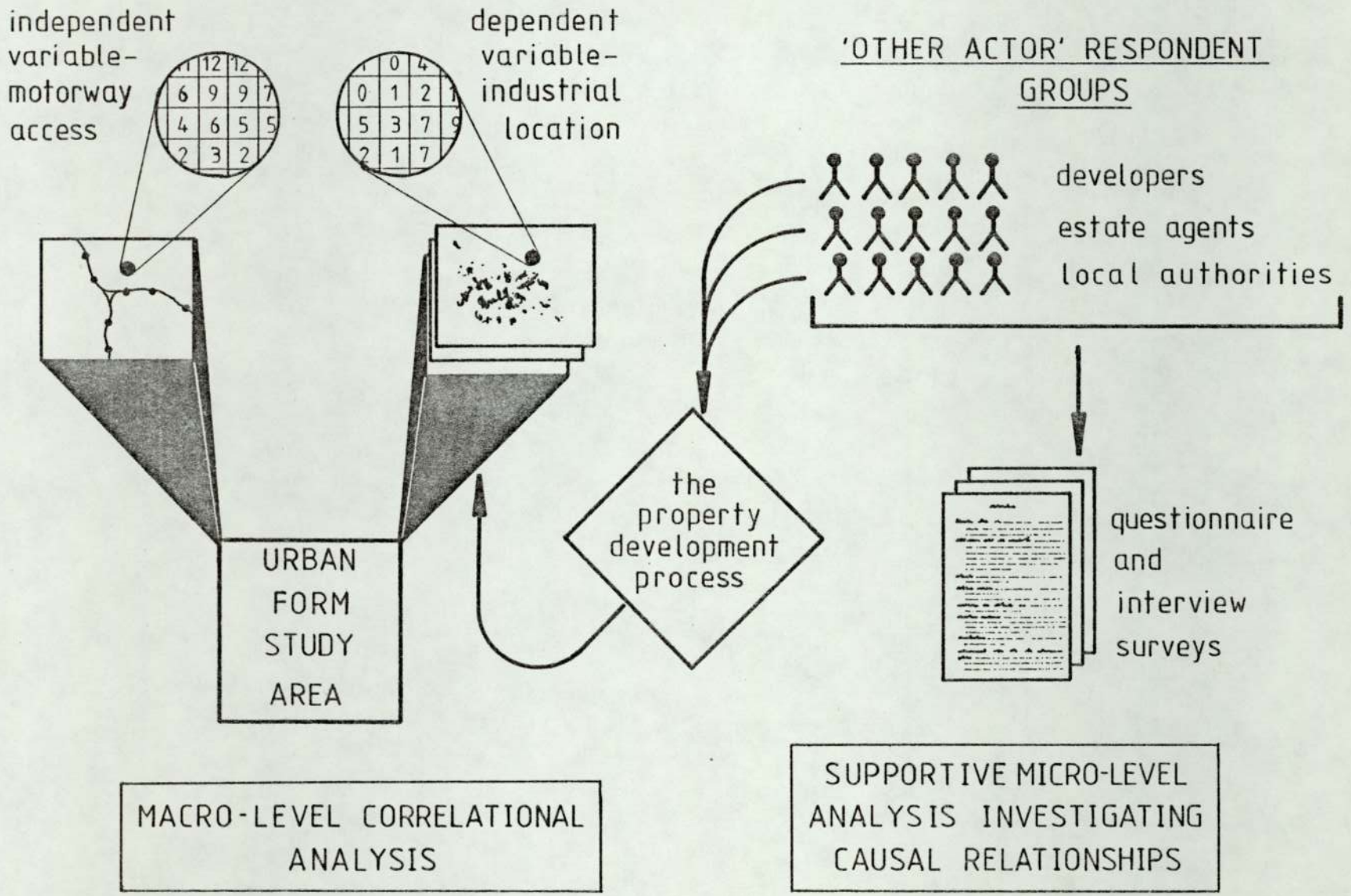


FIGURE 3.0.3: DESIGN OF RESEARCH METHODS

4.0 THE WEST MIDLANDS CONURBATION STUDY AREA

This chapter provides an introduction to the chosen study area - the West Midlands conurbation. A general discussion of the local economy is followed by a description of urban change and planning policies and a detailed review of industrial patterns and the provision of transport facilities.

The West Midlands conurbation contains nearly 2½ million people spread over an approximate area of 70,000 hectares. It forms the central sub-region of the West Midlands region, and its boundary coincides with the West Midlands Metropolitan County, except in the east where it is effectively defined by the designated green belt. Six metropolitan districts make up the conurbation and are shown in the full institutional context in figure 4.0.1.

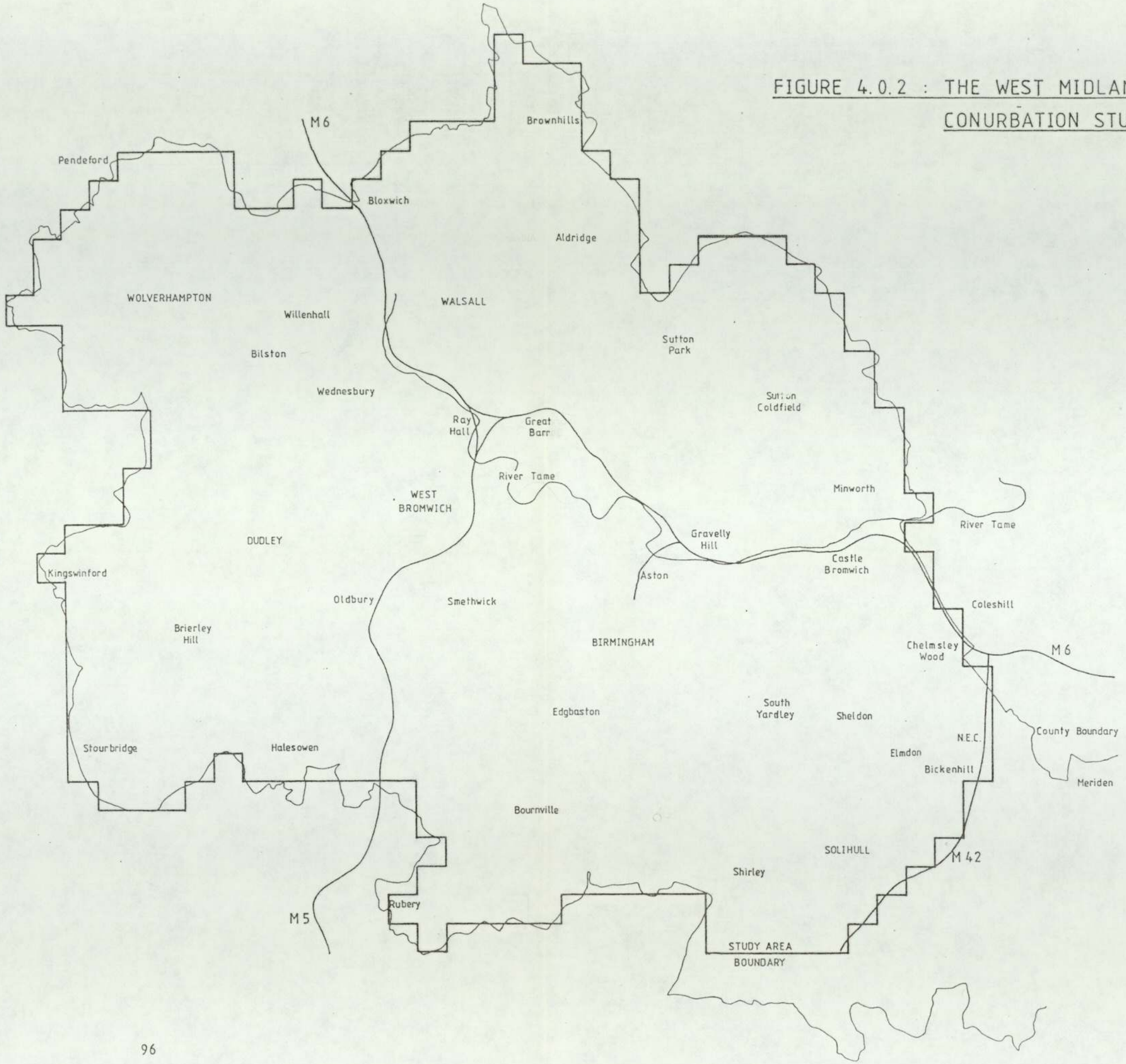
The research requires the study area to extend over a large contiguous urban environment throughout which no special restrictions limit development. Consequently, the study area boundary lies just within the County boundary and the inner edge of the green belt, as shown in figure 4.0.2. Around Elmdon in the east, some green belt land is included because of the exceptional nature of the locality's transport facilities. The study period of the research begins in the early sixties, when motorways first began to encroach on the conurbation, and ends in the late seventies.

4.0.1 ECONOMIC PROFILE

The boundary of the conurbation encompasses the Black Country in the west, and Birmingham with its adjoining towns of Solihull and

FIGURE 4.0.1: THE INSTITUTIONAL CONTEXT OF THE WEST MIDLANDS CONURBATION

FIGURE 4.0.2 : THE WEST MIDLANDS CONURBATION STUDY AREA.



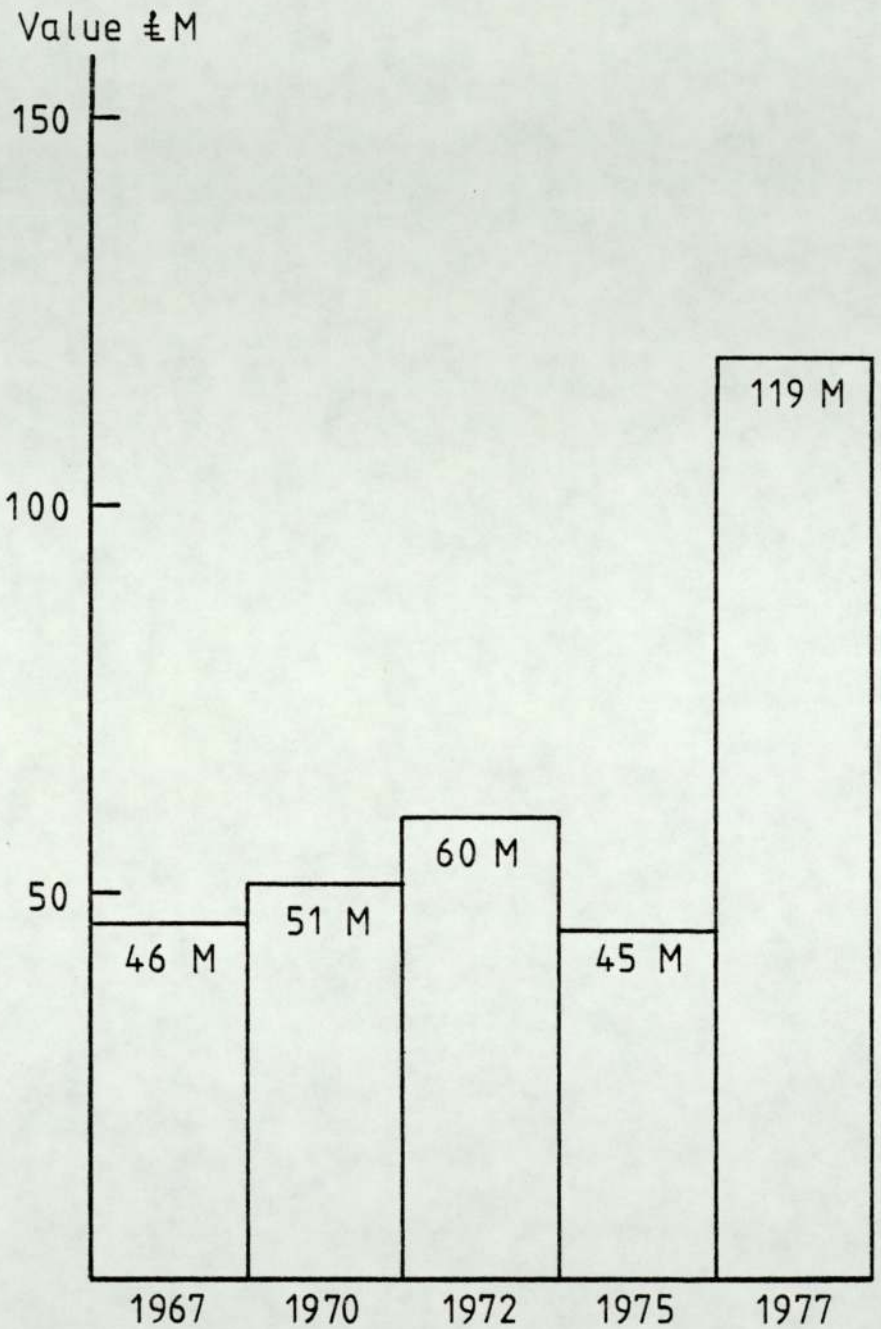
Sutton Coldfield in the east. Although both parts coalesce they have their differences. The Black Country is a host of industrial towns and villages which owe their origins to coal and iron making, and which still specialise in metal based manufacturing. Birmingham grew by concentrating on highly finished products such as guns and jewellery, although its more recent prosperity stems from the engineering and especially motor vehicle industries. Today, the city has become the second largest in England, the regional capital and a major commercial centre. Solihull and Sutton Coldfield are desirable residential areas and shopping centres.

The conurbation's economy has a heavy manufacturing content. In 1976, within the comparable West Midlands County, manufacturing accounted for 48.6% of total employment in contrast to 31.7% for Great Britain. Furthermore, 39.5% of this was concentrated in the metal based industries. The corollary of this high dependence on manufacturing is a lower proportion of employment in other sectors. Transport and distribution, for example, accounted for 15.1% of total employment in the County, compared with 18.8% in Great Britain (JURUE, 1980(i), Table 4.2.1). However, at the start of the study period the manufacturing concentration was even more pronounced. Within the Black Country, total manufacturing employment fell by 7% between 1959 and 1975. Conversely warehousing employment rose by approximately 55% (ibid, figs. 7 and 8). Within the West Midlands County "it is noticeable that the only industrial sector to experience employment growth ... in both the 1959-75 and the 1970-75 period was ... wholesale distribution" (ibid, 4.2.2). The study period, therefore, saw a continuing dominance of manufacturing activities in the conurbation despite experiencing the national trend in the growth of warehousing and office sectors.

For most of the post-war period, the West Midlands has lived up to its reputation as "Britain's most prosperous ... provincial region" (Liggins, 1977, 75). However, as the nation's relative prosperity in the fifties and sixties slumped in the seventies, so the rate of unemployment in the West Midlands began to rise faster than the national average, until in 1975 the unemployed total rose above that average (West Midlands C.C, 1978(i), 12). Liggins (1977) suggests that this turnaround can be traced back to 1966, and offers several explanations. Firstly, the application of industrial development certificate controls thoughout the study period restricted the quantity of new development above a varying size threshold of 1,000 sq ft to 15,000 sq ft. This may have encouraged the emigration of the mobile, expanding and dynamic firms from the region. Secondly, land shortage, physical dereliction and obsolescence may also have forced firms to leave. Thirdly, the industrial structure, which is heavily biased towards a few large industries with uncertain futures, shows no potential for growth. The structure has changed little since the war and newer growth industries are under-represented. Finally, planning policies of urban redevelopment, containment and overspill may have dispersed firms and employment to the new towns and beyond, and also removed cheap premises from the inner city causing existing firms to close and hindering the 'birth' of new enterprises.

It might be expected that these economic developments are paralleled in the property market. Between 1967 and 1977, the West Midlands region experienced a rise in the value of new construction orders for commercial and industrial property from £46 million to £119 million. These statistics, presented in figure 4.0.3, were only exceeded by the increase recorded for Scotland and the North West.

FIGURE 4.0.3: WEST MIDLANDS REGION NEW CONSTRUCTION ORDERS, 1967-1977



Source: Dept. of the Environment, 1978, Commercial and Industrial Property Statistics, 1977, HMSO, London.

The figures show a steady growth in construction from 1967 until the collapse of the property boom in 1974, after which new orders rose dramatically. In 1975 it was observed that "the region consistently improves upon the national average in terms of industrial (property) investment" (Gower Economic Publications, 1975, 157). Interestingly, within the region relatively poor economic health does not appear to be directly related to the state of the property market, and other research supports this conclusion - "despite the generally poor industrial prognosis ... there is a buoyant demand for new industrial ... premises" (JURUE, 1980(i), 3.1).

More detailed information on the changing stocks of industrial property is provided in the regional floorspace statistics presented in table 4.0.1. In 1978 total manufacturing floorspace amounted to almost 40 million sq metres, while total warehousing floorspace was approximately a quarter of this at just over 10 million sq metres. However, for England as a whole, warehousing totalled 45% of manufacturing floor-space, again showing the concentration of manufacturing in the West Midlands. The table shows that the rate of growth of manufacturing floorspace was a quarter that of warehousing in the region during the mid-seventies. Earlier information for the County shows that a floorspace growth of 4% for manufacturing between 1967 and 1973 compared with 27% for warehousing (JURUE, 1980(i), fig. 9). These rates of increase appear to conform to national trends implying that although manufacturing's proportion of total industrial floorspace in the West Midlands is declining, it still maintains a higher proportion than in the rest of the country. Interestingly, despite the central position of the West Midlands for distribution activities, warehousing still remains in a lower proportion than elsewhere. Table 4.0.1 also shows that on average, the size of manufacturing premises in the region is 2,574 sq metres (27,000 sq ft) or more than four

TABLE 4.0.1: MANUFACTURING AND WAREHOUSING FLOORSPACE IN THE WEST MIDLANDS REGION

	TOTAL FLOORSPACE million square metres		TOTAL PERCENTAGE CHANGE 1974-1978	1978 PERCENTAGE SIZE DISTRIBUTION				AVERAGE SIZE sq. mtrs
	1974	1978						
MANUFACTURING				Up to 99 sq mtrs	100-299 sq mtrs	300-999 sq mtrs	1000 and above sq m	
WEST MIDLANDS REGION	37.9	39.5	4%	52%	31%	12%	5%	2574
ENGLAND	226.3	233.4	3%	52%	32%	12%	4%	2355
WAREHOUSING				Up to 199 sq mtrs	200-999 sq mtrs		1000 and above sq mtrs	
WEST MIDLANDS REGION	9.4	10.8	15%	51%	36%		13%	630
ENGLAND	91.3	104.6	15%	60%	29%		10%	522

NOTES: WAREHOUSING - Covered warehouses only: open land storage excluded

MANUFACTURING - Certain industrial hereditaments are excluded, e.g. refineries, iron and steel plant. For these hereditaments measurement of floorspace is inappropriate.

SOURCE: Central Statistical Office, 1979, Regional Statistics 14, HMSO, London.

times the size of warehousing premises at 630 sq metres (6,700 sq ft).

4.0.2 URBAN CHANGE AND PLANNING POLICIES

In the West Midlands conurbation, as in most urban areas, the present pattern of urban form is due to a historical process of new development, demolition, redevelopment and expansion. The Black Country in the west of the study area originally consisted of several freestanding towns and villages which industrialised and grew, aided by canal and rail routes, until they coalesced into a true "conurbation" and merged with Birmingham in the east. Birmingham's growth began at a later date from a multitude of workshops densely clustered around its centre. In the latter part of the nineteenth century new growth began to radiate from the centre along four lines - most importantly to the Tame Valley in the north east, but also to Balsall Heath and Ladywood in the north west, Small Heath in the south east, and Selly Oak and Bournville in the south west. Residential suburbs sprang up along these radial paths which were communications corridors formed by the railway and tramline.

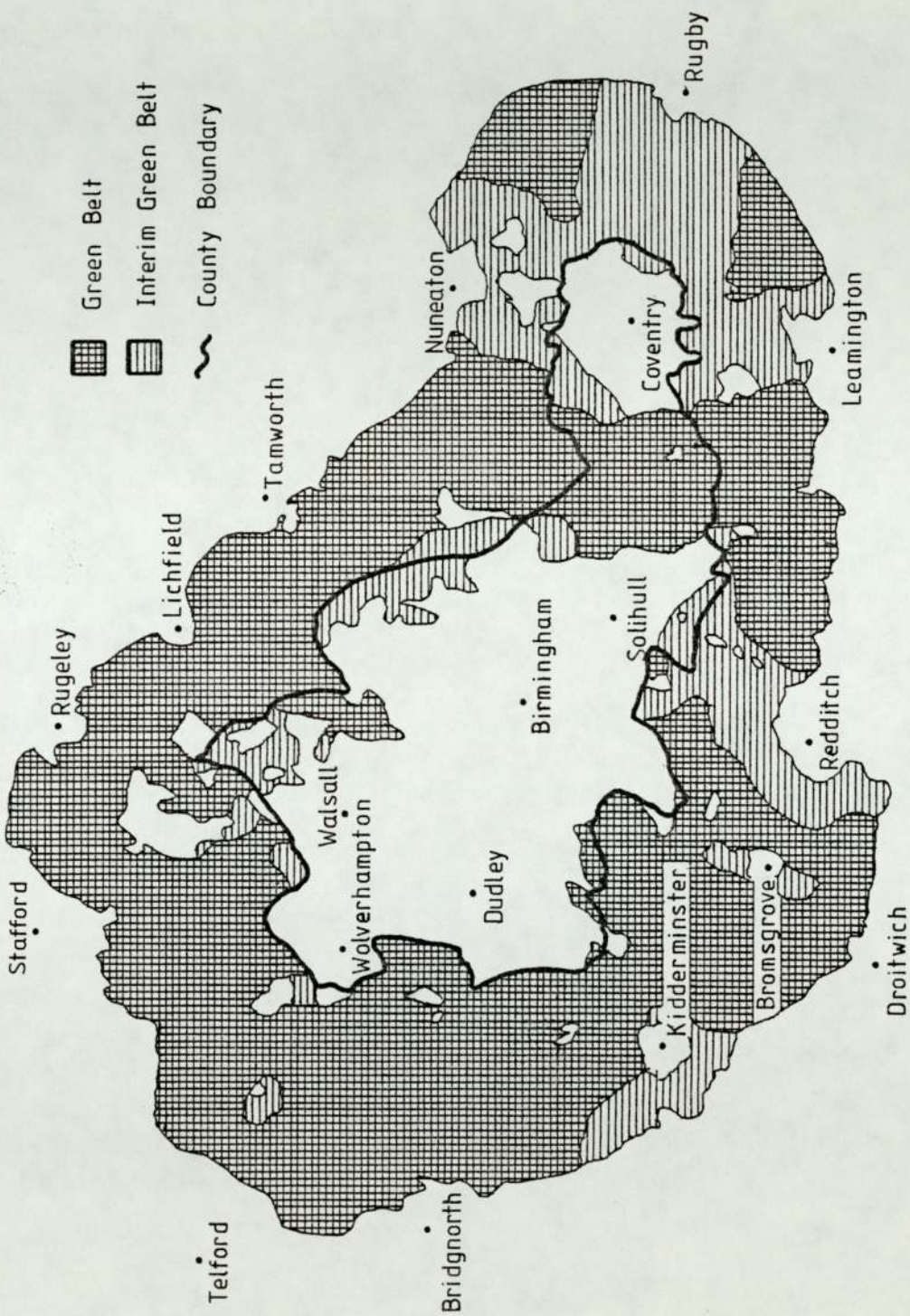
After the First World War, the city grew even faster as Hall describes:

> "Between the two world wars, Birmingham's industry saw a change in scale. Plants like the G.E.C electrical plant at Witton Park, or the Austin works at Longbridge, were far removed from the old workshops of the small masters. Seeking flat land in large quantities, they colonised the outskirts, especially in the Tame Valley from Perry Barr to Castle Bromwich, but also in the south west between Quinton and Northfield and around Kings Norton. Between the new industrial areas, suburbs sprang up swallowing old villages like Yardley, Kings Norton and Northfield. By 1939 a wide belt of mainly semi-detached housing surrounded the city, and densities in the inner wards were much lower than they had been in 1921. Birmingham was de-centralising".
>
> (Hall, 1973, 508)

After the Second World War, against a background of decentralisation, the foundations of planning in the region were laid. The plan of Abercrombie and Jackson (1948) envisaged major redevelopment, while protecting a large green belt of rural land around the conurbation. Assumptions of virtually static population growth enabled the authors to plan a redistribution of people to the conurbation fringe, and beyond to more distant overspill destinations in existing towns. The 'green belt circular' of 1955 (Min. of Housing and Local Government, circular 42/55) opened the way to eventual agreement on the land designation shown in figure 4.0.4. However, the City of Birmingham was unhappy with plans to contain its urban growth into the rural lands of the Shire counties, and fought a series of vigorous battles for permission to build contiguous housing developments. The particularly controversial Wythall proposal was finally defeated in 1959, but left the city with a tarnished reputation for the conservation of undeveloped and green belt land. Later, in 1964, Birmingham succeeded in its application for another major housing scheme at Chelmsley Wood on proposed green belt land to the east of the city.

Although post-war regional planning in the West Midlands suffered from a lack of co-operation between authorities, it was soon more comprehensively undermined by the invalidity of the major assumption of population stability. Unforeseen major population growth occurring after the war threatened the region with extensive urban encroachment at the fringe of the conurbation and considerable haphazard development beyond the green belt. Faced with these possibilities, planners acted to designate new towns at Dawley in 1963 and Redditch in 1964.

FIGURE 4.0.4: THE WEST MIDLANDS GREEN BELT



Later, in 1968, Dawley was expanded into the much larger Telford, and the long delayed Wythall proposal was finally allowed to proceed.

Unfortunately for the new towns, the anticipated out migration from the conurbation was less than expected. Furthermore, the forecast economic and population growth did not materialise after the mid-sixties. The regional birth rate began to decline, and since 1972 the conurbation's population has fallen. These events reduced the target populations of the overspill communities and postponed their completion dates. The changes in the assumptions underlying the plans were summarised in 1976 as follows:

> "a) Total regional population growth will be much less than previously assumed.
> b) The growth of households is continuing.
> c) Overspill from urban centres may be less than previously estimated.
> d) Industrial mobility will be less than previously anticipated.
> e) Both personal and resource costs of commuting will be more significant than they used to be.
> f) Employment growth in both manufacturing industry and services will be lower than previously anticipated.
> g) Public expenditure levels will be lower than previously anticipated and resource constraints may have an important influence on development.
> h) There is an increasing awareness of the social and economic problems of the urban areas and particularly inner areas".
>
> (Saunders, 1977, 42).

At the time of local government reorganisation in 1974 these were developing issues. The boundary changes of that year, which resulted in the formation of the West Midlands Metropolitan County, have been presented in figure 4.0.1. The new county unexpectedly included, not only the conurbation, but also the City of Coventry which, on the criteria of social geography and functional linkage, more correctly belongs to a north-south axis running between Nuneaton and Leamington.

The inclusion of Coventry also necessitated the inclusion of a connecting strip of the green belt around Meriden, which is now part of Solihull Metropolitan District. This strip contains some of the region's most valuable agricultural land and has been considered most vulnerable and sensitive to development. The 1971 Coventry - Solihull - Warwickshire Sub-Regional Study reported that "there can be no doubt that if present planning policies were to be reversed the gap between Coventry and Birmingham would be largely built over in perhaps fifteen years" (1.70). The inclusion of such an area of the green belt into a metropolitan authority, whose largest member is Birmingham, led to fears of urban encroachment resurfacing from the days of the Wythall enquiry.

On this eastern side of the city lies the large Chelmsley Wood housing development of the mid-sixties, and more recently Birmingham has succeeded in attracting the National Exhibition Centre to a site in neighbouring Solihull M.D. In this case, land was released from its green belt designation in "the nation's interest", and on the understanding that no nearby ancillary development would be allowed. The site at Bickenhill was proposed in 1969, construction began in 1973, and the complex opened in 1976. The Centre has excellent communications with the rest of the country lying, as it does, beside Birmingham Airport and the M6, M42 and A45 highways. The Centre, additionally, prompted the construction of Birmingham International, a new intercity railway station on the main London to Birmingham line. Besides the exhibition industry, the environs of Bickenhill and nearby Elmdon may attract development pressures because of accessibility and greenfield site advantages. Indeed, the new county structure plan suggests extensive industrial development of the area as one of its strategic options (West Midlands C.C, 1978(i), 3.36-3.37).

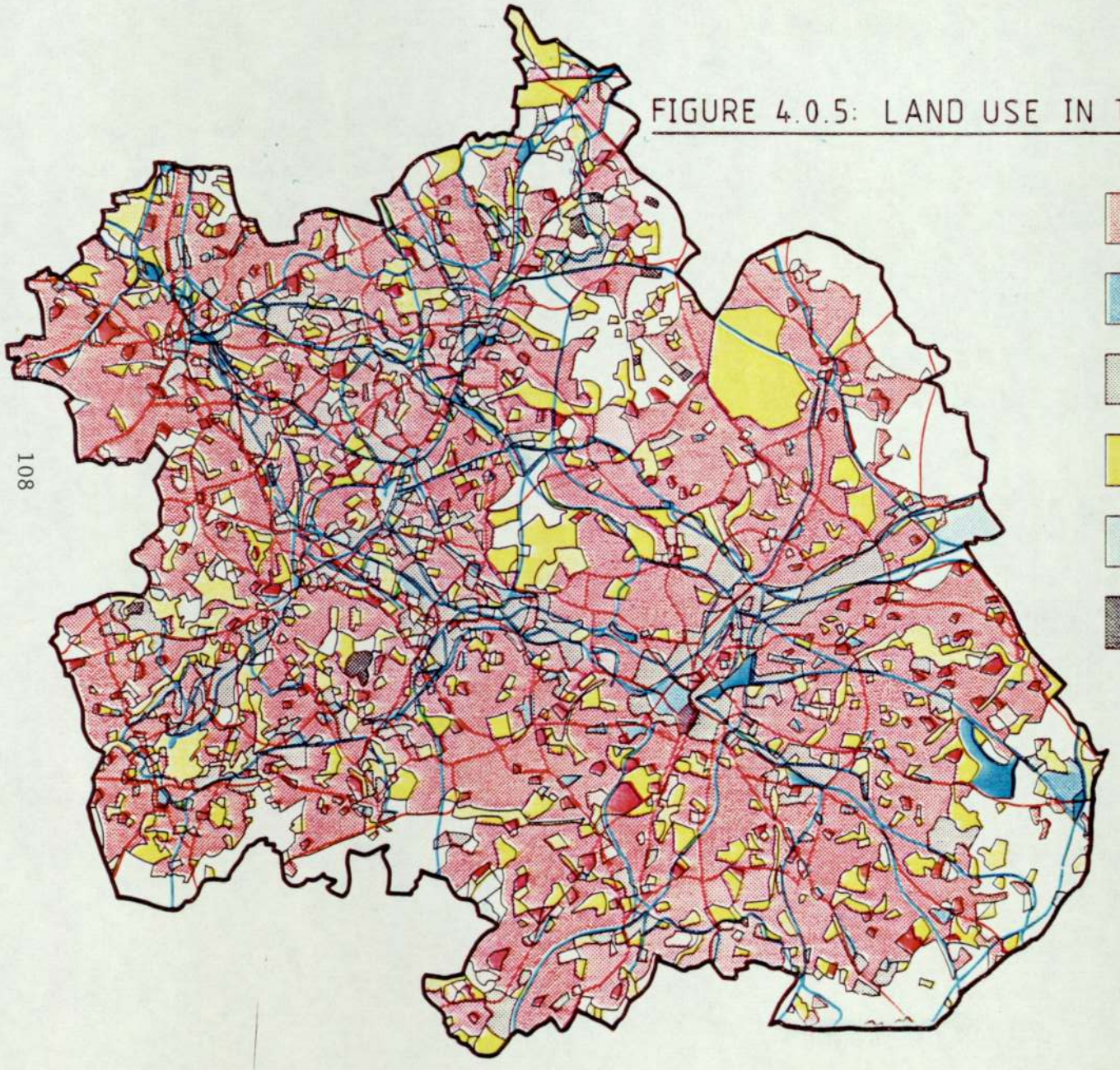
The urban growth and changes described in this sub-section are summarised in the present pattern of conurbation land use which is presented graphically in figure 4.0.5 and statistically in table 4.0.2. 'Residential' use covers the largest proportion of developed land, with 'manufacturing' use in second place covering 8.5% of the total area, rising to 12.3% in Sandwell M.D. The growth of the conurbation has left some considerable open spaces used for agriculture and recreation, namely the Sandwell valley, Sutton Park and parts of Walsall M.D.

4.0.3 PATTERNS OF INDUSTRY

Several studies have analysed the distribution of industry within the West Midlands conurbation. Johnson (1958) was able to use Factory Inspectorate data for 1948 to examine the location pattern shown in figure 4.0.6. He discovered that the apparently disorderly sprawl of the Black Country towns and villages was closely related to a dense network of canals and railways. In Birmingham, he found manufacturing concentrations in a mass of sites for small firms immediately abounding the city centre, in a belt of large sites along the Tame Valley in the north, and concentrated in the middle suburbs such as Hay Mills and Tyseley on the Warwick canal in the east, and Bournville and Stirchley on the Stratford canal in the south.

Carter's later study (1977) compared manufacturing land use patterns in 1948, 1964 and 1975. The years from 1948 to 1964 were characterised by rapid employment growth and relatively unco-ordinated planning activity, and resulted in an addition of about 46% to existing manufacturing land, as shown in figure 4.0.7. Carter measured the distribution of new and existing land use against distance from the "mean centre of

FIGURE 4.0.5: LAND USE IN THE WEST MIDLANDS CONURBATION



Residential
Commercial
Industrial
Recreation
Public Utilities
Minerals
Land
Education
Agriculture
Transportation
Public Assembly/ Buildings
Major Roads

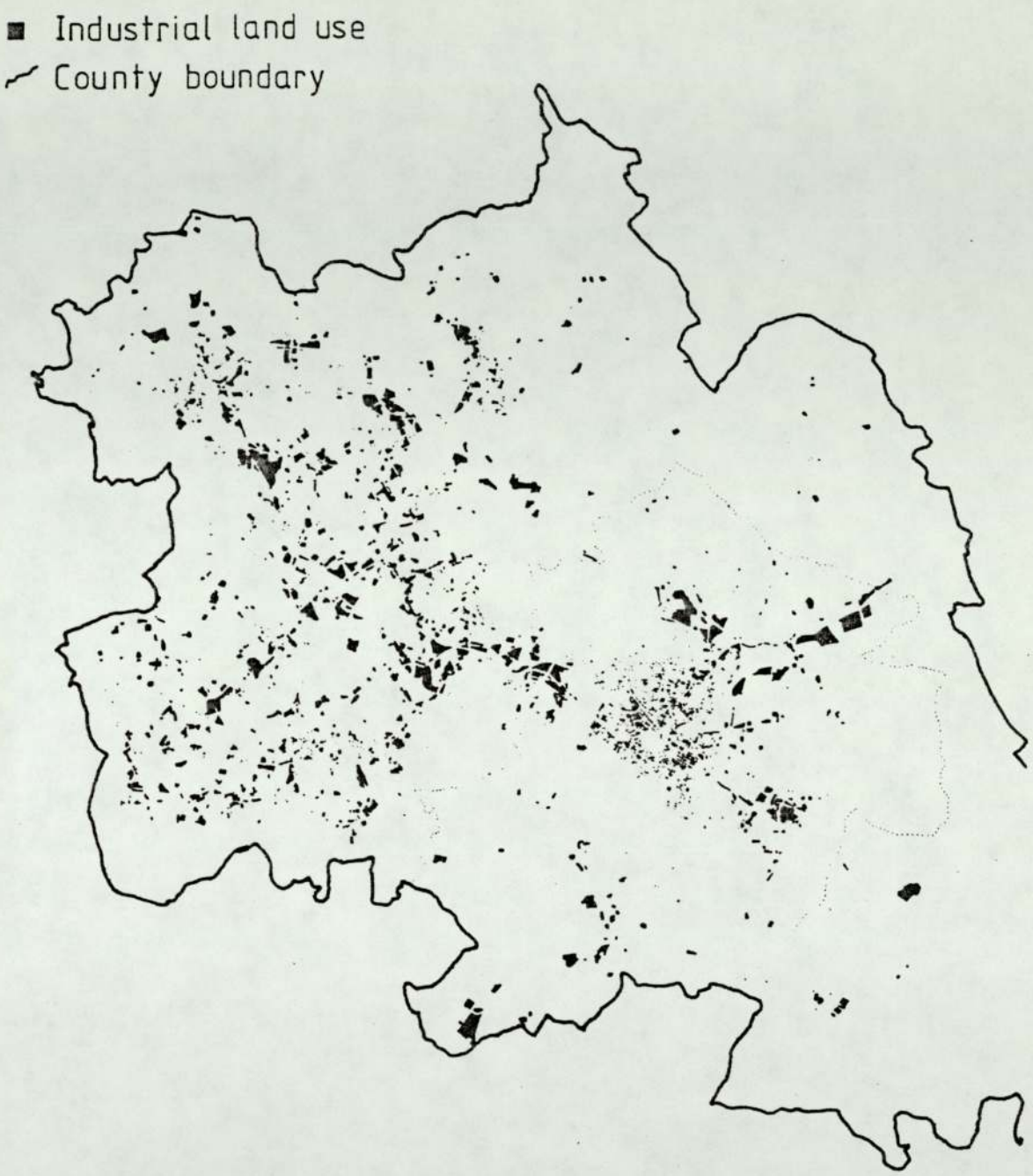
TABLE 4.0.2: LAND USE IN THE WEST MIDLANDS CONURBATION

LAND USE CATEGORY	West Midlands *Conurbation		Birmingham		Dudley		Sandwell		Solihull		Walsall		Wolverhampton	
	Ha	%	Ha	%	Ha	%	Ha	%	Ha	%	Ha	%	Ha	%
RESIDENTIAL	27634	44.4	13375	50.6	4326	44.2	3075	35.9	3540	19.6	3664	34.5	3194	46.3
COMMERCIAL	1775	2.9	622	2.4	198	2.0	403	4.7	212	1.2	249	2.3	303	4.4
MANUFACTURING	5303	8.5	2083	7.9	838	8.6	1049	12.3	180	1.0	716	6.8	617	9.0
MINERAL EXTRACTION	196	0.3	4	0.0	32	0.3	52	0.6	37	0.2	104	1.0	4	0.1
VACANT AND OTHER LAND	6298	10.1	1425	5.4	1687	17.2	1191	13.9	1103	6.2	1178	11.1	817	11.9
AGRICULTURE	6485	10.4	2141	8.1	1243	12.7	388	4.5	11026	61.2	2402	22.6	311	4.5
TRANSPORT-ATION	2131	3.4	807	3.1	265	2.7	452	5.3	322	1.8	346	3.3	261	3.8
OTHERS	12458	20.0	5972	22.5	1204	12.3	1951	22.8	1587	8.8	1946	18.4	1385	20.0
TOTALS	62280	100.0	26429	100.0	9793	100.0	8561	100.0	18007	100.0	10605	100.0	6892	100.0

* Excluding the District of Solihull, most of which lies outside the conurbation..

Source: West Midlands, C.C., 1978(i), 39.

FIGURE 4.0.6: MANUFACTURING LAND USE IN THE CONURBATION, 1948



Source: Carter, 1977, 128.

FIGURE 4.0.7: NEW MANUFACTURING LAND IN THE CONURBATION 1948-1964

Source: Carter, 1977, 131.

distribution in the conurbation", but was unable to find evidence for decentralisation or any other major change. However, in a multi-centred conurbation, such as the West Midlands, such a 'concentric analysis' must be of dubious validity. Carter suggests that new industry sought traditional sites throughout this period because of strong linkages, the presence of skilled labour, the survival of obsolete and cheap houses around the city centre for use as premises, the use of derelict land for factories in the Black Country, and successful flood control which removed development constraints from parts of the Tame Valley.

Although the second half of Carter's study period, 1964-1975, saw greater co-ordination of regional planning, growth slowed down and some economic indicators actually declined. New manufacturing land in this period added 16% to the existing total and this is shown in figure 4.0.8. The new land exhibited four features: (i) the virtual absence of major new sites in Birmingham, (ii) a significant number of small scale additions within three miles of Birmingham's centre, (iii) a continuing wide spread of new use in the Black Country including large sites in relatively central locations, and (iv) the absence of any decentralisation. Carter also discovered that, of land going out of industrial use during his study period, a concentration lay immediately around Birmingham city centre. He suggests that this is due to redevelopment, and that the displaced firms seek similar cheap and small premises nearby, so accounting for the second feature mentioned above. Another study has shown a high concentration of manufacturing activity in the inner areas, peaking markedly within one and two kilometres of Birmingham's centre (JURUE, 1077, fig. 5b). Throughout the second half of Carter's study period, development and structure plans covered the entire conurbation, and planning permission was required for new property development and changes of use.

FIGURE 4.0.8: NEW MANUFACTURING LAND IN THE CONURBATION 1964-1975

Source: Carter, 1977, 137.

Analysing whether new manufacturing land in this period conformed with its land use zoning, Carter discovered that of 2,100 new acres of manufacturing land, 48% lay outside the land use zones.

While studies of manufacturing location are relatively common there is an absence of work on warehousing location, possibly because of its minor importance until recently. A more widely based study of the conurbation's urban structure has been undertaken by Couch (_____), who like Carter (1977) and JURUE (1977), approached his analysis by measuring distance from a central point, in line with the concentric view of urban form. Couch investigated employment and floorspace density functions. His study suggests that because the unskilled live nearer to the urban centre than the skilled, journey to work costs will cause wage rates for the latter to decline steeply from the centre, to the consequent locational advantage of engineering companies and other skill users at the urban periphery. Conversely, service industries will face fewer disincentives to locate at the centre. Couch's conclusions are admittedly tentative and require further study. However this evidence suggests that skill using manufacturing companies may be more likely to seek a suburban or peripheral location than low skill warehousing firms.

In relation to the present research topic it is interesting to note that Couch observed firm's locations to follow the main road systems of the conurbation very closely (ibid, 19). He also suggests that between Birmingham and Sandwell employment and floorspace density functions decay, not with distance from a 'central place', but from an axis which is the A41 main road from Birmingham to West Bromwich via a junction with the M5. An investigation of road frontages in the county (West Midlands CC, 1978(i), 30) showed that residential

land fronts onto 32% of the strategic highway network, business and commercial land onto 10%, industrial land onto 7% and retail land onto 7%. However, the major roads of the network with the highest peak traffic flows have only 25% of their frontage residential, up to 20% business and commercial, 8% industrial and 13% retail. These findings show that a premium appears to be placed on frontage benefits when certain activities are choosing a location.

4.0.4 TRANSPORT FACILITIES

This section describes the development of the West Midlands motorways, and the access which the local road network provides to these motorways and to other major transport facilities in the conurbation.

Figure 4.0.9 shows the conurbation in the national motorway and trunk road network. The M6 provides connections to the northwest and via the M1 to London and the southeast. The M5 links the conurbation with South Wales, Bristol and the southwest. Primary routes provide good access to Derby, Nottingham and the northeast via the A38, to Coventry and the M1 via the A45, to Leicester via the M69, to Oxford via the A34, and to Telford and Shrewsbury via the A5/M54. Birmingham is virtually surrounded by the M5, M6 and M42, and the Aston Expressway, the A38(M), links the city centre to the M6. This considerable investment has placed Birmingham at the hub of the motorway system - a position which Williams has ranked as the most accessible in the country (1977, 370). The M5 and M6 run through the middle of the conurbation dividing it into three parts - Birmingham and Solihull, Sutton Coldfield and Walsall, and the remainder of the Black Country. In almost all cases the motorways skirt through the fringes or the suburbs of conurbation's towns and city.

The conurbation has experienced motorway links since 1959 when the

FIGURE 4.0.9: THE WEST MIDLANDS CONURBATION IN THE NATIONAL MOTORWAY AND TRUNK ROAD NETWORK.

M1 'Birmingham to London' motorway was opened with its M45/A45 connection. Two years prior to this date the Ministry of Transport laid down plans for an additional two north-south motorways: the M5 from Birmingham to South Wales, and the M6 from Birmingham to Preston. These envisaged routes ended outside the conurbation's boundary. To connect them to one another and to the conurbation was the task of the Midlands links motorways. In order to select the path of these motorways three factors were addressed:

> "(i) consideration of the requirements of traffic of which the greater part had its origin or destination within the conurbation limits,
> (ii) the most advantageous siting for an interchange between the M5 and the M6,
> (iii) the respective degrees of urban development on the various alternative routes within the conurbation ... to minimise property demolitions".
>
> (Sir Owen Williams, 1972, 1).

Faced with a choice between a peripheral route around the conurbation or a direct route through it, the consulting engineers chose to avoid the extensive feeder road system of the former and settle for a direct route, despite the attendant problems of land acquisition and construction.

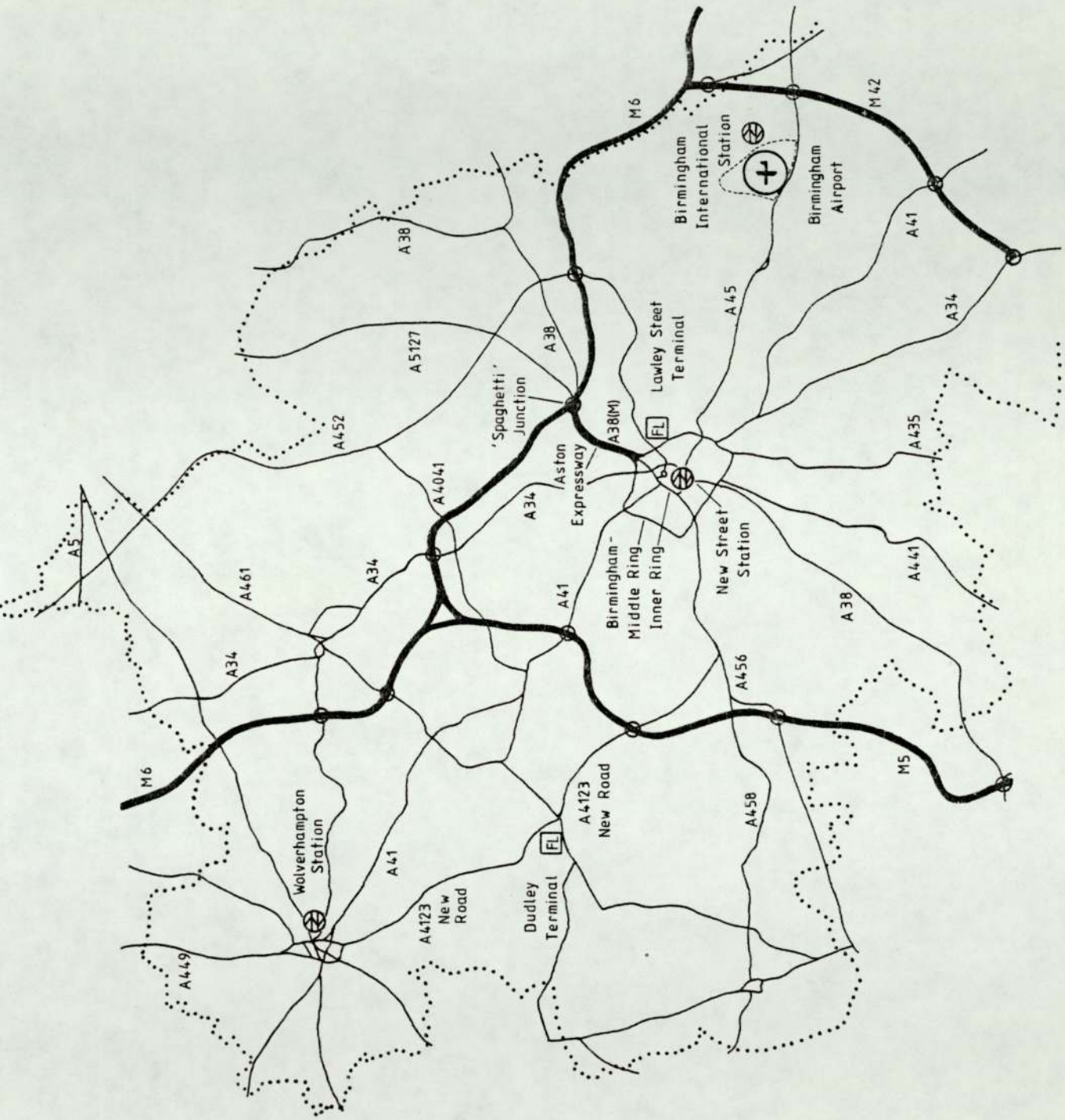
By the start of the sixties a route had been selected through consultation with the local authorities, which approximated to the eventual path of the motorways. Construction work began in 1963, and the entire project was completed in 1972. The interchange between the M5 and M6 was located at Ray Hall, West Bromwich, on open land in the Sandwell valley. To the east, the other main interchange of the project, known as 'Spaghetti Junction', was sited at Gravelly Hill to link the M6, A38 and local roads to the A38(M) Aston Expressway running directly into Birmingham's centre.

The Midlands links motorways run for 23 miles through built up areas, pass within 2½ miles of Birmingham city centre, and provide nine points of access to and from other roads. Their alignment avoided large scale demolitions and resulted in the removal of 300 homes and 70 industrial premises, many of which would have been cleared in the course of general redevelopment. Land acquisition was reduced, and waste and derelict land reclaimed by following a course often over rivers, canals, sewage works and industrial waste tips.

Other motorways also lie within the study area. The M42 is partly complete, having been opened in 1977 over an eleven mile length to provide access southwards from the M6 to the airport, the National Exhibition Centre, Solihull and Shirley. Eventually this road is intended to join the M5 at Bromsgrove, closing the 'motorway box' around Birmingham, and to extend to the M1 near Derby. The A38(M) mentioned above, is an urban motorway interconnecting with the M6 and Birmingham's major middle and inner ring roads, which opened in 1972. The planned M54, between Telford and the M6, is only built around Telford but will pass just to the north of Wolverhampton when it is completed.

The main years of motorway building also witnessed considerable investment in the conurbation's internal road infrastructure. The present highway network is shown in figure 4.0.10. The conurbation has a history of major road schemes, including Joseph Chamberlain's new Corporation Street in Birmingham, and the high capacity New Road (A4123) built in the thirties between Birmingham, Dudley and Wolverhampton.

FIGURE 4.0.10: THE STRATEGIC HIGHWAY NETWORK, AND MAJOR RAIL AND AIR FACILITIES OF THE CONURBATION



However, the Birmingham inner ring road project and the improvement of middle and outer ring and radial routes represented a massive investment in changing the highway network, which caused substantial disruption and diversion of traffic within the city throughout the sixties and early seventies. The present inner ring road is a dual carriageway with most interchanges grade separated. The middle ring road or 'Middleway' was similar in concept but has only been partially completed. The most substantial radial route improvement has been along the A34 from Birmingham to the M6 at Great Barr, and then to Walsall. Road improvement projects in the Black Country have been on a smaller scale; notable schemes being the Wolverhampton ring road and the Willenhall by-pass. With this widespread and considerable investment, it is Mustow's opinion that "the one area where there have been major and significant changes is in the increase in highway capacity through the direction of investment into 'bottle neck' situations" (1977, 399).

The conurbation's highway network provides main road links with all junctions on the motorways. The railway station and airport at Elmdon are accessible via the motorways and the A45 dual carriageway. In Birmingham, New Street Station fronts onto the inner ring road, while the Lawley Street Freightliner terminal adjoins the relatively unimproved Middleway. The Dudley Freightliner terminal lies close to the Birmingham to Wolverhampton New Road dual carriageway. Wolverhampton railway station lies within the town centre close to the ring road.

4.0.5 WEST MIDLANDS POLICY AND RESEARCH ISSUES

The facets of the study area described in this chapter emphasise certain issues which are particularly relevant to the research.

One of these issues is the possible 'growth pole' development of green belt land at Elmdon, where the National Exhibition Centre lies alongside the M42 and M6, an inter-city rail station and Birmingham Airport. The potential for such growth, which is a structure plan option, will be studied in later chapters because of its significance for urban development patterns and rural conservation. If growth at Elmdon were 'access-induced', then the role of the rail station and airport, as well as the motorway, could be potentially significant. The substantial local and trunk road improvements, which have occurred within the study area, often result in facilities very similar to motorways in terms of separate multi-lane carriageways, grade separated interchanges and long sight lines. Therefore the possibility that the hypothesised attraction of industry to motorways may be replicated by other routes and facilities, must be considered in the research.

This chapter has described how the conurbation motorways were often planned to follow existing canals or rivers in an effort to minimise property demolitions. Hence, it could be inferred that new patterns of industrial location which appear to closely follow the path of motorways, are in reality simply attracted to existing industry which itself is sited by canals and rivers. The research methodology is able to differentiate between this 'random association' and a more meaningful correlation in several ways. Firstly, the measurement of motorway proximity is taken from motorway junctions and not from the entire route length. Secondly, only relatively short lengths of motorway actually coincide with rivers and canals. Finally, the secondary research method is specifically designed to establish causal links and illuminate spurious associations.

In view of the research interest in factories and warehouses, the statistics presented on the average size of these premises in the region are relevant. The relatively small average size of 6,700 sq feet for warehouses contrasts with the general modern conception of large central distribution depots whose extensive land requirements determine their locations. Although these average size figures reflect the historical stock of properties, they also emphasise that large units are not the sole form of warehouse development. The average factory size of 27,000 sq feet is far larger than the current most active market sector which is below 15,000 sq feet.

Finally, the new county structure plan is in the course of preparation. This foresees new industrial development being sited in three alternative urban strategies. These concentrate on the inner city, the suburbs or the greenfield sites such as Elmdon, and are directly relevant to the research interest in urban form. Consequently the research findings can be related to whichever of these has the greatest growth potential based on current evidence.

5.0 METHODS AND RESULTS

5.1 CONSTRUCTING THE ACCESS AND LOCATION SURFACES

5.2 ANALYSIS AND INTERPRETATION OF THE ACCESS AND LOCATION SURFACES

5.3 THE OTHER ACTORS - QUESTIONNAIRE SURVEY OF ESTATE AGENTS AND DEVELOPERS

5.4 THE OTHER ACTORS - INTERVIEW SURVEY OF LOCAL AUTHORITIES

The discussion on methodology in section 3.0 determined that the research methods would take two forms. They first would attempt to establish a correlation between new industrial location and motorway proximity, which was absent from previous location patterns. Secondly, they would support this by surveying the other actors in the location process, and thereby seek causal evidence of a relationship between motorways and industrial location. Throughout these investigations comparisons would be sought between factory and warehouse location.

Section 5.0 will describe in detail how these methods were undertaken and the results they provided. The correlational method will be described by the term "access and location surfaces", because these surfaces measure the relevant variables. Section 5.1 describes the construction of the surfaces, and section 5.2 presents the results of their analysis. The second method will be referred to by the term "other actors', and is presented as a questionnaire survey of estate agents and property developers in section 5.3, and as an interview survey of local authorities in section 5.4. A questionnaire survey was chosen for the former group because of their greater numbers which made them difficult to incorporate into an interview approach. Additionally, the information required from the local authorities was too varied to be obtained from a formal, structured list of questions.

5.1 CONSTRUCTING THE ACCESS AND LOCATION SURFACES

5.1.1 THE CONCEPT OF 'SURFACES'

In the quantitative analysis of the impact of motorways on industrial location, the collected location and access data will be presented and examined using the concept of 'surfaces'. Haggett writes that a surface may be used to represent any spatial phenomenon.

> "The greater part of the earth's surface consists of interstitial zones around and between the skeleton (of route networks and nodal centres) and are conventionally studied from the viewpoint of land use ... These zones (can be viewed) not as a mosiac of distinct land use complexes but as density surfaces ... Like height contours on a topographic map we can regard (location or access) density as ... contours; indeed we could produce three dimensional models of these distributions in much the same way as terrain models. This surface may be thought of statistically as a response surface, in which height (i.e. location density) varies as a response to controlling factors. Ways of depicting geographical distributions depend as much on cartographic convention as on the inherent nature of the phenomenon being shown."
>
> (Haggett, 1965,153)

An example of the use of surfaces can be found in the development potential analysis undertaken for the West Central Scotland Plan (1974). This evaluated land throughout the region in terms of fifty two factors, ranging from "steepness of slope", to "access to other regions'. Twenty nine factors considered important in identifying suitable sites for industry were combined in a surface which determined the potential of land for new industrial development. This massive exercise, which involved wide ranging and arbitrary assumptions, was undertaken as a planning tool, rather than to analyse location behaviour which the present research seeks to do.

The access and location surfaces used here extend over the whole conurbation study area, and are based on the 1:50,000 series Ordnance Survey map. For convenience, a cellular structure is used; each cell on each surface being assigned a number corresponding to location density or proximity to motorways. By using the map's kilometre grid squares for the cells, 702 measurements can be recorded on a single surface, thereby providing a complete and detailed representation of local conditions.

This chapter now describes the access surface construction, and the location surfaces' construction.

5.1.2 THE ACCESS SURFACE

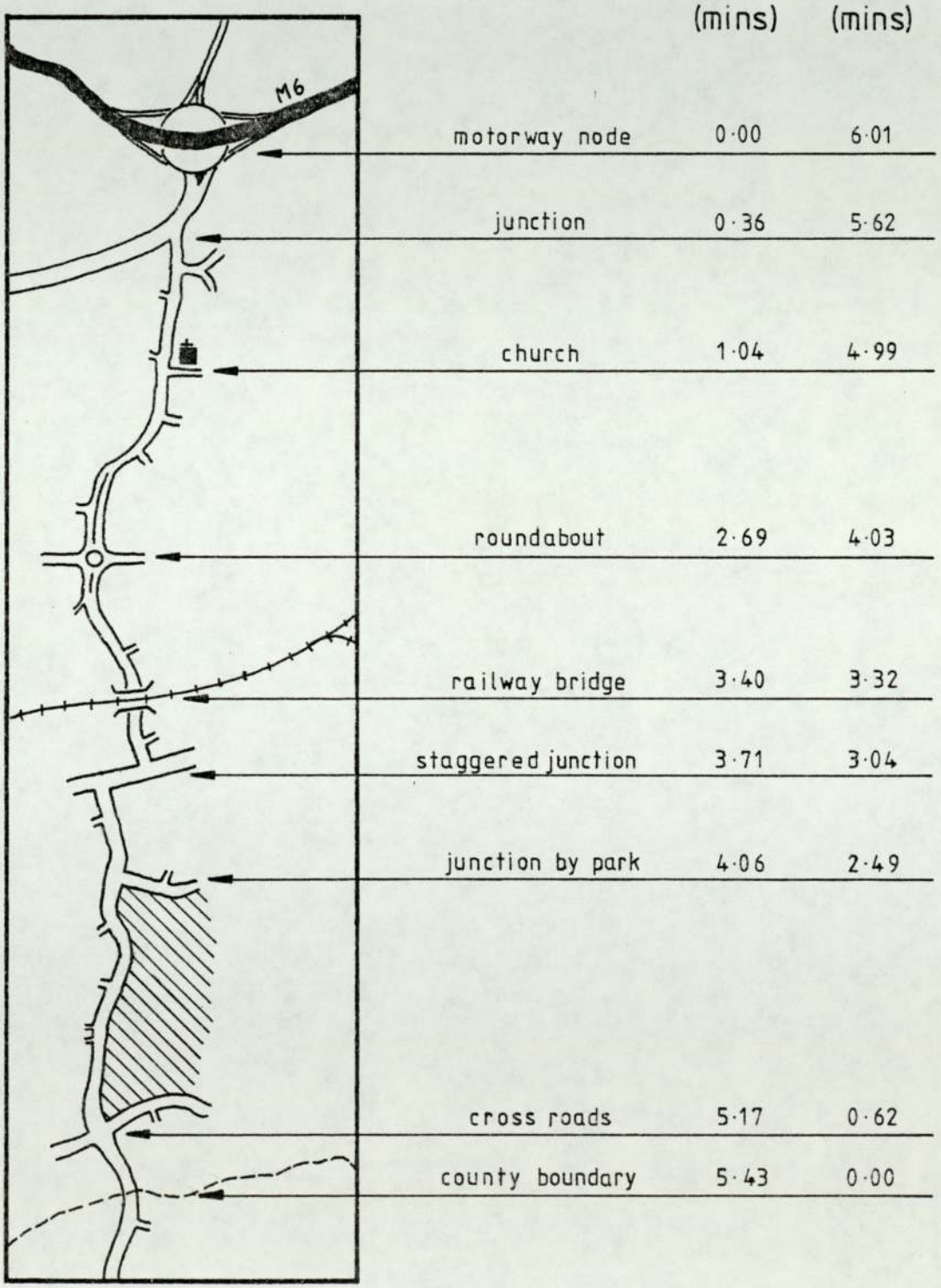
The purpose of the access surface is to provide a measure of proximity to the motorway network via its road junctions throughout the conurbation. This measure is in the form of road travel times for reasons which have already been explained, and these times are used to measure the distance from each of the motorway junctions under investigation. Due to intermittant delays and congestion at peak periods, these times were obtained in off peak daylight hours, in order to produce a more accurate standard measure. Under these conditions, the improved higher quality roads permit higher relative speeds and obtain for their environs a higher access rating. This travel time information was produced at the close of the study period, and therefore avoids the considerable disruption which major road building had inflicted on the conurbation in earlier years.

Once the choice of a travel time measure had been made, it was necessary to identify a road network radiating through the study area from the transport nodes under investigation. This had to be

sufficiently dense to produce the accurate and detailed isochrones which formed the initial surface. The strategic highway system of the West Midlands County, shown in figure 4.1.10, forms the basis of the network. Fortunately, a council-sponsored study had measured travel times along the system, and the research is indebted to the assistance of council officers in making this information available. The strategic system primarily includes the main radial and circumferential routes around the population centres of the conurbation, which is not directly equivalent to the radial routes from the conurbation's motorway junctions. In consequence, original data required collecting along several routes.

Along these routes travel times were measured in the same manner as in the County's study. Most of their investigations were carried out in 1976 and 1977, whereas the additional routes were surveyed in the spring of 1978. To ensure compatibility between both surveys, several routes included in the County's data were measured again, but no significant discrepancies were uncovered. Re-examination also took place of those roads which has been improved, such as by widening, since the earlier measurement. All observations were taken by driving along the assigned route at the average speed of the traffic during the hours of 10.00 am to 3.30 pm. The vehicle contained a driver and an observer. On leaving the motorway node under study, a stopwatch was started and the passage of time recorded at regular and frequent intervals which coincided with landmarks visible on the map. An example of such a route and the recorded observations is shown in figure 5.1.1. This exercise was repeated thrice in each direction. If significant discrepancies occurred between the three results, additional measurements were taken. Where abnormal conditions, such as road works or a slow moving vehicle, affected a run, the exercise

FIGURE 5.1.1: EXAMPLE OF THE MEASUREMENT OF ROAD TRAVEL TIME



was either repeated in their absence, or an estimated adjustment was made to the results. All runs were undertaken in good light and in dry conditions by the same vehicle.

The results obtained from both the County and direct measurement were presented in the same form. The times for all runs on each route were averaged, and the distances covered in one minute intervals were marked on the map from the starting point of the motorway node in question. Single minute intervals were regarded as the necessary level of detail required. When all routes radiating from a motorway junction had been so marked up to the limit of the estimated 'catchment' zone of that junction, the isochrones were drawn in accordance with contour line convention. In this way every motorway junction involved in the research was provided with its own isochrone map covering those locations to which it appeared to offer the closest access to a motorway.

The access surface incorporated only 10 junctions on the M5 and M6 alone. The M42 was excluded from the investigation because it had opened only a year before the close of the study period. Junction 5 on the M6 was excluded because it provides only a limited access southbound. By contrast, three junctions which lie outside the study area were included because they offer the closest motorway access for parts of the conurbation. These were junctions number 4 on the M5, and numbers 4 and 11 on the M6. The access surface constructed assigns identical importance to every junction. Depending on the success of the later analysis, alternatives which assigned access values on the basis of a junction's traffic flow, or which incorporated the M42 could be considered. These options are further discussed in appendix A.

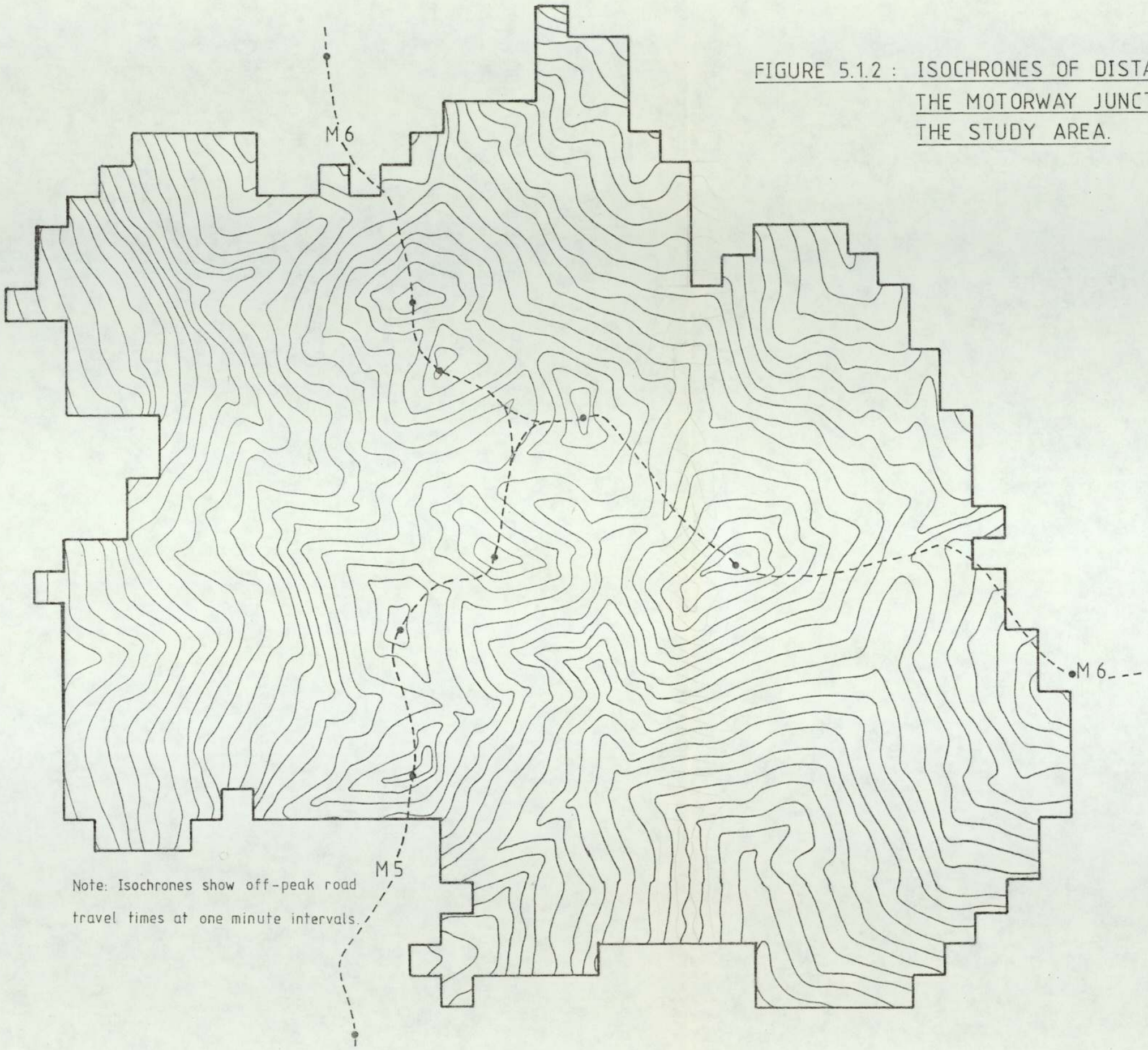
The access surface is a composite of the individual junction isochrone maps. Motorway accessibility worsens with distance from each junction until the equal valued isochrones of adjoining nodes meet, and merge. The most accessible points, at the nodes themselves, have an access value of "1", whilst at the furthest margin the value is "22", indicating that it is 22 minutes travel time away from the nearest motorway junction. The composite isochrone map is presented in figure 5.1.2. The surface required transforming from this initial stage into a map of enumerated grid squares which would facilitate statistical analysis. Within any cell or grid square, the largest proportion of land contained between any two isochrones led to the value of the more accessible contour being assigned to that cell. Figure 5.1.3 shows the result of this modification.

5.1.3 THE LOCATION SURFACES

The location surfaces are designed to represent the patterns of industrial location existing at the start of the study period before the motorways were built, and the patterns of new locations during and at the close of the study period. They are also designed to represent the different patterns of factory and warehouse locations. Hence they have two purposes, firstly a comparison over a time series and secondly a comparison across a cross section. Section 3.0 has already made brief mention of the selection of land use and planning application data for these respective purposes.

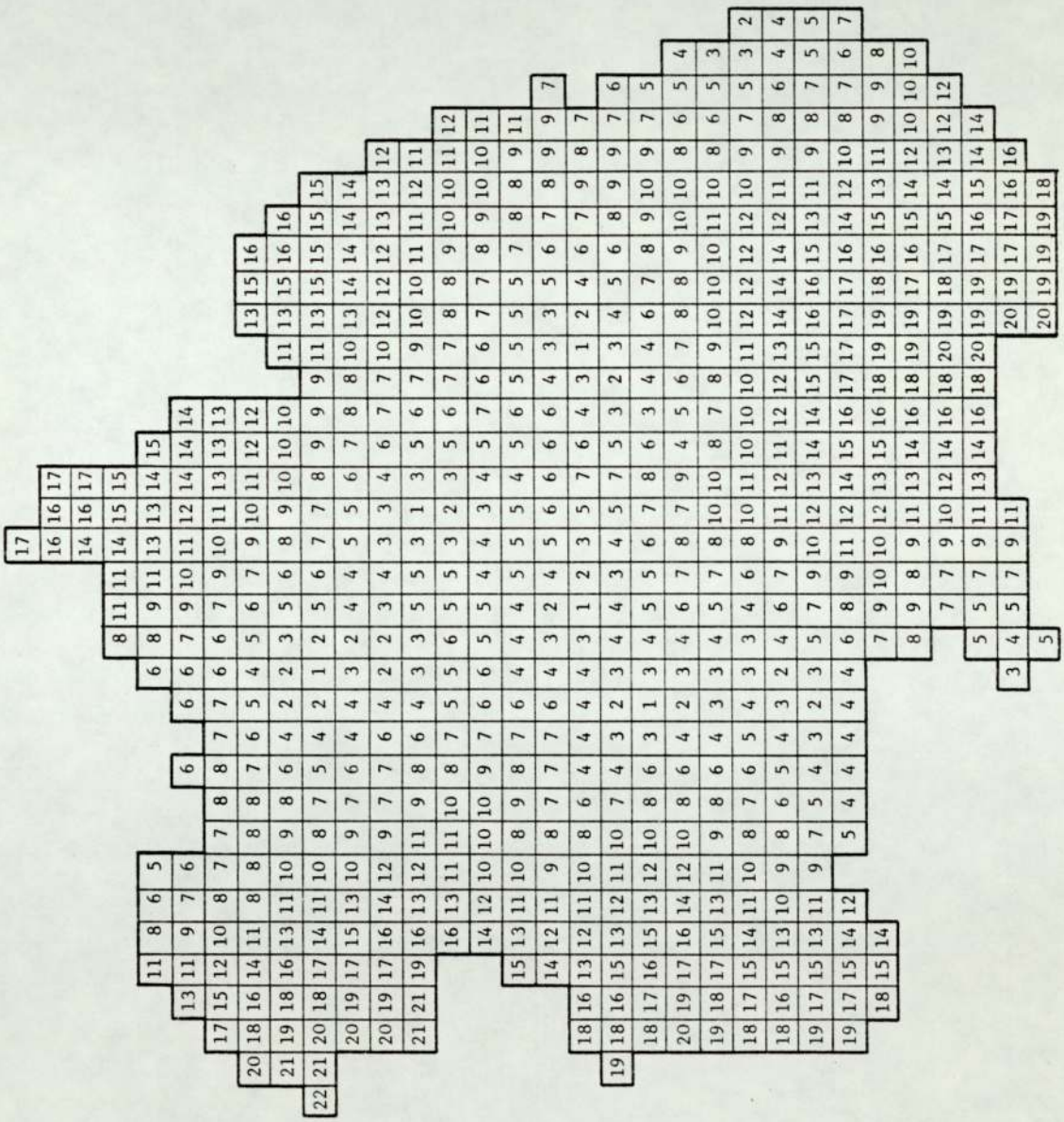
The research was fortunate in obtaining copies of the maps of manufacturing land use prepared by Carter (1977) and already described above in section 4.0.3. One map, portraying the land use stock in 1964, coincides well with the start of the study period. Unfortunately Carter made no investigation of warehouse location, and

FIGURE 5.1.2 : ISOCHRONES OF DISTANCE FROM THE MOTORWAY JUNCTIONS OF THE STUDY AREA.



Note: Isochrones show off-peak road travel times at one minute intervals.

FIGURE 5.1.3: THE ACCESS SURFACE - CELLULAR REPRESENTATION



no similar study of this form of land use was uncovered. This reflects the only recent importance of the activity, as emphasised by the statistics on page 100. In order to provide a representation of new manufacturing land use during and after the building of motorways another of Carter's maps was adopted. This showed new land use between 1964 and 1975, and at the time of data collection was the most recent land use information available for the whole study area.

These two land use maps were to form the raw material for the time series comparison. Transforming them into usable location surfaces involved estimating the proportion of manufacturing land lying within each cell of the study area. As Carter and the present research both used the same scale of maps, by superimposing a kilometre grid onto his land use maps this task was simplified. Across each kilometre grid square or cell was laid a smaller network of lines (3 x 3) to aid estimation of the percentage of that cell covered with manufacturing land use. In this conventional manner each cell was allocated a location value on a scale ranging from zero to nine (or 0-100% coverage), and the location surfaces 'F1' and 'F2' were constructed as shown in figures 5.1.4 and 5.1.5.

Returning to the representation of warehousing location, it was discovered that alternative measures to land use such as trade directories, failed to cover the entire study area and also largely ignored warehousing. In the absence of other sources, planning records were sought. The local government boundary changes attendant on the 1974 reorganisation present difficulties in obtaining comprehensive planning application data for prior years. Indeed some applications made before 1974 cannot be traced (JURUE, 1976, 71). In

FIGURE 5.1.4: LOCATION SURFACE F1 - MANUFACTURING LAND USE IN 1964

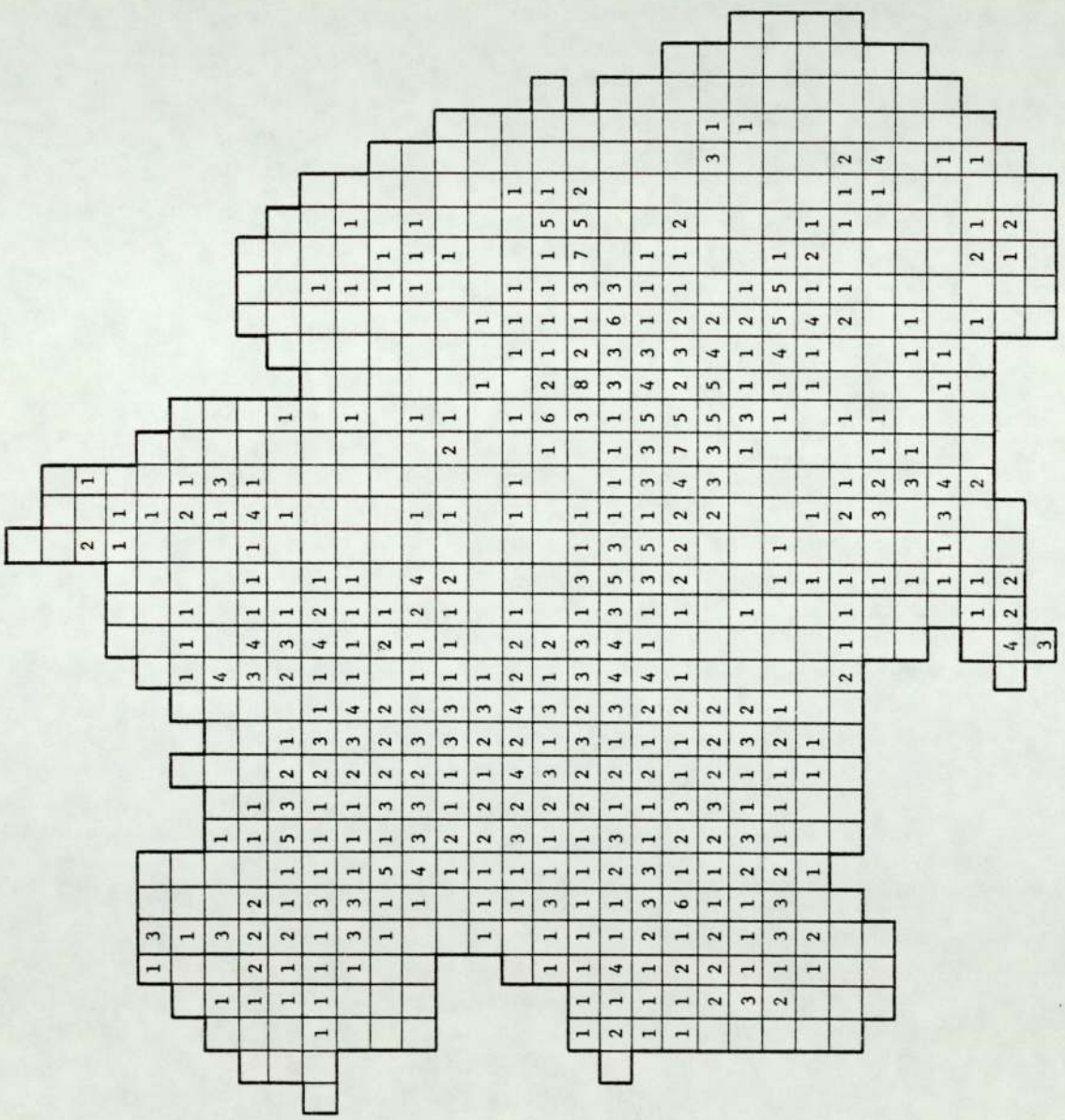
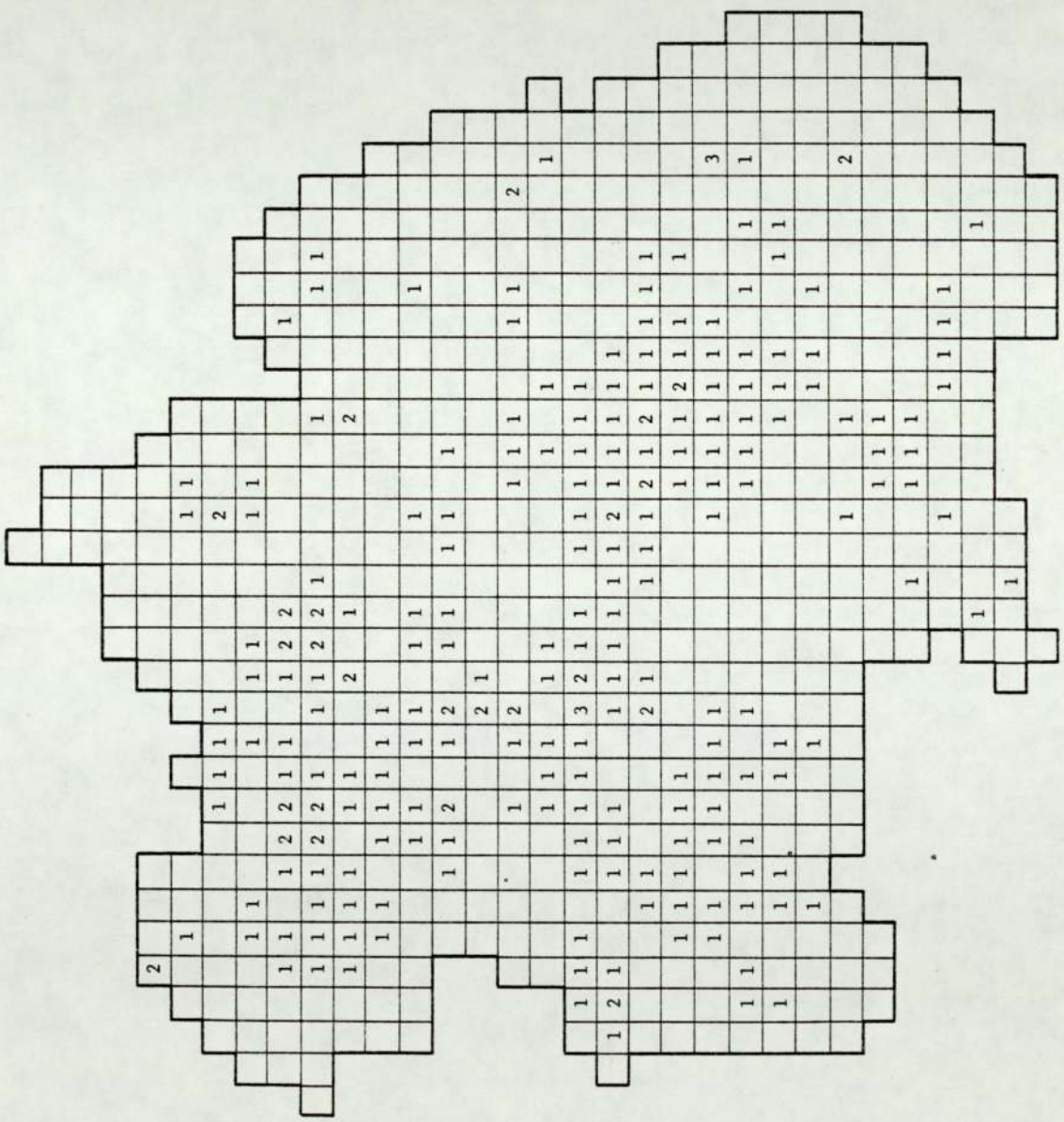


FIGURE 5.1.5: LOCATION SURFACE F2 - NEW MANUFACTURING LAND USE 1964-1975



the face of such difficulties, the research decided to limit comparisons over time to manufacturing activity alone. The cross sectional investigation was to be based on planning applications made for factories and warehouses between 1974 and the close of the study period in 1978. Planning applications are an essential preliminary to any future development and consequently records for these four years are likely to reflect actual construction and occupations occurring between 1975 and 1980. Naturally planning application data will not be directly comparable to land use data, and this is not intended.

The collection and collation of planning applications is a complex and extensive exercise. Details of individual applications were required as a measure of location decision making interest within each cell. Scale measures, such as floorspace, were not sought. Every application made in the study area between April 1974 and March 1978 for new factory or warehouse developments was traced. This is the full four years following local government reorganisation. Applications for a change of use or an extension to existing premises were not included because in such cases the location choice would be largely determined by the prior existance of the premises. Additionally, where an outline application was followed by an application in detail, the information was not double counted. Otherwise outline and detailed applications were both recorded as statements of location interest. Applications were analysed, rather than permissions, so that the 'demand' for locations could be assessed rather than their 'supply'. This produces a larger set of data for investigation, and also enables applications to be studied for which decisions were still outstanding at the close of the study period.

The difficulties involved in collecting planning application data in the West Midlands have been discussed elsewhere:

> "It was found that the systems for recording information about planning applications differ for each authority. Birmingham retains comprehensive information about planning applications by use of a computer system ... For the other local authorities the only information retained (apart from the application forms themselves) is that contained within the statutory planning registers ... The descriptions recorded on many planning applications (and transferred to the planning register) are vague ... Floorspace statistics or some other measure of scale appropriate to planning applications cannot easily be obtained ... "
>
> (JURUE, 1976, 69)

It was decided to use the planning registers as the basis for the data collection. These provide a description of the proposed development and use, the proposer, the date of application, the address of the location and the planning committee's decision. The local authority has a statutory duty to keep these up to date and accessible to the public.

In the final twelve months of the study period there were approximately 16,400 planning applications made to the six conurbation authorities, around 1,500 of which were for factories and warehouses excluding changes of use. Therefore throughout the four years, approximately 65,000 applications required sorting. The tedious task of sifting through every planning register was avoided in some cases where authorities had conducted 'in house' classification of applications, and made these available. The exercise was eased for the largest authority, Birmingham, by computerised records which were provided as a printout classified into factory and warehouse uses and listed by National Grid reference numbers to assist in locating.

For each application, information was collected on use, and address or grid reference. With the aid of an 'A - Z' street directory each address was pinpointed within the cells of the study area, as was each grid reference. The total number of factory applications and the total number of warehouse applications within each cell were summed separately, and these respective totals became the location values of that cell. These produced the location surfaces for factories ('F3') and warehouses ('W1') which are shown in figures 5.1.6 and 5.1.7.

The use of planning application data in this manner produces some uncommon interpretations of the scale of development. For example, both a large factory and a small workshop could each result from one application, and so be counted as equivalents on the location surface. This is because planning applications are being used, intentionally, to measure the location choices of developers, for choice is a fundamental concern of the research.

In total four location surfaces were produced. The two manufacturing land use surfaces, F1 and F2, will be used to contrast the pattern of factory location in 1964 prior to the motorways, with new additions up to 1975. The factory and warehouse planning application surfaces, F3 and W1, will be used to contrast the location preferences of developers for these types of property with regard to motorways, over the years 1974 to 1978.

FIGURE 5.1.6: LOCATION SURFACE F3 - MANUFACTURING PLANNING APPLICATIONS, 1974-1978

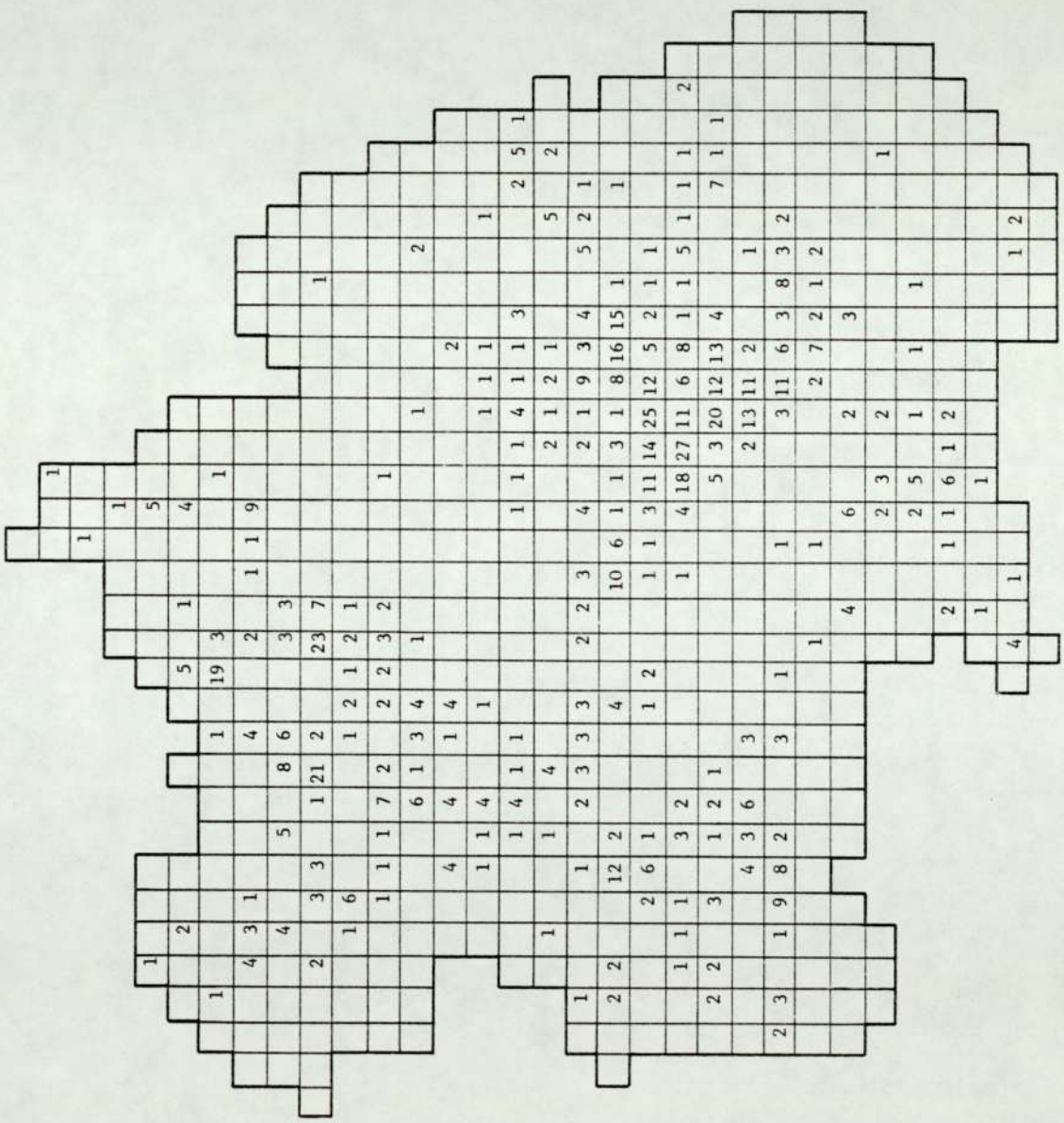
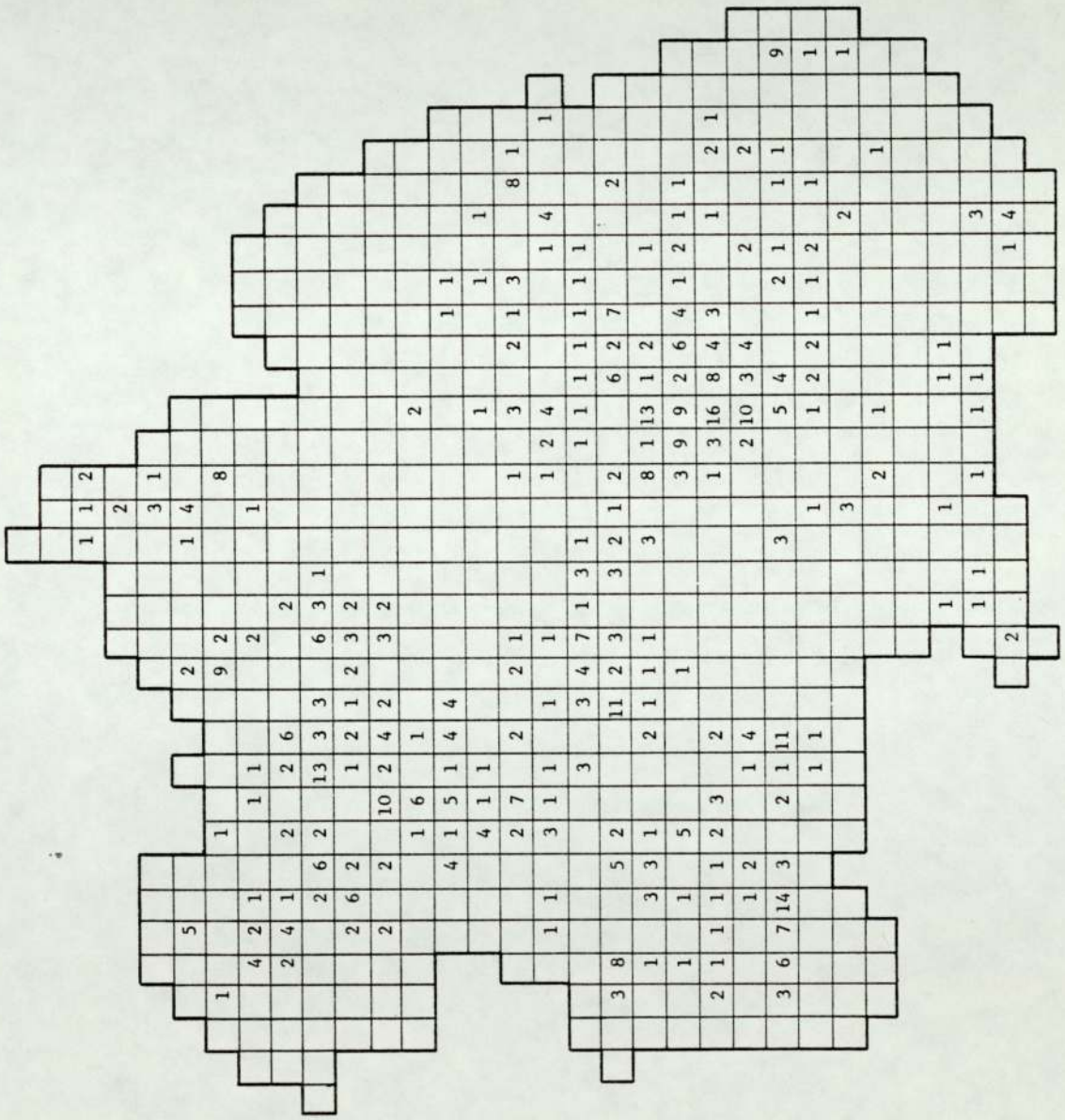


FIGURE 5.1.7: LOCATION SURFACE W1 - WAREHOUSING PLANNING APPLICATIONS, 1974-1978



5.2 ANALYSIS AND INTERPRETATION OF THE ACCESS AND LOCATION SURFACES

5.2.1 METHODS OF ANALYSIS

The four location surfaces and the access surface are listed in table 5.2.1. It has already been explained in section 3.0, that the analysis of these surfaces will seek to describe associations between motorway access and industrial location. The causal interpretation of any associations as relationships is the primary concern of later sections which discuss the 'other actors'. The entire research method adopts the study of the West Midlands conurbation as a population in its own right, and not as a sample.

The data from the surfaces are aggregated in table 5.2.2. This simple transformation is described in appendix A. Against every access value in the table are presented the corresponding mean location densities, recorded in each of the four location surfaces. Alongside these densities lie standardised values, computed to remove differences of scale between the location surfaces, so as to enable concentration to be paid to the form of association alone. A multiplication factor was employed to equalise column totals and so standardise the figures.

Prior to the proposed statistical analysis, the location surfaces were examined to determine whether they differed significantly from one another. When statistical sampling is undertaken, this exercise is of vital importance to ascertain whether the differing

TABLE 5.2.1: THE SURFACES TO BE COMPARED

THE ACCESS SURFACE

X1 - Travel Time Access to the M5 and M6 junctions of the Study Area

THE LOCATION SURFACES

F1 - Manufacturing Land Use in 1964

F2 - New Manufacturing Land Use 1964-1975

F3 - Planning Applications for Manufacturing Use 1974-1978

W1 - Planning Applications for Warehousing Use 1974-1978

TABLE 5.2.2: CORRELATION TABLE OF DATA FROM THE ACCESS AND LOCATION SURFACES

ACCESS SURFACE X1 - VALUES	LOCATION SURFACE F1		LOCATION SURFACE F2		LOCATION SURFACE F3		LOCATION SURFACE W1	
	MEAN	STD	MEAN	STD	MEAN	STD	MEAN	STD
1 (NODE)	1.40	1.40	1.00	2.72	1.20	1.03	0.60	0.71
2	1.35	1.35	0.41	1.12	2.94	2.53	2.12	2.50
3	1.37	1.37	0.50	1.36	1.92	1.65	1.03	1.21
4	1.75	1.75	0.47	1.28	1.96	1.68	1.55	1.82
5	1.04	1.04	0.42	1.14	1.39	1.19	0.90	1.06
6	1.27	1.27	0.44	1.20	1.58	1.36	0.89	1.05
7	0.95	0.95	0.33	0.90	1.25	1.07	0.90	1.06
8	1.11	1.11	0.47	1.28	0.96	0.83	0.94	1.11
9	0.83	0.83	0.30	0.82	1.64	1.41	0.98	1.15
10	1.00	1.00	0.39	1.06	1.73	1.49	1.27	1.50
11	0.76	0.76	0.39	1.06	0.76	0.65	0.68	0.80
12	1.06	1.06	0.29	0.79	1.23	1.06	0.71	0.84
13	1.13	1.13	0.29	0.79	1.19	1.02	1.13	1.33
14	1.03	1.03	0.18	0.49	0.67	0.58	0.39	0.46
15	0.76	0.76	0.31	0.84	0.59	0.51	0.90	1.06
16	0.59	0.59	0.38	1.04	0.59	0.51	0.66	0.78
17	0.86	0.86	0.18	0.49	0.59	0.51	0.41	0.48
18	0.53	0.53	0.18	0.49	0.24	0.21	0.24	0.28
19	0.20	0.20	0.05	0.14	0.05	0.04	-	-
20	0.33	0.33	0.11	0.31	-	-	0.11	0.13
21	-	-	-	-	-	-	-	-
22 (MARGIN)	-	-	-	-	-	-	-	-

sample statistics do actually represent different population parameters. If the differences are not significant, then they are likely to result from sampling error and the analysis is invalidated. Although the present research is based on data for the whole population, an examination of differences between variables (or the surfaces) is still valuable. The presence of significant differences in population data increases the explanatory power of the analysis and minimises the opportunity for chance or measurement error to distort the results. A chi-square test was adopted to measure the differences between the dependent variables F1 and F2, and between F3 and W1. The application of the tests and the results obtained are fully described in appendix A. Unfortunately, the exercise was unable to detect differences between the surfaces at any reasonable level of significance. A host of factors influence industrial location, and it is therefore not surprising that the addition of a potential new determinant into the urban environment, namely motorways, does not produce a notable change from the existing patterns which existing factors act to reinforce. It is unfortunately impossible to measure the impact of motorways in the absence of these factors. Furthermore, as the location surfaces were constructed only a few years after the motorways opened, the time may well be premature for evaluating their full impact on location.

The disappointing results of the chi-square test do not invalidate the analysis of surfaces. Subject to measurement error, any population data is actual and not indicative. However chance coincidences may still disrupt a causal analysis. It is considered that because of the large number and high density of cells and the very basic secondary data employed, distortions due to chance and measurement errors will be slight.

However they must still be accounted for. Blalock suggests that significance tests may only be ignored if it is wished to make 'descriptive' use of statistics on population data, and not if "one wishes to make inferences about the causal processes that may have generated the population data" (1979, 241-243). It is possible within the present research design to treat the analysis of surfaces as purely 'descriptive' because it is the later survey of other actors which is intended to provide any causal explanations. Therefore, in the absence of statistically significant differences between the location surfaces, the research will proceed to identify the actual association existing between the surfaces representing motorway access and location. In a population, the variations observed between associations, which are 'non-significant' statistically, can be due to either measurement error, chance or causal processes. If those variations are explained by the survey of other actors, then intuitively, the operation of chance and measurement error may be discounted.

The analysis of the surfaces is based upon statistical regression and correlation techniques. The research hypotheses, laid down earlier, are that new manufacturing locations are attracted to the vicinity of motorway junctions, and that the attraction of motorways is a greater influence on the location of warehouses than factories. The standard test of these would be to formulate a null hypothesis which the analysis would seek to disprove. This would be achieved by selecting a significance level and critical region for the test statistic to be computed. Whether the test statistic falls within the critical region determines whether the null hypothesis may be rejected or not. However, the implications of the chi-square tests and the attendant decision to undertake a 'descriptive' rather than an interpretive analysis, are that this formal approach is not

appropriate. Significance tests, and especially analysis of covariance, cannot seriously be applied when the dependent variables do not differ significantly.

Due to the difficulties with the data, the analysis will be restricted both in extent and complexity and will necessarily be exploratory. In the following regression analysis only the regression functions and the coefficients of correlation and determination will be reported. A function with a correlation coefficient of less than unity will not signify a relationship appertaining to a wider population, but rather be a 'descriptive' summary of the nature of association. Similarly, residuals will not be due to sampling error, but rather to the inaccuracy of the function, chance or measurement error. The stages of the regression analysis are reported in the following sections.

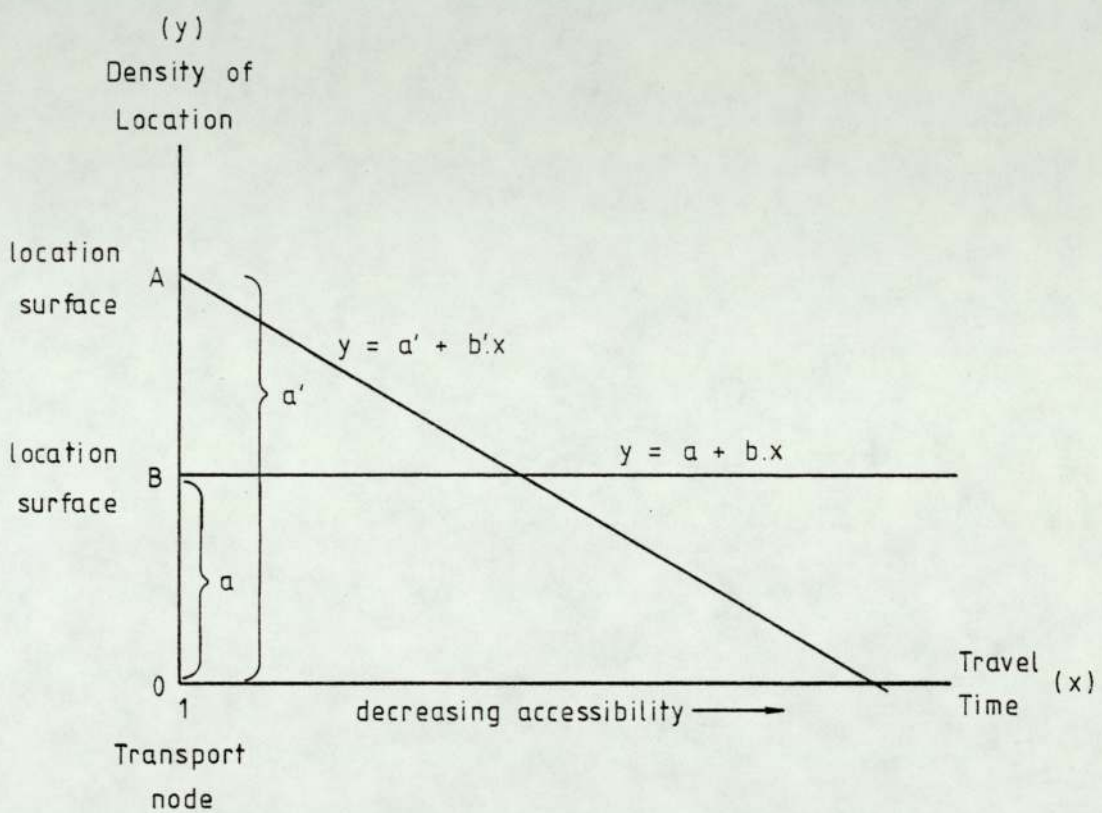
5.2.2 BIVARIATE LINEAR ANALYSIS

Following preliminary examination of the surfaces, a bivariate linear regression exercise was undertaken with X1 as the independent variable, and F1, F2, F3 and W1 consecutively as the dependent variable. The basis of this exercise is summarised in figure 5.2.1. In the linear regression equation,

$$y = a + b.x,$$

coefficient "b" represents the gradient of the regression line, which in this case measures the degree to which location density rises as one approaches the motorway nodes. The access value scale starts at "1" for high accessibility and increases in value as accessibility declines. Consequently, whenever the general density of a location surface rises near to the motorway nodes, the coefficient "b" will have a negative value; although it will represent a direct

FIGURE 5.2.1: GRAPHIC DESCRIPTION OF LINEAR REGRESSION ANALYSIS AND ITS APPLICATION



Where, $b > b'$, and b' is negative.

Hence, location surface A shows a greater concentration around the motorway junctions than location surface B.

and not an inverse association between the two variables. Hence, if "b" held a larger negative value in the regression of F2, than in that of F1, new manufacturing land use would appear to be more concentrated around the motorway nodes than older manufacturing land use.

The results of the analysis are presented in table 5.2.3, which shows the four linear regression functions and the coefficients of correlation and determination. Figures 5.2.2 and 5.2.3 diagram the scatter points and the regression lines of F1, F2 and F3, W1 respectively against the access surface.

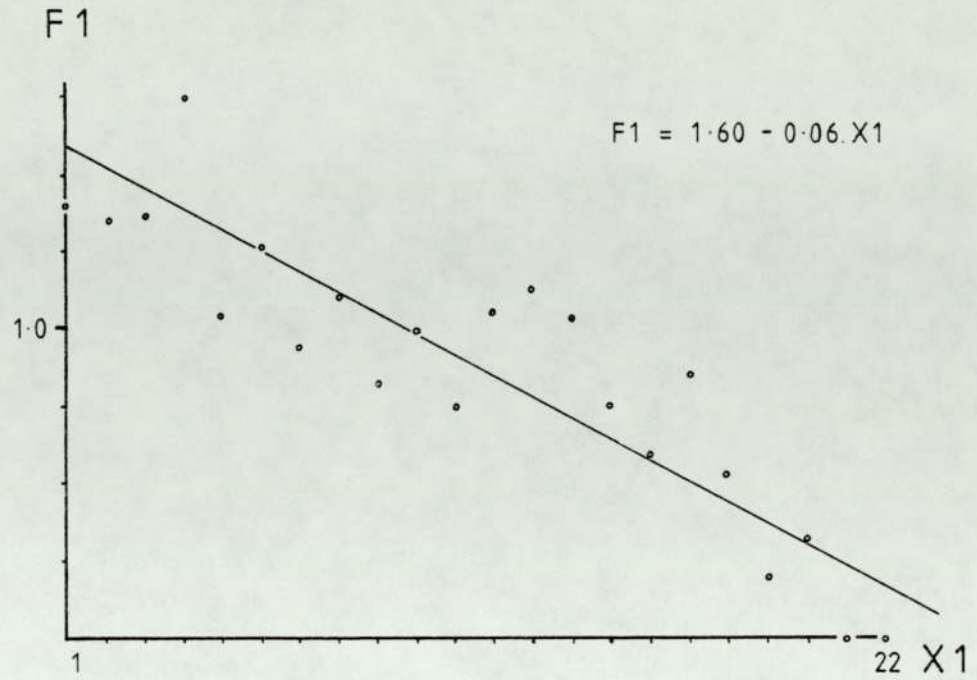
The most obvious feature of the correlations and regressions of F1 and F2 is that the location land use densities both decline with distance from the transport node. In each case zero densities occur at the same points on the margin. With F1 there is a gradual rise in density away from the margin with a peak value of 1.75 occuring at access value "4". The pattern of F2 is less regular while still presenting a gradual rise, until at access value "1" there is a sudden and sizeable peaking to a density of 2.72. It is to be expected that surface F1 should exhibit a decline in land use density with distance from the nodal point, because most motorway junctions lie in the middle parts of the conurbation and avoid the perimeter where no traditional industry lies. Consequently, over the more accessible parts of the surface, it would be likely that the F1 densities would present a 'plateau', as is indeed shown in figure 5.2.2. The significance of F2 lies in its much higher density than F1 within one minutes travel time of the motorway. Beyond this the 'plateau' can again be observed.

The linear regression analysis presents a negative "b" coefficient

TABLE 5.2.3: RESULTS OF THE BIVARIATE LINEAR ANALYSIS

DEPENDENT VARIABLE F1	
F1 = 1.60 - 0.06 X1	r_2 = 0.89 r^2 = 0.79
DEPENDENT VARIABLE F2	
F2 = 1.75 - 0.08 X1	r_2 = 0.84 r^2 = 0.71
DEPENDENT VARIABLE F3	
F3 = 1.90 - 0.09 X1	r_2 = 0.87 r^2 = 0.76
DEPENDENT VARIABLE W1	
W1 = 1.73 - 0.07 X1	r_2 = 0.78 r^2 = 0.61

FIGURE 5.2.2: REGRESSION OF LOCATION SURFACES F1 AND F2 ON THE ACCESS SURFACE



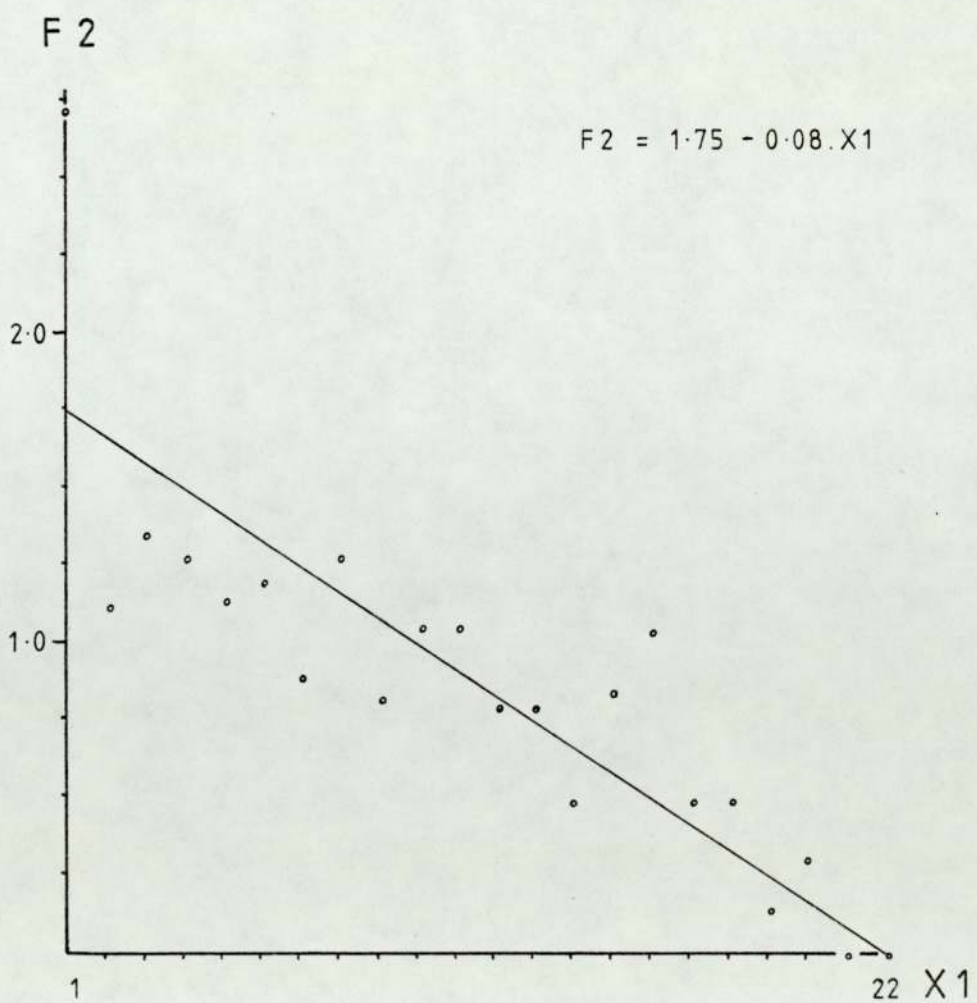
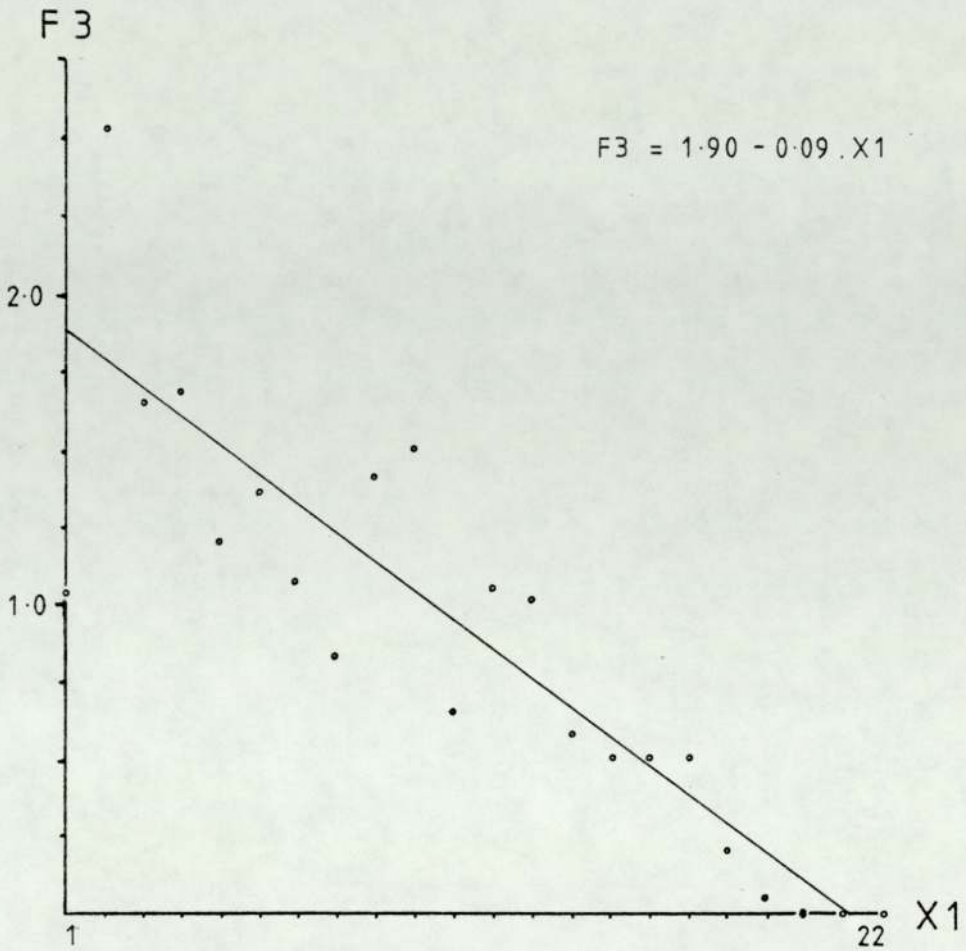
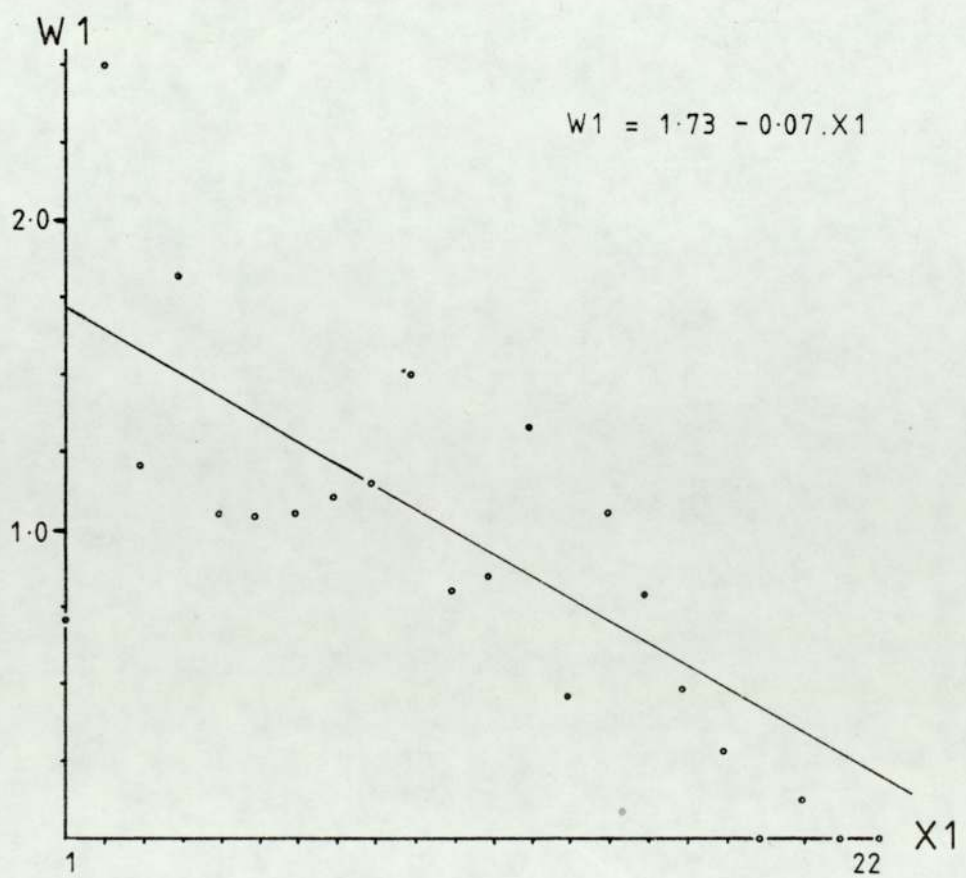


FIGURE 5.2.3: REGRESSION OF LOCATION SURFACES F3 AND W1 ON THE ACCESS SURFACE





for both surfaces, although of a rather low value. The value for F1 is 0.06 and for F2 is 0.08, which is a definite proportional rise, but a slight absolute rise in gradient resulting from the peak value of F2. Both regressions record high determination coefficients, with only 21% of the F1 data being unexplained by the regression function, and a larger 29% of F2 data, due to the extreme peak value and the more erratic build-up of density.

The regressions of F3 and W1 share some similarities with the other location surfaces. Zero planning application densities occur at the lowest access values and then increase gradually to peak near the nodal point. In fact, both F3 and W1 seem to share some minor peaks and troughs, before reaching a maximum density at access value "2", and then falling drastically to the most accessible point. This last feature is surprising in view of the high land use density recorded around the node in F2. Assuming that the research hypothesis is correct, two explanations can be offered. Firstly, the majority of available land within access value "1" may have been developed over the F2 period of 1964 to 1975. In the succeeding years covered by F3 and W1, developments attracted to the motorway would have located at access value "2" because of land shortages at "1". Secondly, the explanation may lie in the varying sizes of plots and developments. If the projects in zone "1" are of a much larger size than those in zone "2", then they will require relatively fewer planning applications to develop a similar or larger land area. Big developments may occur nearer the motorway because of the existence of large plots created by redevelopment, which can be turned to uses such as industrial estates. Alternatively, if land surrounding a motorway junction is in higher demand, then big companies with big projects may be more able to pay the higher land prices.

The linear analysis of F3 and W1 produces a negative "b" coefficient which is larger for the factory surface. This suggests that there is a slightly greater concentration of manufacturing than warehousing activity around the motorway junctions. Such a result conflicts with the research hypothesis which forecast the opposite result. The coefficients of determination explain all but 24% of the data in F3, but a less satisfactory, all but 39% of the data in W1.

5.2.3 NON LINEAR BIVARIATE ANALYSIS

The value of the above analysis depends on a good fit between the data and the regression line, which is present in all cases except W1. However, it is possible that the goodness of fit can be improved by non-linear regression, and this would provide a more accurate description of the association and in particular the decay of location density with distance from the motorway node. For this purpose, three transformations were selected which appeared to cover most of the eventualities arising from a visual examination of the surfaces. These transformations were:

1.	natural logarithmic	$y = a + b.\log_e x,$
2.	exponential	$y = a.e^{b.x}$
3.	power	$y = a.x^b$

The scope for the success of this exercise is limited by the relatively high linear correlation coefficients.

The results of the three transformations of the regression of linear data are shown in table 5.2.4. As can be seen, in only one case did a transformation improve on the value of the correlation coefficient.

TABLE 5.2.4: RESULTS OF NON-LINEAR BIVARIATE ANALYSIS

DEPENDENT VARIABLE F1 (Linear correlation: $r = 0.89$, $r^2 = 0.79$)		
Logarithmic	$F1 = 1.83 - 0.43 \log_e X1$	
	$r = 0.78$	$r^2 = 0.61$
Exponential	$F1 = 7.4e^{-0.26\ X1}$	
	$r = 0.62$	$r^2 = 0.38$
Power	$F1 = 10.07\ X1^{-1.48}$	
	$r = 0.45$	$r^2 = 0.20$
DEPENDENT VARIABLE F2 (Linear correlation: $r = 0.84$, $r^2 = 0.71$)		
Logarithmic	$F2 = 2.24 - 0.62 \log_e X1$	
	$r = 0.87$	$r^2 = 0.76$
Exponential	$F2 = 8.0e^{-0.27\ X1}$	
	$r = 0.64$	$r^2 = 0.41$
Power	$F2 = 12.58\ X1^{-1.61}$	
	$r = 0.49$	$r^2 = 0.24$
DEPENDENT VARIABLE F3 (Linear correlation: $r = 0.87$, $r^2 = 0.76$)		
Logarithmic	$F3 = 2.23 - 0.61 \log_e X1$	
	$r = 0.77$	$r^2 = 0.59$
Exponential	$F3 = 16.38e^{-0.37\ X1}$	
	$r = 0.74$	$r^2 = 0.55$
Power	$F3 = 27.34\ X1^{-2.17}$	
	$r = 0.55$	$r^2 = 0.30$
DEPENDENT VARIABLE W1 (Linear correlation: $r = 0.78$, $r^2 = 0.61$)		
Logarithmic	$W1 = 1.94 - 0.48 \log_e X1$	
	$r = 0.64$	$r^2 = 0.41$
Exponential	$W1 = 12.07e^{-0.34\ X1}$	
	$r = 0.68$	$r^2 = 0.46$
Power	$W1 = 17.84\ X1^{-1.94}$	
	$r = 0.49$	$r^2 = 0.24$

This was surface F2 where "r" was raised to 0.87 and a further 5% of the data was explained by a logarithmic function. This is presented graphically on figure 5.2.4, which shows how the function's gradient rises as the motorway node is approached, thereby more accurately fitting the peak density at access value "1", and also reflecting a greater degree of manufacturing activity clustered around the node.

5.2.4 MULTIVARIATE ANALYSIS

This final exploratory exercise introduces a second independent variable into the regression. Its causal justification is described in figure 5.2.5. The additional variable is intended to act as a composite of all the main influences, other than motorways, which affect industrial location. These would be extremely difficult to quantify individually, and therefore they are subsumed under the composite or proxy variable which is location surface F1. By definition, this is an amalgam of all the forces acting to form manufacturing land use before the mid sixties. It cannot therefore account for influences which have appeared since that time. This exercise involves the multiple and partial correlation of the two independent variables, X1 and F1, with each of F2, F3 and W1 as the dependent variable.

The resulting partial and multiple correlation coefficients are presented in table 5.2.5, together with the linear bivariate total coefficients for comparison. The addition of a second independent variable will inevitably produce a higher multiple correlation coefficient than total coefficient. However the usefulness of this exercise is more correctly reflected in the partial correlation coefficients which show the amount of variation explained by one independent variable after the other has explained all it can.

FIGURE 5.2.4: THE LOGARITHMIC REGRESSION FUNCTION OF LOCATION SURFACE F2 ON THE ACCESS SURFACE

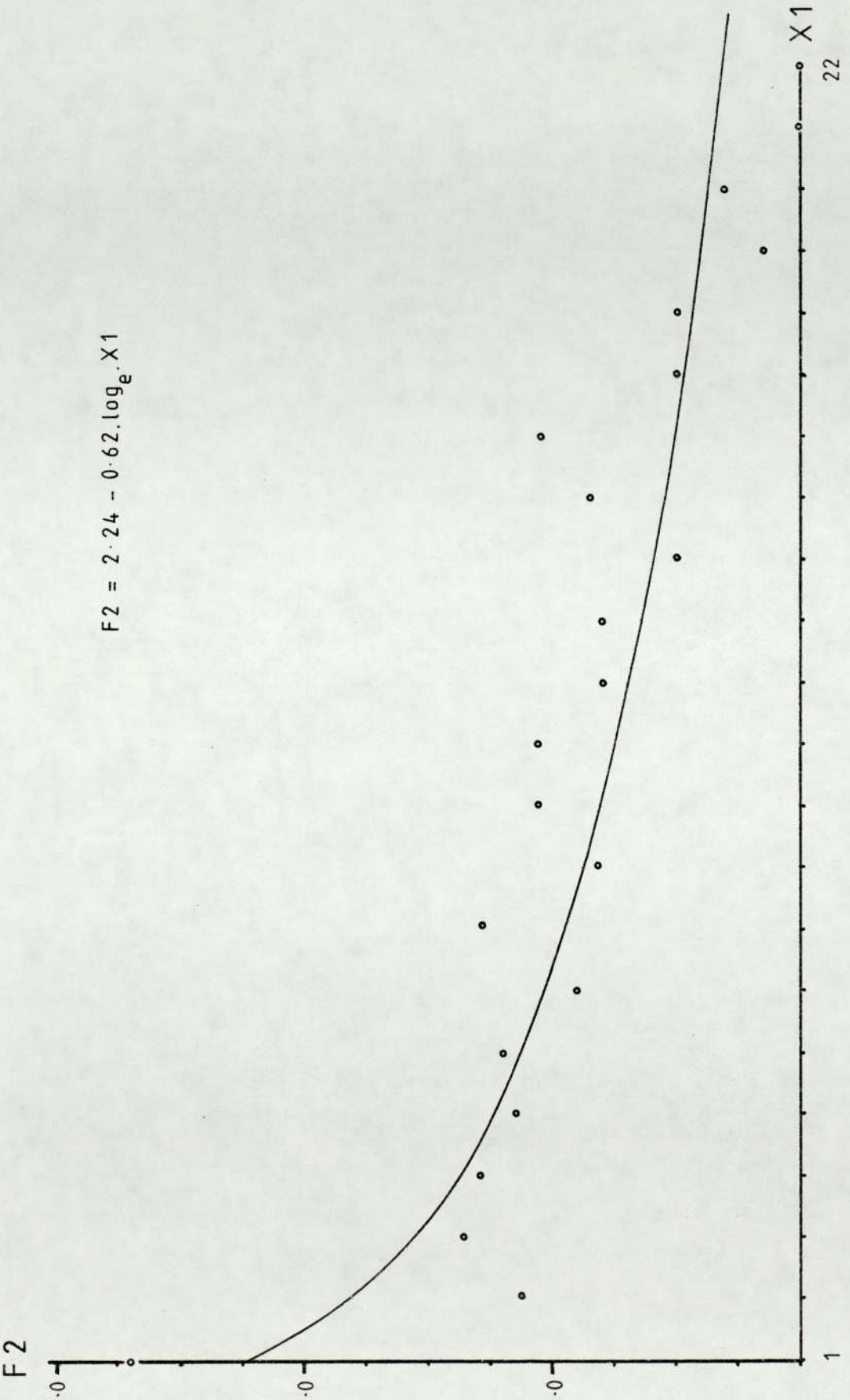


FIGURE 5.2.5: THE CAUSAL BASIS OF THE MULTIVARIATE ANALYSIS

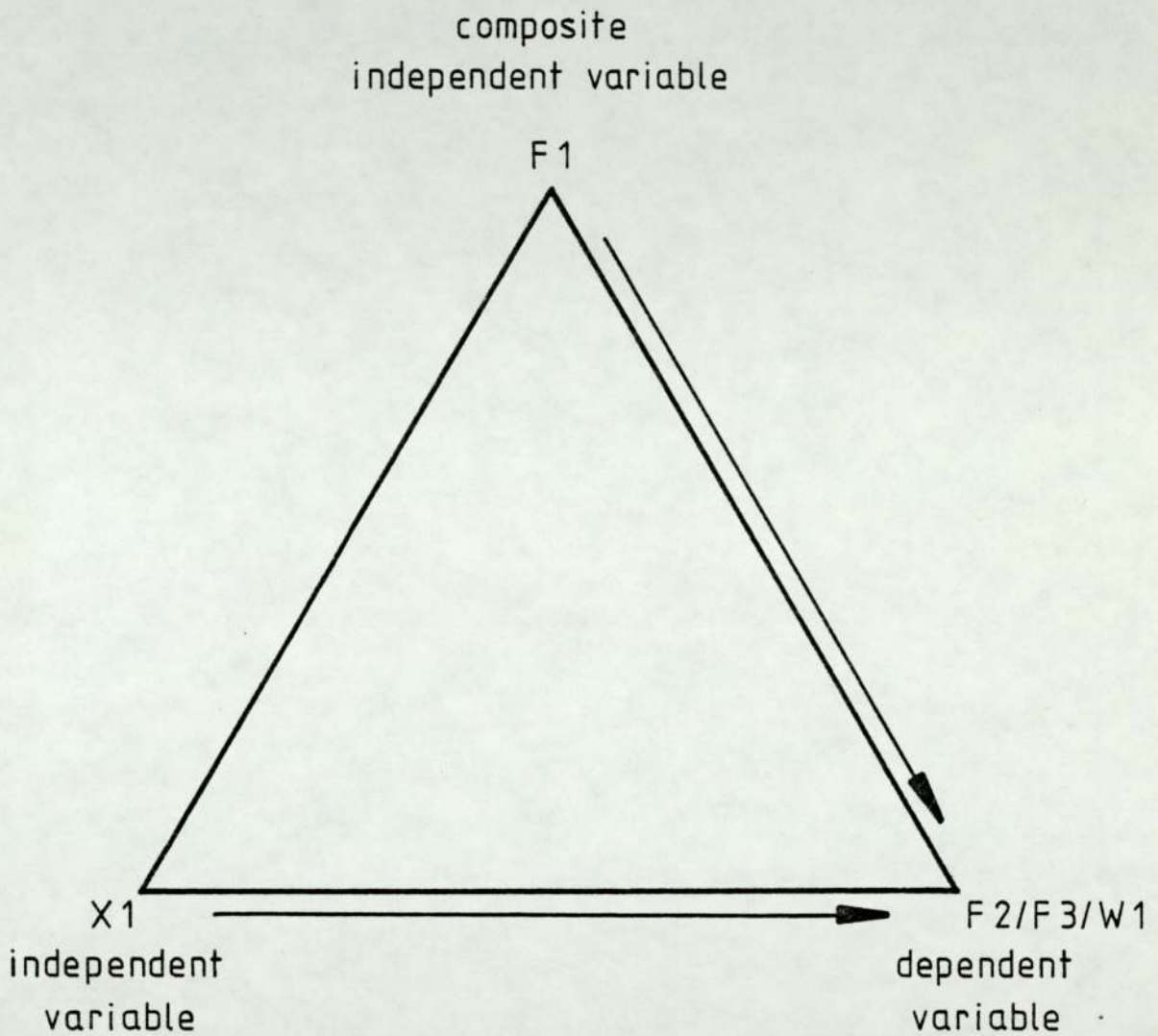


TABLE 5.2.5: RESULTS OF THE MULTIVARIATE ANALYSIS

	LOCATION SURFACES - DEPENDENT VARIABLES		
	F2	F3	W1
PARTIAL COEFFICIENT	$r_{F2X1.F1} = -0.56$	$r_{F3X1.F1} = -0.53$	$r_{W1X1.F1} = -0.27$
($r_{yx_1.x_2}$)	$r_{F2X1.F1}^2 = 0.31$	$r_{F3X1.F1}^2 = 0.28$	$r_{W1X1.F1}^2 = 0.07$
MULTIPLE COEFFICIENT	$R_{F2.X1F1} = /0.85/$	$R_{F3.X1F1} = /0.88/$	$R_{W1.X1F1} = /0.81/$
($R_{y.x_1x_2}$)	$R_{F2.X1F1}^2 = 0.72$	$R_{F3.X1F1}^2 = 0.78$	$R_{W1.X1F1}^2 = 0.65$
BIVARIATE TOTAL COEFFICIENT	$r_{F2X1} = -0.84$ $r_{F2X1}^2 = 0.71$ $r_{F2F1} = 0.76$	$r_{F3X1} = -0.87$ $r_{F3X1}^2 = 0.76$ $r_{F3F1} = 0.83$	$r_{W1X1} = -0.78$ $r_{W1X1}^2 = 0.60$ $r_{W1F1} = 0.79$
(r_{yx})	$r_{F2F1}^2 = 0.58$	$r_{F3F1}^2 = 0.69$	$r_{W1F1}^2 = 0.62$

In the hypothesised relationship where X1 and F1 both determine the form of surfaces F2, F3 and W1, the resulting partial correlation coefficients should also be greater than the total coefficients. However, in every case the results show a substantially lower partial coefficient. This is due to a lack of independence between F1 and X1, which exhibit marked multicollinearity. Hence variations in the dependent variable which are explained by F1 are almost equally well explained by X1. A consequence of this high intercorrelation between X1 and F1 is an only marginally higher multiple correlation coefficient by no more than 0.01-0.03 above the total coefficients. This problem also exacerbates any measurement errors or other distortions in the calculation of partial and slope coefficients, and consequently seriously weakens the value of any regression results. In view of this and the general weakness of the analysis at this stage, no multiple regression functions are presented.

5.2.5 SUMMARY AND INTERPRETATION

The analysis of surfaces forms the first part of the research method. As it is an integral component of the entire design, meaningful conclusions can only be drawn when the whole is complete. This section, therefore, seeks to review the results presented above, and make some preliminary attempts at their interpretation. Overall, the analysis of surfaces has lacked sufficient power to produce evidence of causality, because of the absence of significant differences between the location surfaces. This chapter has concentrated therefore, on purely 'descriptive' statistics in order to effectively summarise associations which the findings of later chapters will amplify. The above analysis explores the two research hypotheses.

The first hypothesis is that new factory locations will be concentrated

around motorway junctions in contrast to old factory locations. The analysis used the two manufacturing land use surfaces F1 and F2, and found that the new locations of F2 exhibited a clustering immediately around the junctions which was absent from F1. In terms of the linear regression this was described by a slight rise in the slope coefficient between F1 and F2. However, by using a logarithmic transformation of the access surface variable, it was possible to produce an improved regression function which replicated the form of F2 and explained 76% of its data. Whereas there was little difference between the greater parts of the two location surfaces when regressed against the access surface, there appeared a definite increase in the land use density of F2 at the most accessible point. This is in line with the hypothesis, but only in the immediate vicinity of the motorway.

The second hypothesis was that warehouse locations would be found to be generally closer to motorway junctions than factory locations. This exercise was based upon the two planning application surfaces which represent the mid-seventies period. When regressed against the access surface, these both showed a gradual but intermittant rise in location density as the motorway node was approached, a high peak density surrounding the node, and a sudden drop in density at the node itself. Contrary to the hypothesis, this pattern and rise in density were stronger in F3 than in W1, as expressed by higher slope and correlation coefficients. The apparently 'refuted' hypothesis was based on the assumption that, as 'transport' is of far greater relative importance as an input to warehousing than to manufacturing activity, then it would be more valued as a location factor. Motorways are a form of transport and hence should be expected to hold a greater affinity

for warehouse than factory location. However, the essence of the argument drawn together in section 3.0, is that various intangible and psychological factors have as much importance for the location decision maker as the more obvious, definable advantages. The basis of the second hypothesis may therefore be fallacious, for it ignores a variety of, possibly, more significant determinants.

Mention must finally be made of the occurrence at the motorway nodes of a high manufacturing land use density in F2, and of relatively low planning application densities for both factories (F3) and warehouses (W1). To explain this anomally, it can be postulated that in the late sixties and early seventies covered by F2, extensive development occurred around the motorway junctions, and produced a land shortage in the subsequent period covered by F3 and W1. Consequently, motorway orientated developments took the nearest available sites which occurred at access value "2" and produced the peak densities recorded at this value. Alternatively differences between the land use and planning application data may explain this discrepancy.

5.3 OTHER ACTORS - QUESTIONNAIRE SURVEY OF ESTATE AGENTS AND DEVELOPERS

The aims of the questionnaire survey were twofold; firstly to explain the role of developers and estate agents, and the process of industrial site selection and development in the presence of motorways; secondly, in supporting the analysis of surfaces, to scrutinise doubtful associations and to determine causal inferences. In order to achieve these aims respondents were asked to identify the factors and the locations in the West Midlands study area which they valued for the sites of new industrial properties. If it is accepted that other actors are key location decision makers, then their answers will identify causal relationships between the presence of significant factors and subsequent developments.

Postal questionnaires rather than interviews were chosen as the vehicle for the survey. As a standard format was to be used with no probe or follow-up requirements, and as the numbers involved were not insubstantial, the use of interview techniques would have been an inefficient application of research resources.

This chapter reports on the design and implementation of the questionnaires, their results and their implications. The forms used differed between the estate agents and developers and both can be found in appendix B. The abbreviations, "EAQ-" and "DQ-", will be used to refer to the specific questions which these forms address to estate agents and developers respectively.

5.3.1 SURVEY DESIGN AND IMPLEMENTATION

Three general considerations influenced the survey design. Firstly, the accuracy and extent of the information sought, required that respondents had a considerable local knowledge and experience of the local property market. Consequently, the questionnaires were addressed only to the directors, partners and senior managers of industrial estate agencies and property development companies operating within the study area. Secondly, to ensure the co-operation of these individuals, who would have limited time, the design had to be short, simple and require less than fifteen minutes to answer. With this type of respondent, intelligence, a knowledge of specialist terms and a spatial orientation were assumed, so removing the need for lengthy and verbose introductions and questions. Thirdly, because the target population was small (approximately fifty in total), and because postal questionnaires generally result in poor responses, special efforts were required to ensure as complete a set of replies as possible.

Although separate questionnaires were needed to deal with the estate agents and with the developers, both followed a common outline, concentrating on factory and warehouse properties and the presence of motorways. Questions were very similar and the main difference lay in the form of words used to examine the same topic. In order to avoid bias, the respondents were not informed that motorways were of central importance to the research. Both questionnaires were designed around two key questions, the first of which asked for an assessment of specific location factors, while the second presented a map on which the favourability of certain locations were to be marked.

Various general and supplementary questions were scattered around these which were to be used either to assess the extent of the other actors' role, or to interpret and analyse the key questions. The purpose of each minor question is revealed in the presentation of results. One question (EAQ6; DQ6) was asked about office location because of its connections with industry and its possible dependence on good accessibility.

In the layout of the questionnaires, the most straightforward and easiest to answer of the minor questions were placed first in order to attract the respondent and lead him into the first key question (EAQ4; DQ4). More minor questions connected this to the more demanding second key question (EAQ8, Q9; DQ8), which it was hoped would interest the respondent. Finally, the name and position of the individual completing the form was requested in an attempt to encourage it to be answered by the addressee, and to check whether this was the case. To achieve brevity and an orderly and attractive presentation, both questionnaires were limited to ten questions, spread over two sheets of paper. All but two of the questions were closed and the two key questions were coded to assist in statistical comparison. Discussions with estate agents, developers and other property experts were held throughout the design period to ensure that the survey achieved its objectives.

The first key question (EAQ4; DQ4) asked respondents to evaluate the importance of seven factors in factory and warehouse location. This number was felt to offer and adequate selection without being too long and off-putting. These seven were chosen with the aims of representing the factors commonly investigated in studies of the firm (see table 2.2.1; and Cameron and Clark, 1966) and of examining issues of particular significance to estate agents and developers.

The first six factors were common to both questionnaires. Surveys of the firm have concentrated primarily on labour, linkage and transport factors, and for the former the term "local skilled labour" was adopted. Linkages are commonly described as 'access to suppliers and markets' in such surveys. However these terms have limited meaning to estate agents and developers, and therefore a more relevant form of words - "traditional industrial area" - was chosen as indicative of linkage. Two transport factors - "proximity to motorways" and "proximity to rail services" - were included. The two remaining common factors were more particularly related to property market considerations. A "greenfield site" and "main road frontage" imply advantages of space, low construction costs, environment, image and prestige, of which property experts have considerable knowledge. In the developers' questionnaire the seventh factor explored a basic feature of the land market - "low land values". Estate agents were instead questioned on the importance of a "nearby commercial centre" which would offer the benefits of shops, offices and business services.

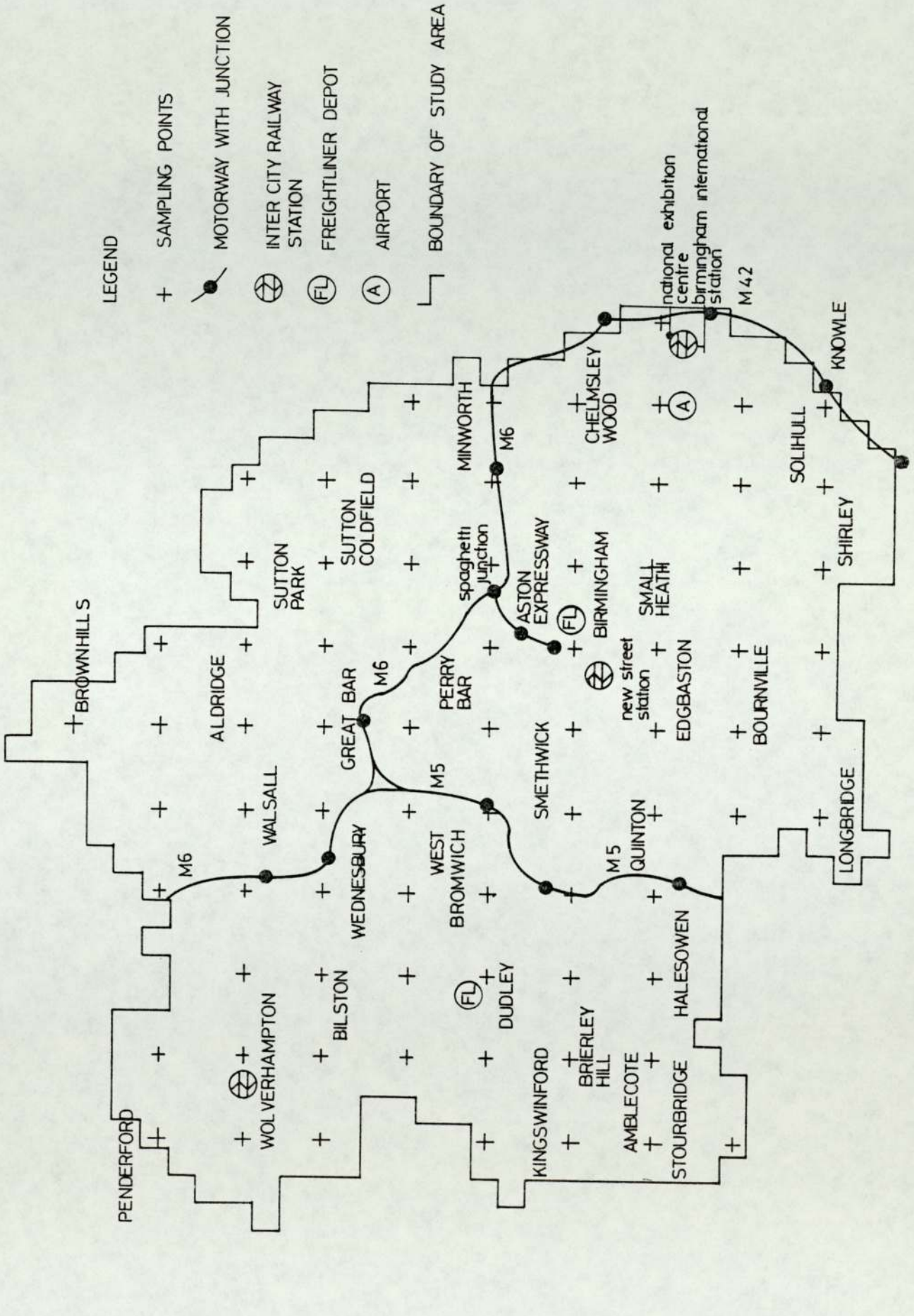
A four point scale ranging from "no advantage" to "a very major advantage" was provided for respondents to use in assessing each factor. This enabled direct comparison between factory and warehouse responses and between the developers' and estate agents' responses. Spaces for replies concerning factories were placed on one side of the list of factors, with spaces for replies concerning warehouses on the other. This was to encourage a separate evaluation of the two categories.

The second key question (EAQ8, Q9; DQ8) utilized the local knowledge and spatial orientation assumed to be held by respondents.

They were asked to evaluate several locations marked on a map of the study area in terms of attractiveness, demand and rental for factory and warehouse properties. An Ordnance Survey 1:50,000 series map was chosen because of the detail it provided. 'Dyeline' copies were produced and one can be seen in the appendix. On these copies all features outside the study area were blacked out in order to concentrate the respondents' attention on the conurbation. The question sought to produce a contoured representation of locational favourability from the answers obtained, and this required a regular grid of sampling points at frequent intervals. Each point covered a kilometre square, so identifying a locality, but avoiding any particular site. A rectangular grid had these points placed every three kilometres. This was randomly superimposed onto the maps, and resulted in seventy eight sample points which can be seen in figure 5.3.1. These points were identified on the maps by a coloured, transparent, adhesive square which attracted the respondent to the correct location, could be written on and did not hide any detail.

Unfortunately it was unrealistic to expect each respondent to reply to each of the seventy eight sample squares, and to attempt this would have placed the level of response in jeopardy. Discussions within the property sector suggested that, although estate agents and developers would have little difficulty in answering the question, no more than fifteen to twenty responses should be asked from each. Consequently it was necessary to sub-divide the two respondent groups for this question, and re-combine their answers at a later stage. In this split, each sub-distribution was evenly and regularly scattered around the study area in order to avoid any bias. However such actions made a high quality and volume response even more vital.

FIGURE 5.3.1: THE SAMPLING GRID



With a limited number of sampling points and a limited number of respondents, the intention and wording of the second key question needed careful consideration. The question sought to obtain both an assessment of rents charged and a coded evaluation of favourability. To ensure comparability, all codes were based on a five point scale. Developers were asked to mark "the relative attractiveness of each location ... for one of (their) average-sized factory/warehouse developments" on a scale ranging from "very unattractive" to "very attractive". Pilot work suggested that combining the two categories of use would not produce any conceptual difficulties for the developers. Mention of average-size was to allow further analysis using results from the size of developments question (DQ3). Respondents were asked to assume that sufficient land with planning permission existed and that construction costs were fixed, in order that wider locational attributes would be evaluated and not site considerations. The group of developers were allocated forty of the sample squares, which were then split three ways so that each respondent was required to make no more than 13 or 14 replies.

The second key question addressed to the estate agents was actually composed of two question. The first (EAQ8) asked for an evaluation of the demand for warehouse units at sample squares marked in one colour, in terms of a scale ranging from "no demand" to "prime demand". The second (EAQ9) asked for an assessment of the average rent it could be expected to charge for a hypothetical factory unit located in sample squares of another colour. Two questions were included because pilot work revealed that estate agents would find it difficult to combine their assessments of factory and warehouse premises.

Furthermore it was decided that a question on rents could be more easily and accurately answered by estate agents because of their more extensive involvement in the market, than by developers. To ensure that replies to this question were reliable, the property was described as one of the more standard and common units to be found in the conurbation. Of the thirty eight sample squares allocated to the group of estate agents, eighteen were coloured yellow and assigned to the warehouse demand question (EAQ8), and twenty were coloured green and assigned to the factory rental question (EAQ9). The group was then randomly divided so that no respondent would have to reply to more than eighteen or twenty sample squares of both yellow and green.

The survey was addressed to all estate agents and developers active in the market for new industrial property within the study area. The names of twenty eight estate agents and twenty four developers were identified from directories, magazines, advertisements and contacts in the market. As this constituted a relatively small group, the piloting of the questionnaires did not use any of these respondents, but was fortunate in finding a developer and estate agent who had knowledge of the market and the area but no longer operated within it. Various other contacts in the property sector provided useful information, and where relevant this is mentioned in the discussion of results. In each estate agency and property development company, telephone enquiries ascertained the name of a director, partner or senior manager involved with industrial property, and it was to these individuals that the survey was sent. It contained the two pages of questions, the map, a covering letter and a stamped addressed envelope for return. The covering letter, which is in the appendix, was designed to encourage a good response.

It referred to the importance of the role played by the addressee in the property market and explained that this was why his assistance was requested; it emphasised that the research was officially sponsored and that the results might interest him; and it promised that those co-operating would obtain a copy of the report. A majority of the questionnaires were posted. However, a few were delivered in person during the course of a separate survey undertaken by JURUE. The first forms were despatched at the end of November 1978, and in some cases after up to three telephone reminders, the final replies were received by the end of the following January.

Seventeen of the twenty-eight estate agents returned usable replies. Six failed to reply and five had to be removed from the sample for a variety of reasons - three belonged to larger organisations which replied on their behalf, one was unavailable during the survey period and one preferred to discuss the issues rather than complete the form. This respondent was interviewed after the results had been analysed and his comments are reported later in the chapter.

Twenty of the twenty-four developers returned usable replies; one failed to reply; one refused to reply because of "confidentiality" and two were removed from the sample because of unavailability and an error of inclusion. This very good response, which was generally of a high quality, is summarised in table 5.3.1. Among the estate agents three replies were completed by persons other than the addressee, and the same was true of the developers. However in two of these cases the addressee replied with a covering letter containing relevant information. Some respondents were extremely helpful and provided additional details, advice and suggestions which were most valuable and are reported later in the chapter.

TABLE 5.3.1: RESPONSE TO THE QUESTIONNAIRE SURVEY

	SAMPLE GROUP	
	ESTATE AGENTS	PROPERTY DEVELOPERS
Original Sample Size	28	24
Final Sample Size	23	22
Positive Response	17	20
Negative Response	-	1
No Response	6	1
Response Rate	74%	91%

5.3.2 RESULTS OF THE SURVEY

The results are presented in three sections. Firstly the minor questions are discussed to provide general information and indicate the extent of the role of other actors. Secondly the results of the first key question and subsequent location factor questions are presented. Finally, the map question is reported.

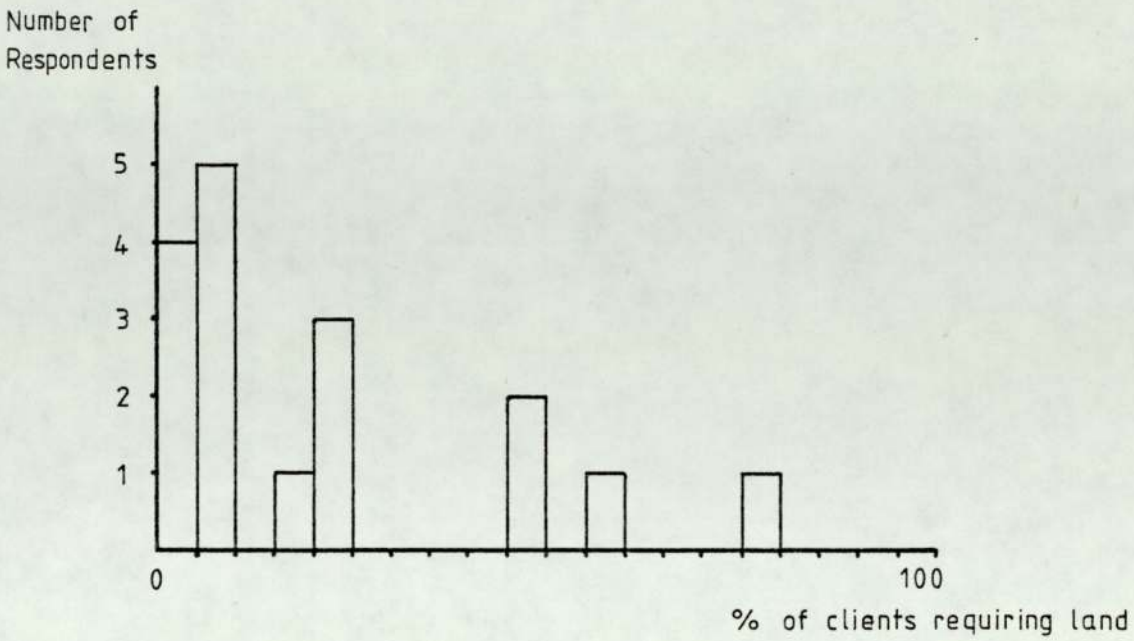
In each questionnaire the introductory question (EAQ2; DQ2) sought to identify with which property types respondents were involved. The results, which are presented in table 5.3.2, show that all respondents had some involvement in factories, warehouses or industrial estates, as would be expected from the sample selection. In addition over half of each group were also involved with offices, and it was these respondents who identified office location factors in a later question.

Estate agents estimated the proportion of their clients approaching them for land as opposed to new premises (EAQ3). Figure 5.3.2. shows that in most cases less than 25% of clients are interested in land. Although no information exists on the size of the different agencies, on the nature of their clients, or on applicants, this figure indicates the importance of ready build premises in a great many location decisions. The developers provided further evidence on location decision makers by estimating the percentage of their developments whose locations were determined by clients (DQ9). Figure 5.3.3 demonstrates that the vast majority of these developments were outside the immediate locational control of the eventual occupier. Clearly, the developer chooses a site where he anticipates demand, and although in some cases a customer may have decided to occupy before building commences, the original location decision is predominantly taken by the developer.

TABLE 5.3.2: THE INVOLVEMENT OF ESTATE AGENTS AND DEVELOPERS IN PROPERTY TYPES

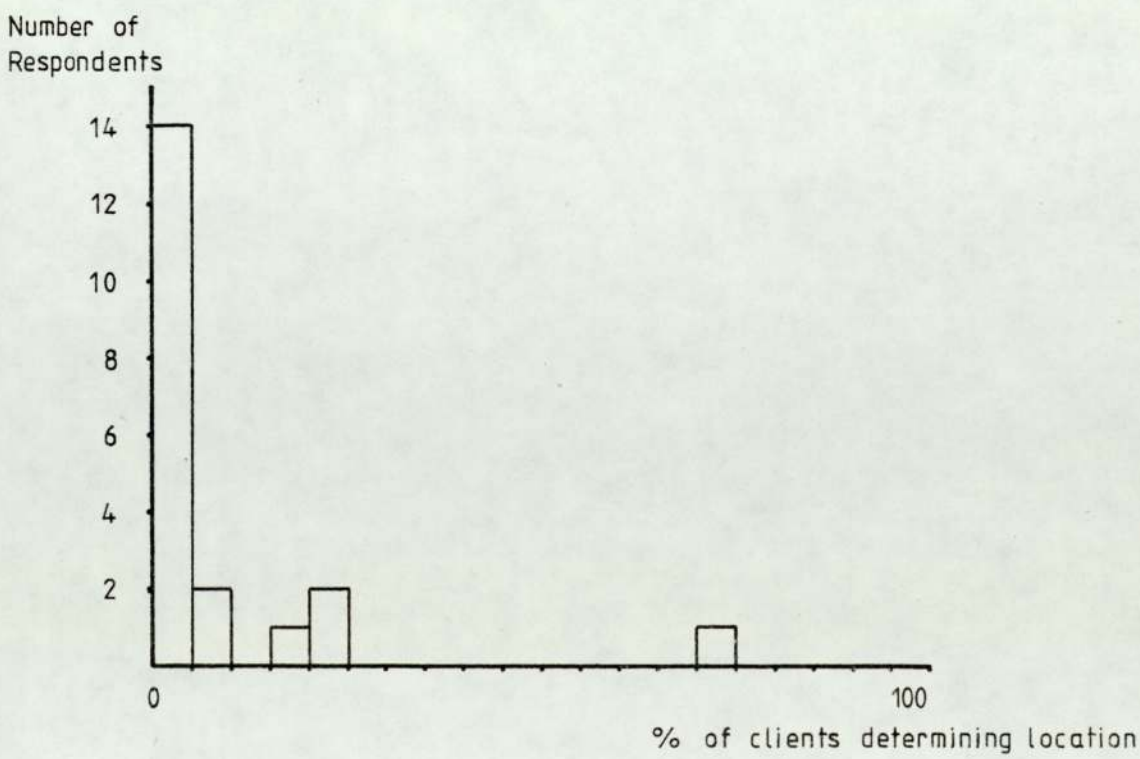
Estate Agents Property Type	No Involved	Developers Property Type	No Involved
New Factory Units	17	Factory Units	19
New Warehouse Units	16	Warehouse Units	19
New Offices	12	Offices	13
Land for Factory, Warehouse or Office Development	15	Industrial Estates	20
(No. of Respondents = 17)		Nursery Factory Units	11
		Refurbishment	13
		(No. of Respondents = 20)	

FIGURE 5.3.2: PROPORTION OF ESTATE AGENTS' CLIENTS REQUIRING LAND AS OPPOSED TO NEW PREMISES



Total no. of respondents = 17, mean = 23%

FIGURE 5.3.3: PROPORTION OF DEVELOPERS' CLIENTS DETERMINING LOCATIONS



Total no. of respondents = 20, mean = 9%

Developers were asked for the average size of factory or warehouse development they undertook (DQ3) in order to analyse replies to the key questions. Figure 5.3.4. presents the results, which show an adjusted mean size of 15 acres after the very extreme response of 120 acres had been removed. The smallest site mentioned was 0.5 acres.

The first key question of the survey (EAQ4; DQ4) investigated the importance of certain location factors, and its results are presented in table 5.3.3. There appeared to be no difficulty in answering the question except for the term "low land values" which caused some confusion because low values are only an advantage when they are below the market value of the land concerned and potential margins are high. This resulted in considerable variance.

For factory locations both respondent groups agreed that a "traditional industrial area" was the most important advantage, although "local skilled labour" and "proximity to motorways" were also major advantages. Developers assessed "main road frontage" as a major advantage, but estate agents felt it to be a minor one. Other minor advantages for factory location were "proximity to rail services", "nearness to a commercial centre", "low land values" and from the developers' viewpoint a "greenfield site". However, the estate agents considered this last factor to offer no advantage.

Estate agents and developers were in strong agreement in placing "proximity to motorways" as the most important advantage for warehouse location. A "traditional industrial area" was felt to be a major advantage by both groups, as was "main road frontage" by the developers.

FIGURE 5.3.4: AVERAGE SITE SIZE OF INDUSTRIAL DEVELOPMENTS

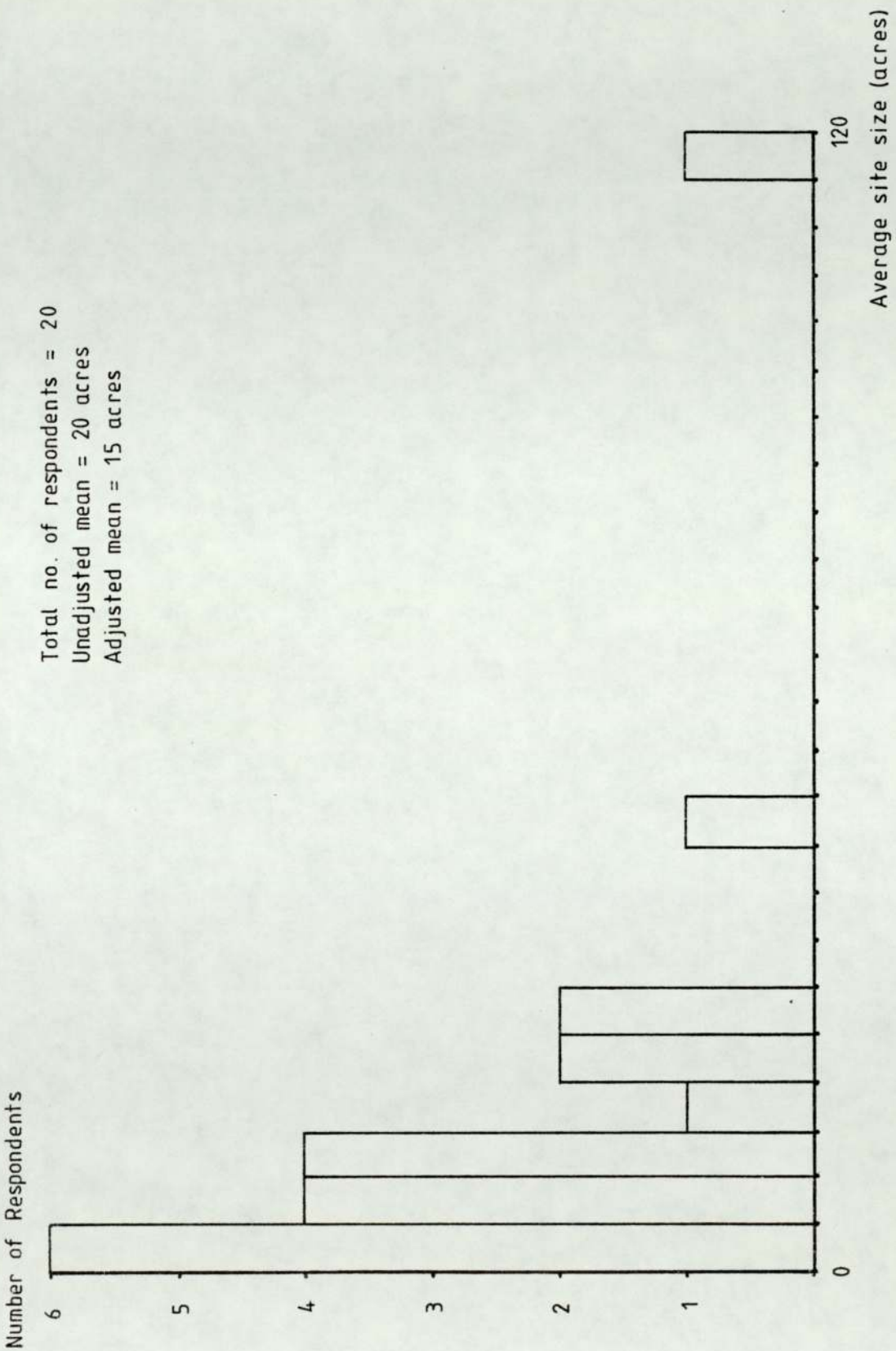


TABLE 5.3.3: LOCATION FACTORS EVALUATED BY ESTATE AGENTS AND DEVELOPERS

CODE	1	2	3	4
DEFINITION	Very Major Advantage	Major Advantage	Minor Advantage	No Advantage

Numbers written beneath codes indicate the frequency with which that factor was awarded that code.

Table A - Estate Agents

Location Factors	Factories						Warehouses					
	Codes				Median	Rank	Codes				Median	Rank
	1	2	3	4			1	2	3	4		
Traditional Industrial Area	9	7	-	-	1	1	1	7	8	-	2	2
Proximity to Motorways	7	8	1	-	2	2.5	16	-	-	-	1	1
'Greenfield' Site	-	-	6	10	4	7	-	1	9	6	3	5
Local Skilled Labour	5	9	2	-	2	2.5	1	2	8	5	3	5
Main Road Frontage	1	5	10	-	3	5	1	7	5	3	3	5
Proximity to Rail Services	-	2	10	4	3	5	-	2	12	2	3	5
Near to a Commercial Centre	1	3	10	2	3	5	-	6	7	3	3	5

No. of Respondents = 16

Table B - Developers

Location Factors	Factories						Warehouses					
	Codes				Median	Rank	Codes				Median	Rank
	1	2	3	4			1	2	3	4		
Traditional Industrial Area	12	6	-	-	1	1	5	8	5	-	2	2.5
Proximity to Motorways	7	10	1	-	2	3	14	4	-	-	1	1
'Greenfield' Site	1	3	8	6	3	6	1	5	8	4	3	5.5
Proximity to Rail Services	1	2	12	3	3	6	1	3	11	3	3	5.5
Local Skilled Labour	10	6	2	-	2	3	2	.5	6	5	3	5.5
Main Road Frontage	4	12	2	-	2	3	5	11	2	-	2	2.5
Low Land Values	2	4	7	5	3	6	2	4	7	5	3	5.5

No. of Respondents = 18

The importance of accessibility was emphasised in additional information provided by respondents, and motorways and good roads were stressed as necessary conditions for successful warehouse and factory developments. One respondent described motorways as "essential", while another stated that industrialists "wish to be no more than fifteen minutes travel time from motorways on good roads". An isochrone of this size around motorway junctions would incorporate a large majority of the study area.

Although respondents believed that motorways provided locational benefits, these benefits "fall off rapidly if the road system is such as to delay or make access to a site difficult". Major congestion or complex and limited access from a site to a motorway appears to severely reduce the value of that site, and such effects are most prevalent in the immediate vicinity of a motorway junction. This evidence may help to explain the phenomenon of relatively low location densities occurring at the highest access values in the analysis of some surfaces reported in section 5.2. One respondent also considered this effect to limit the value of sites with a main road frontage because of congestion and limited access difficulties. A similar problem can affect industrial estates where a large number of firms require access onto a major road via a single junction. The Spearman rank correlation coefficient was used to measure the differences between the responses of the estate agents and developers, and for the factory and warehouse locations. Four developers and two estate agents had valued factors for factory location identically to factors for warehouse location. However, the coefficients presented in table 5.3.4 show relatively poor relationships, justifying the separate approach taken to investigate each area. The highest coefficient correlates warehouse responses by estate agents and developers, but is still below the 5% level of significance.

TABLE 5.3.4: SPEARMAN RANK CORRELATION COEFFICIENTS OF LOCATION FACTOR RESPONSES

Responses Compared	r_s	N
1. Estate agents' ranking of factory and warehouse factors	0.54	7
2. Developers' ranking of factory and warehouse factors	0.59	7
3. Ranking of factory responses by estate agents and developers	0.53	6*
4. Ranking of warehouse responses by estate agents and developers	0.79	6*

*Correlations 3 and 4 include only the first six common factors.

It is possible that the determinants of location vary with the scale of development. For example, a large warehouse supplying a wide area may be more suited to a cheaper greenfield site with motorway access than to a traditional industrial area. A large factory or factory estate might be able to internalise the agglomeration economies of traditional industrial areas and become more footloose. To investigate this possibility the developers' response was analysed by the average size of development undertaken by each respondent, but to no significant conclusion. With individual developers involved in a wide range of site sizes, and with the largest industrialists often building their own premises such a result was not improbable.

As a 'follow-up' to the first key question respondents were asked to identify any location factors which had been overlooked (EAQ5; DQ5). The small response of twelve out of thirty seven respondents confirms the comprehensive nature of the foregoing list. Four items affecting a locality were mentioned:

"access to airport"
"access to ports"
"good environment"
"ability to create an 'image'"

Additional items listed referred to the market and institutional environment ("rental margin above building costs", "established reasonable rent levels", "demand", "existing space in area", "speed of obtaining planning permission", "IDCs", "local authority attitudes"), and advantages to the site ("approach roads", "access to buildings", "adequate services").

Respondents also identified the key determinants of a successful office location (EAQ6; DQ6), which are listed in table 5.3.5. As the question was open and uncoded, the replies have been classified arbitrarily and frequency of mention has been taken as an indicator of importance. Access factors covering both commuting and longer distance travel appeared most often in the replies. The importance of parking provision combined with a concern over congestion may be to the advantage of some suburban locations despite a strong desire to be near other offices in the city centre. Labour supply is seldom mentioned which suggests it lacks major importance in spite of the often stated constraint placed on office location by female staff requiring nearby shops and other amenities.

The second key question relates specifically to the West Midlands study area, and as an introdruction to this question and its map of the conurbation, respondents were asked (EAQ7; DQ7), to list the neighbourhoods in which they operated. The results are summarised in table 5.3.6 which also shows the location of respondents' offices. This information is used in analysing the key question.

The map question itself, recorded values for the attractiveness,demand and rentals of a grid of sampling points throughout the study area. These results are presented on a series of maps which use contour lines to encircle points of equal value. It is stressed that these contours provide only a rough indication of where the limits of each response value lie. In the first key question "traditional industrial areas", "proximity to motorways", and "local skilled labour" were identified as major location determinants. In order to compare map question results with these factors, two base maps were used.

TABLE 5.3.5: OFFICE LOCATION FACTORS IDENTIFIED BY ESTATE AGENTS AND DEVELOPERS

Table A - Estate Agents

Access Factors (16)

Personnel access (1)
Communications (1)
Buses (1)
Rail (1)
Intercity rail (1)
Road Access (1)
Transport systems (3)
Near arterial roads (1)
Parking (4)
Easy access w.r.t. parking (1)
Within 5 miles of motorway (1)
(see also Image Factors)

Amenities (7)

Urban amenities (1)
Shops (4)
Banks (1)
Institutions (1)

Office Centres

Central business district (3)
Commercial Centre (1)
Established office area (3)
Established professional area (1)
Within inner ring (1)

Market Factors (1)

Shortages (1)

Image Factors (5)

Fashionable (2)
Prestige (1)
Frontage (a) peripheral city locations with good frontage (1)
(b) suburban locations with main road frontage (1)

Other Factors

Planning permission (1)
Contacts (1)
Staff availability (3)

N.B. Numbers in parentheses refer to frequency of mention
No. of Respondents = 15.

Table B - Developers

Access Factors (23)

Public Transport (6)
Car Parking (8)
Road Access (3)
Rail Access (3)
Air Access (1)
Uncongested Access (2)
(see also Image Factors)

Other Factors (1)

Local workforce (1)

Environmental/Amenities (12)

Environment (3)
Shopping (5)
Housing (1)
Recreation (1)
Amenities (2)

Office Centres (8)

Central Business District (3)
Traditional Office area (4)
Proximity to other offices (1)

Image Factors (6)

Prominant position for individual identity (3)
Main Road Frontage (3)

Market Factors (9)

Demand (3)
Rental Values (2)
Land Values (1)
No oversupply (3)

N.B. Numbers in parentheses refer to frequency of mention.
No. of Respondents = 12.

TABLE 5.3.6: RESPONDENTS' LOCATION AND INVOLVEMENT IN THE CONURBATION

	NO. OF ESTATE AGENTS INVOLVED	NO. OF PROPERTY DEVELOPERS INVOLVED	NO. OF ESTATE AGENTS' LOCATIONS	* NO. OF PROPERTY DEVELOPERS' LOCATIONS
Aldridge	8	6	0	1
Birmingham	16	17	11	6
Brownhills	4	4	0	0
Dudley	9	14	2	3
Halesowen	11	11	2	2
Solihull	8	9	0	1
Stourbridge	6	10	0	0
Sutton Coldfield	7	5	0	0
Walsall	12	13	0	0
Warley	11	12	0	0
West Bromwich	13	16	1	0
Wolverhampton	12	15	1	4

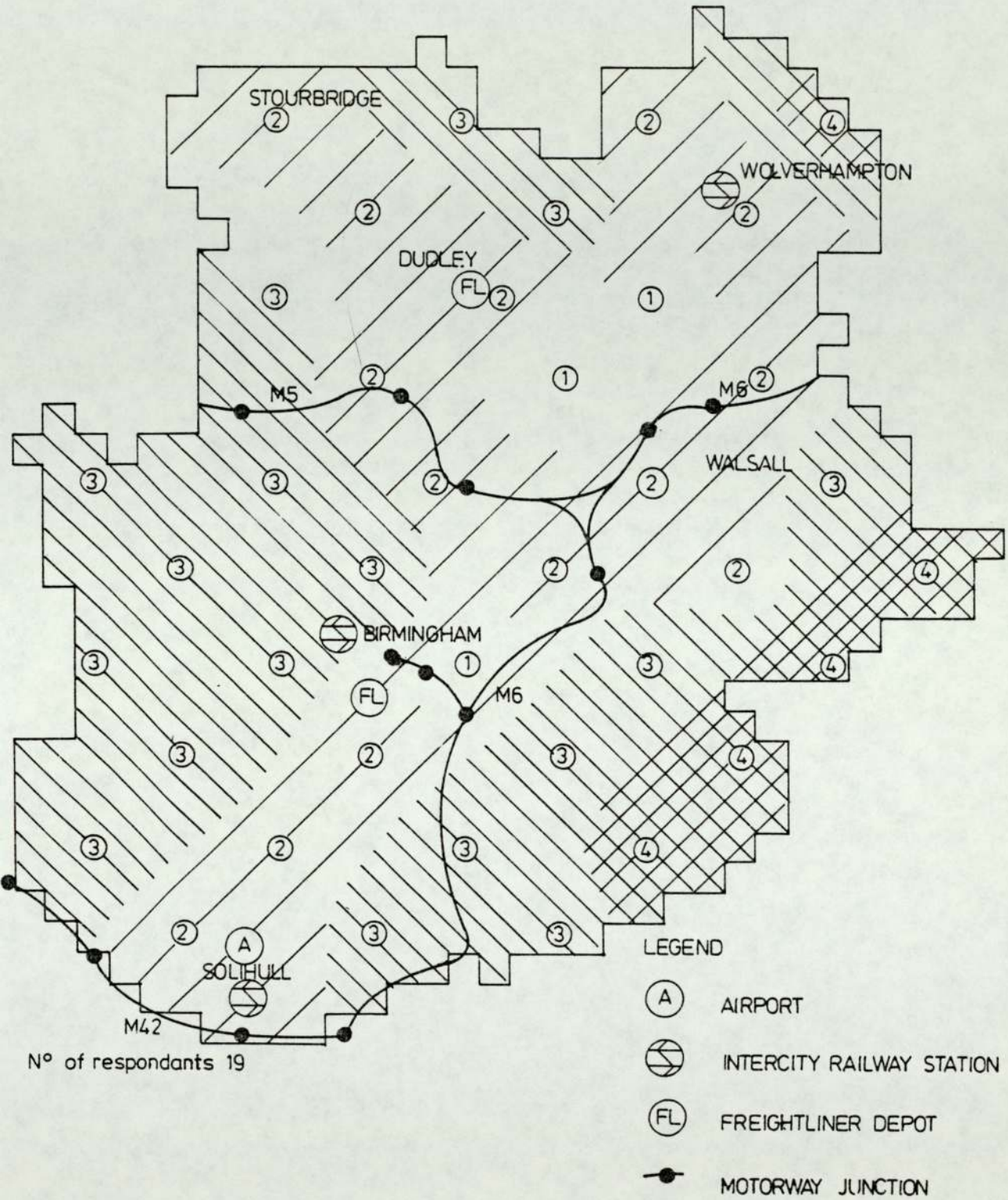
*Note: Three developers were located outside the study area.
Total number of respondents: estate agents - 17
developers - 20

One shows existing factory land use and will be employed to describe the traditional industrial areas and the presence of skilled labour. The second shows the motorways of the conurbation and some additional selected transport infrastructure.

The sample of developers was asked to mark on the map the relative attractiveness of forty locations for factory/warehouse developments (DQ8). A five point code was employed and the median values of the results are shown in figure 5.3.5. Attractive locations cover much of the Black Country, and a northwest-southeast corridor through Birmingham to Solihull, with peaks at Perry Barr and around Bilston-Wednesbury. The north eastern and north western periphery through Sutton Coldfield, Aldridge and Brownhills to Pendeford appears unattractive to development.

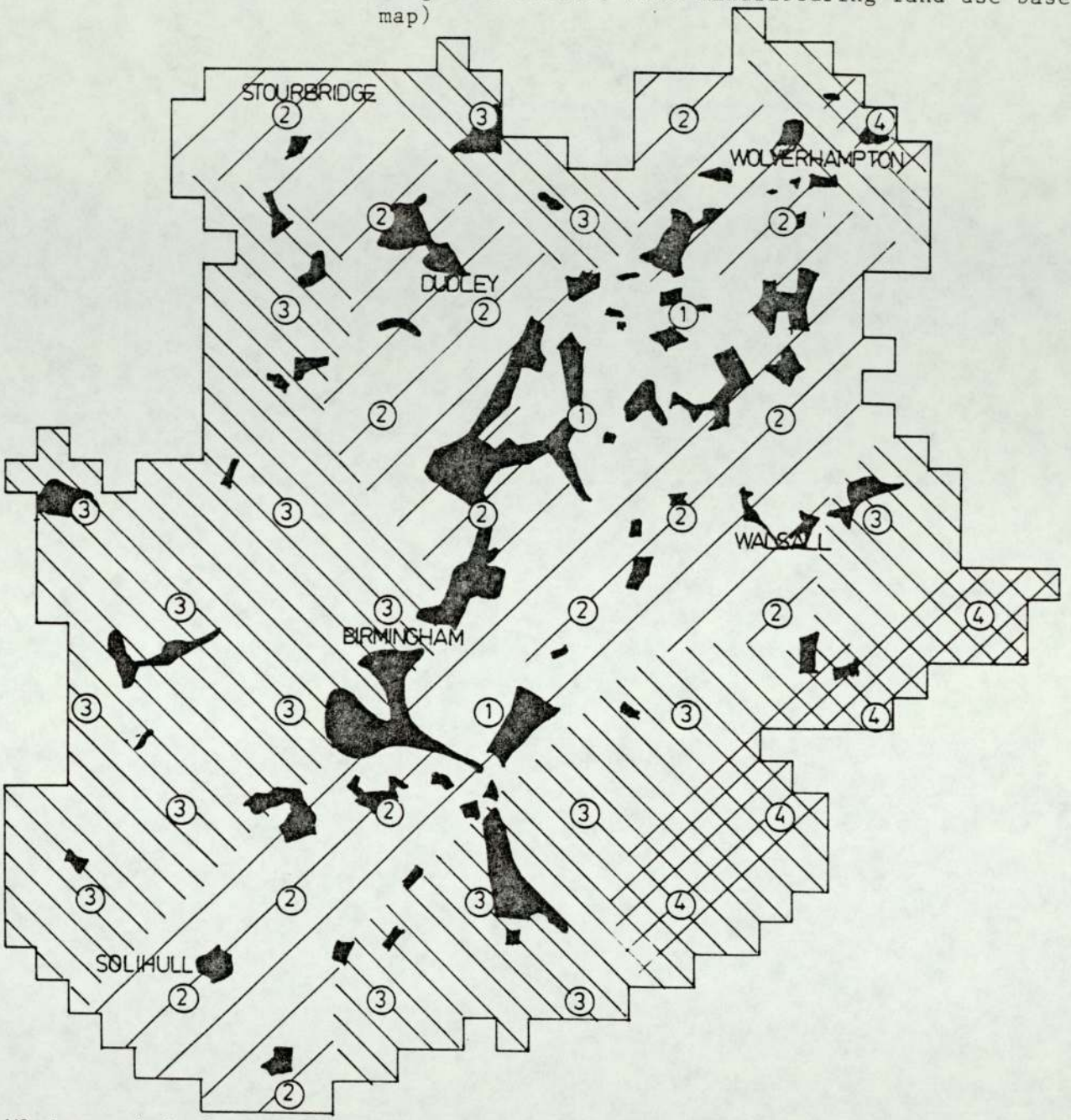
These findings are compared with the motorways of the study area in figure 5.3.5.a. Most of the attractive locations are well served by motorways and other transport infrastructure, although both the southern parts of the M5 and Birmingham fall into a "neither attractive nor unattractive" zone. In addition, Stourbridge ("attractive") and the highly favoured Bilston-Wednesbury area contain none of those facilities. Although the first key question identified the major importance of motorway proximity, rail services were only assessed as a minor advantage. However, both Dudley and Wolverhampton which were assigned an "attractive" rating, are removed from the major transport factor. These anomolies may partly be explained by redefining "proximity" in terms of travel time rather than simple distance, which would make Dudley closer to the M5 along the high quality A4123 New Road, and which would also sandwich Bilston and Wednesbury against the motorways to the north and east.

FIGURE 5.3.5: DEVELOPERS' IDENTIFICATION OF THE ATTRACTIVENESS OF THE STUDY AREA FOR FACTORY/WAREHOUSE DEVELOPMENT
(figure 5.3.5.(a) with transport base map)



CODE	1	2	3	4	5
DEFINITION	VERY ATTRACTIVE	ATTRACTIVE	NEITHER	UNATTRACTIVE	VERY UNATTRACTIVE

FIGURE 5.3.5: DEVELOPERS' IDENTIFICATION OF THE ATTRACTIVENESS OF THE STUDY AREA FOR FACTORY/WAREHOUSE DEVELOPMENT (figure 5.3.5.(b) with manufacturing land use base map)



N° of respondants 19

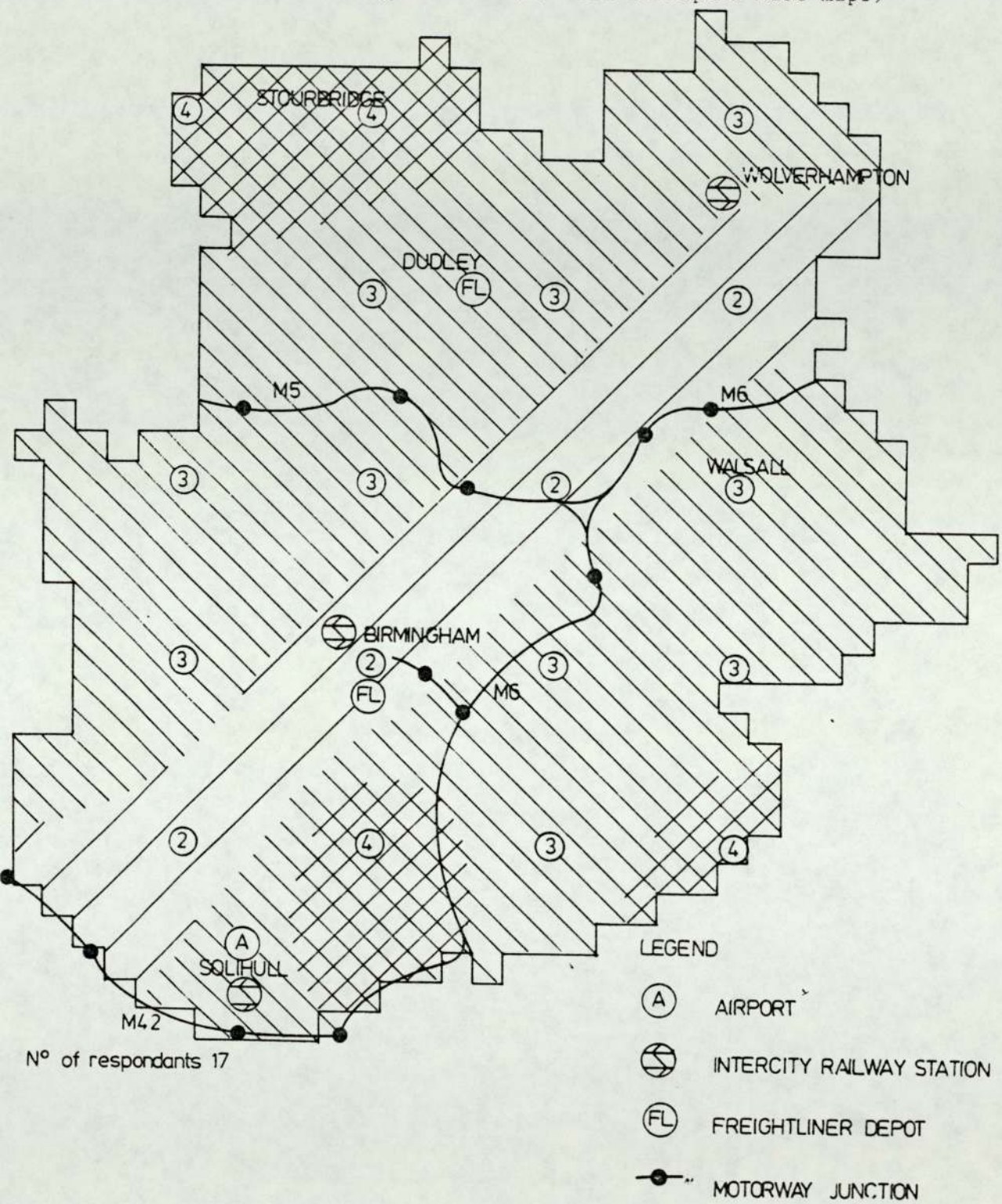
CODE	1	2	3	4	5
DEFINITION	VERY ATTRACTIVE	ATRACTIVE	NEITHER	UNATRACTIVE	VERY UNATTRACTIVE

INDUSTRIAL LAND USE

Several patterns are discernable in the manufacturing land use base map of figure 5.3.5.b. Birmingham holds a concentration around its centre in the long established inner areas, with an extensive belt of manufacturing along the Tame Valley to the north, and large scattered suburban sites at Bournville, Longbridge and Solihull. In the Black Country the pattern is more random reflecting the many settlements of which the area consists. A long strip of industrial land runs from Birmingham through Smethwick to Dudley and West Bromwich. Although a great deal of manufacturing land falls within the area of "attractive" responses, there are major omissions such as much of the Tame Valley and large suburban and peripheral sites. In addition, the points of greatest attraction do not represent particularly heavy concentrations of industrial land.

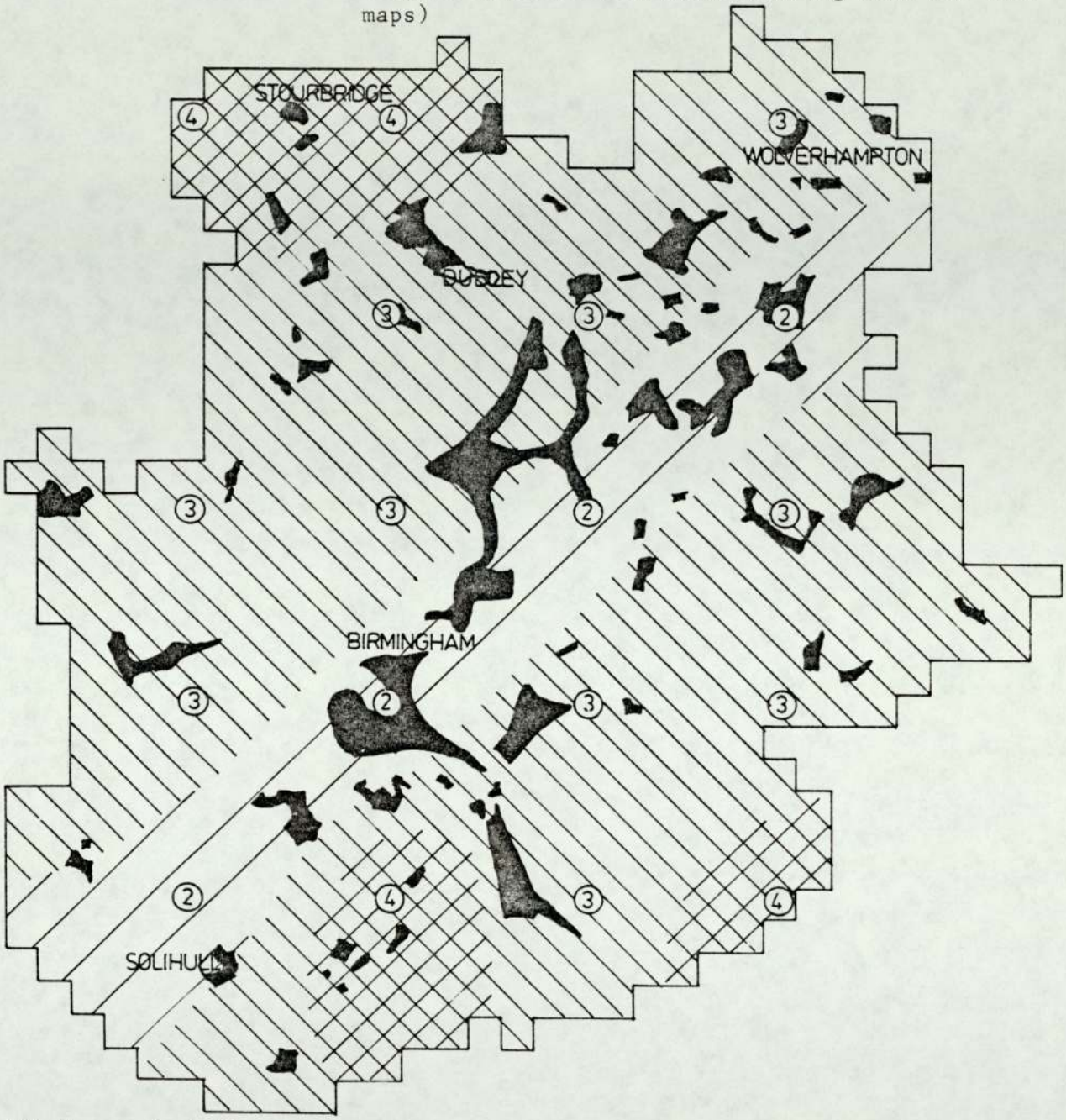
The sample of estate agents was addressed two questions which involved use of the map. The first (EAQ8) asked them to mark on the map, using a five point code, the relative demand for warehouse units at eighteen locations throughout the conurbation. Figure 5.3.6 presents the median values of replies for each sample square. A high demand for warehouse units was attached to a corridor running across the conurbation from northwest to southeast, which was also a feature of the developers' map answers. Low demand exists to the northwest of Sutton Coldfield, around Stourbridge and Kingswinford in the southeast, and due east of Birmingham. Despite motorway proximity being previously identified as a very major determinant of warehouse location, there is little indication from these results that the two are related. Similarly, there seems to be no relationship between manufacturing land use and warehouse demand.

FIGURE 5.3.6: ESTATE AGENTS' IDENTIFICATION OF DEMAND IN THE STUDY AREA FOR WAREHOUSE UNITS
(figure 5.3.6(a) with transport base maps)



CODE	1	2	3	4	5
DEFINITION	PRIME DEMAND	HIGH DEMAND	AVERAGE DEMAND	LOW DEMAND	NO DEMAND

FIGURE 5.3.6: ESTATE AGENTS' IDENTIFICATION OF DEMAND IN THE STUDY AREA FOR WAREHOUSE UNITS
(figure 5.3.6(b) with manufacturing land use base maps)



N° of respondants 17

CODE	1	2	3	4	5
DEFINITION	PRIME DEMAND	HIGH DEMAND	AVERAGE DEMAND	LOW DEMAND	NO DEMAND

INDUSTRIAL LAND USE

Their second map question asked estate agents to mark on the map the average rents they would expect to charge for a hypothetical factory unit located at twenty points throughout the conurbation (EAQ9). Figure 5.3.7. shows the mean value of replies for each sample square. High rents are commanded in the south and east of the conurbation around Birmingham and Solihull, rising in Small Heath to peak markedly at Gravelly Hill beside Spaghetti Junction. A belt of land in the south of the city from Edgbaston to Shirley fetches lower rents. The cheapest factory premises were found in the west around Kingswinford, and in the far north at Aldridge, Brownhills and northern Walsall. No relationship is apparent between factory rents and motorways or manufacturing land. The only similarity with the previous map questions is in emphasising the disadvantage of certain peripheral western and northern locations, and in showing the Gravelly Hill area in a consistently favourable position.

Replies to this question were subject to a great deal of variance at the same sample locations, and this prompted an investigation of the information furnished by respondents. One respondent's replies ranged between £1.40 psf and £2.00 psf, while another's replies ranged between £0.90psf and £1.20psf respectively for the same locations. Furthermore, the range between the highest and the lowest rent estimated by each agent was in one case as much as £0.60psf, and in another as little as £0.10psf. In an attempt to arrive at a more assenting reply to this question, each agent's answers were coded on a five point scale. From this revision, figure 5.3.8 presents estimates of the coded rents for the factory unit. This coding succeeded in reducing the extreme variance in all cases except for the Sutton Park and Solihull-Knowle sample squares, which was probably because of the great unliklihood of factory developments at these locations.

FIGURE 5.3.7: ESTATE AGENTS' ESTIMATES OF AVERAGE RENTS FOR A FACTORY UNIT IN THE STUDY AREA
(figure 5.3.7(a) with transport base map)

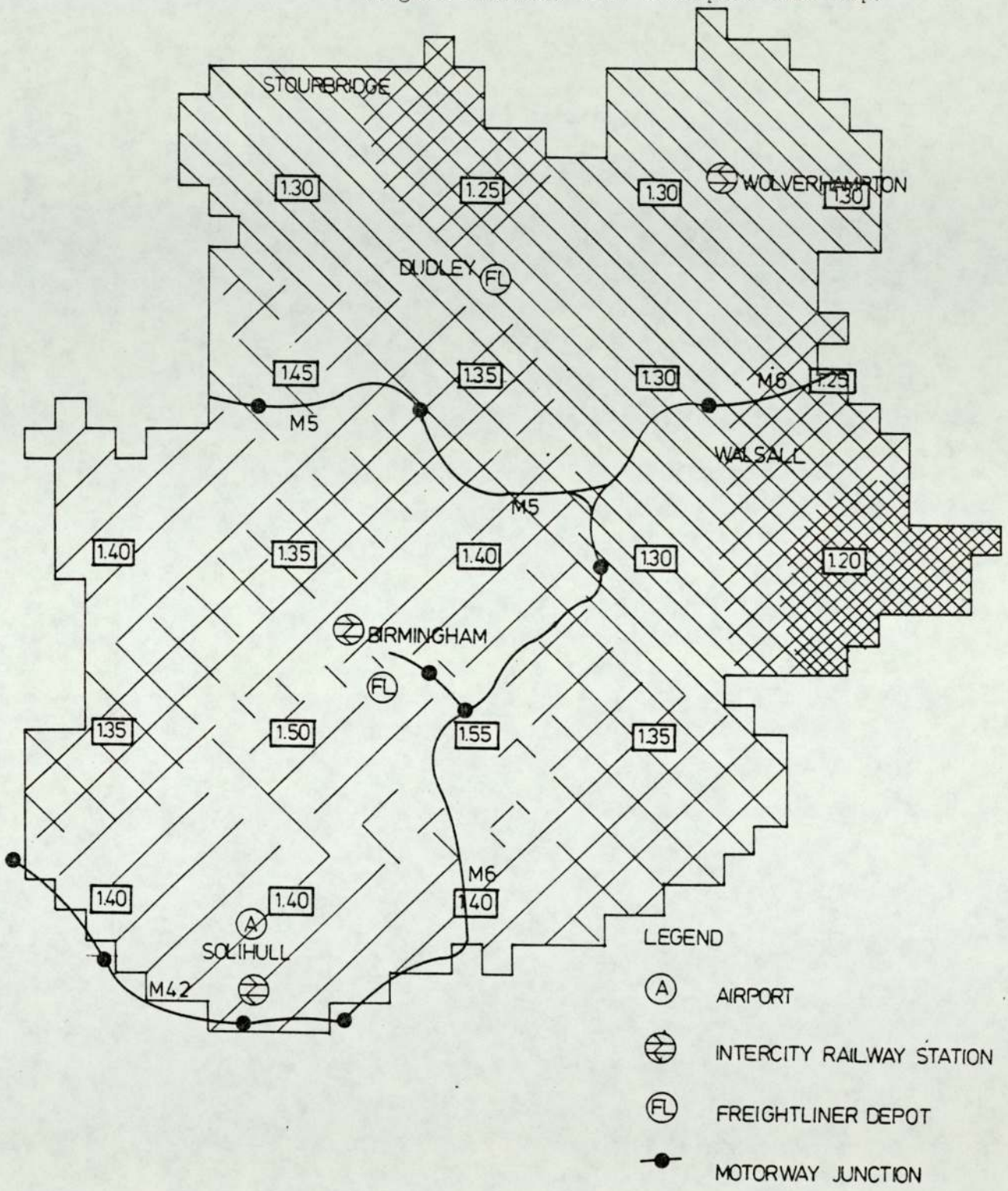
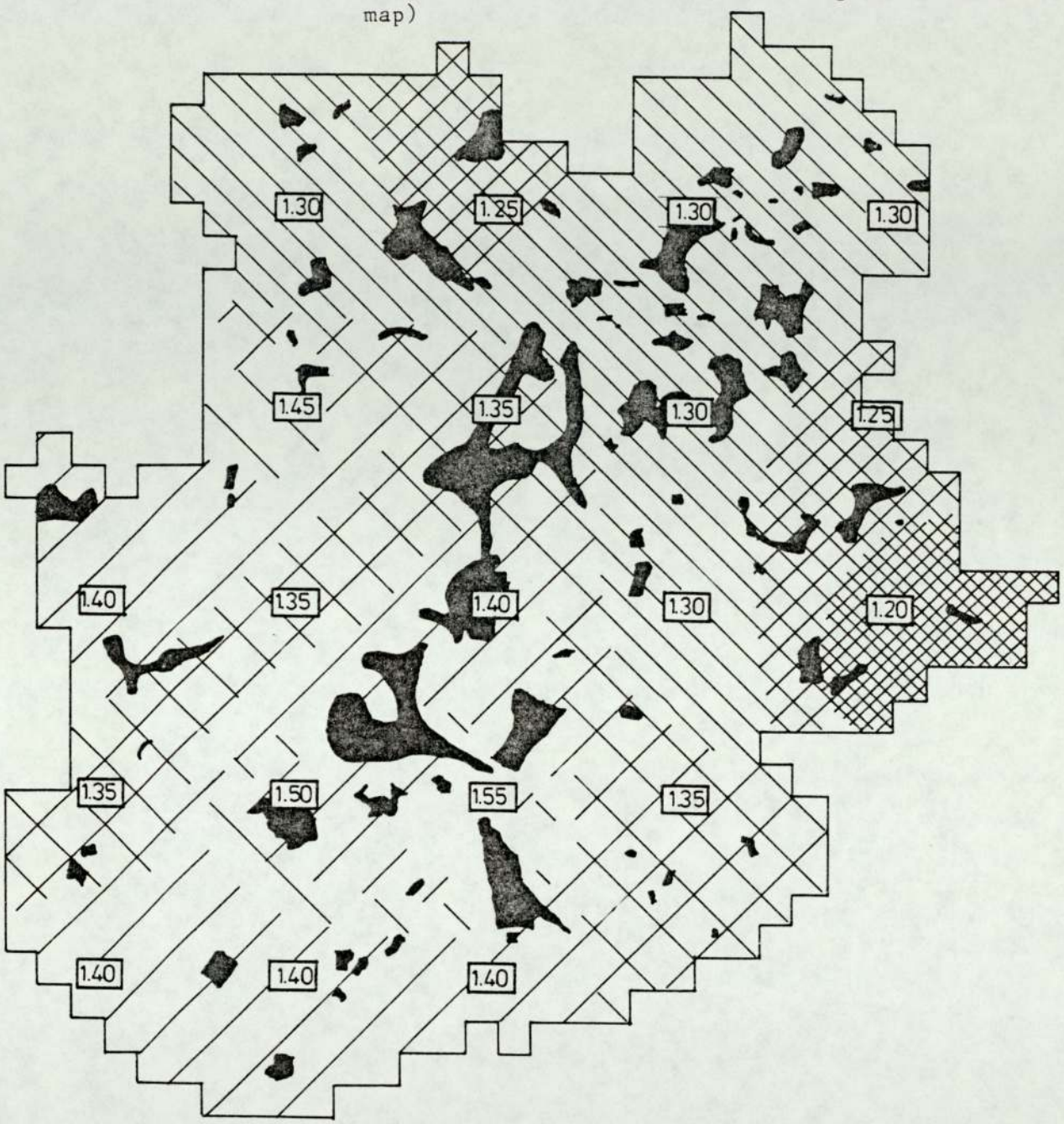
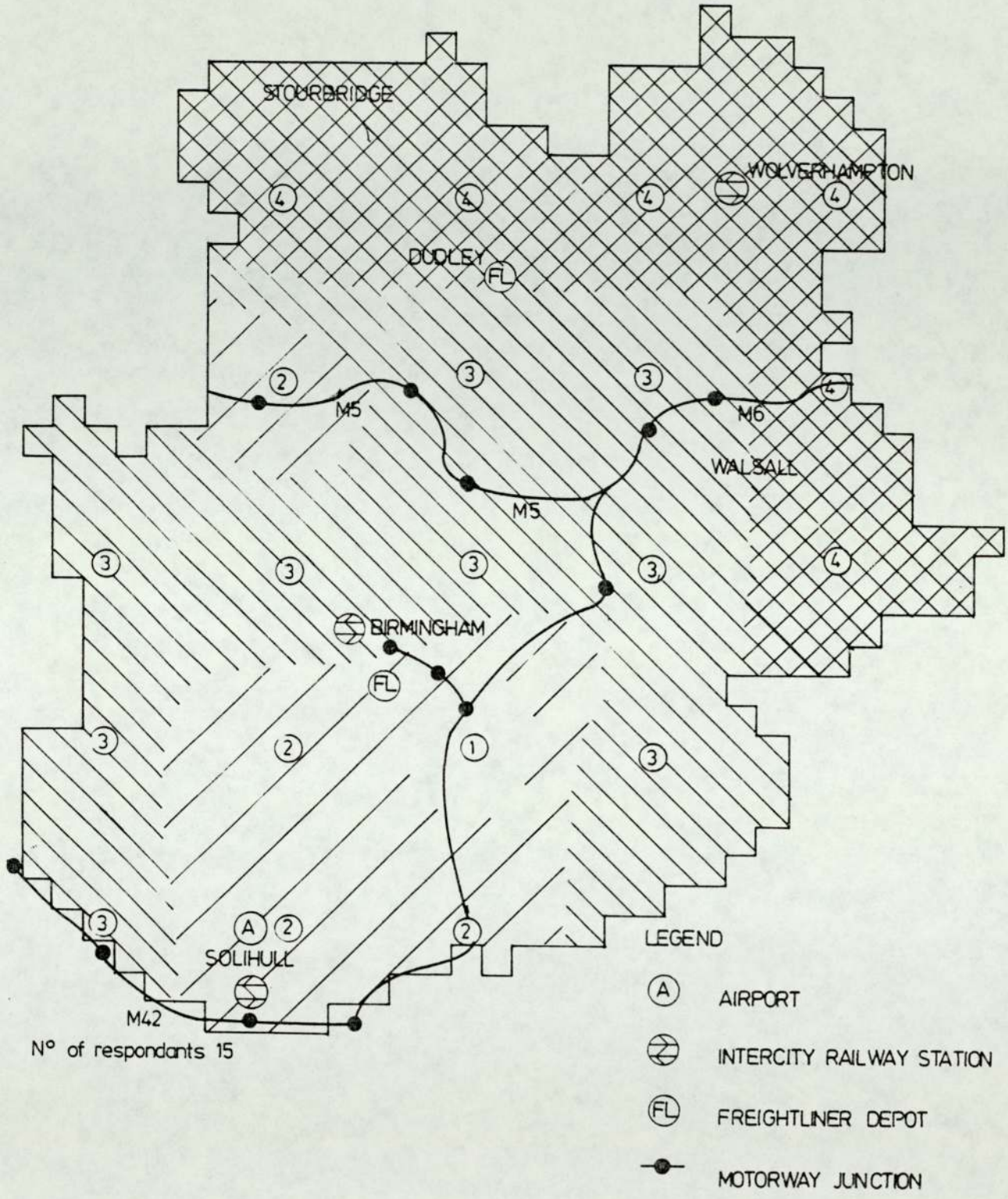


FIGURE 5.3.7: ESTATE AGENTS' ESTIMATES OF AVERAGE RENTS FOR A FACTORY UNIT IN THE STUDY AREA
(figure 5.3.7(b) with manufacturing land use base map)



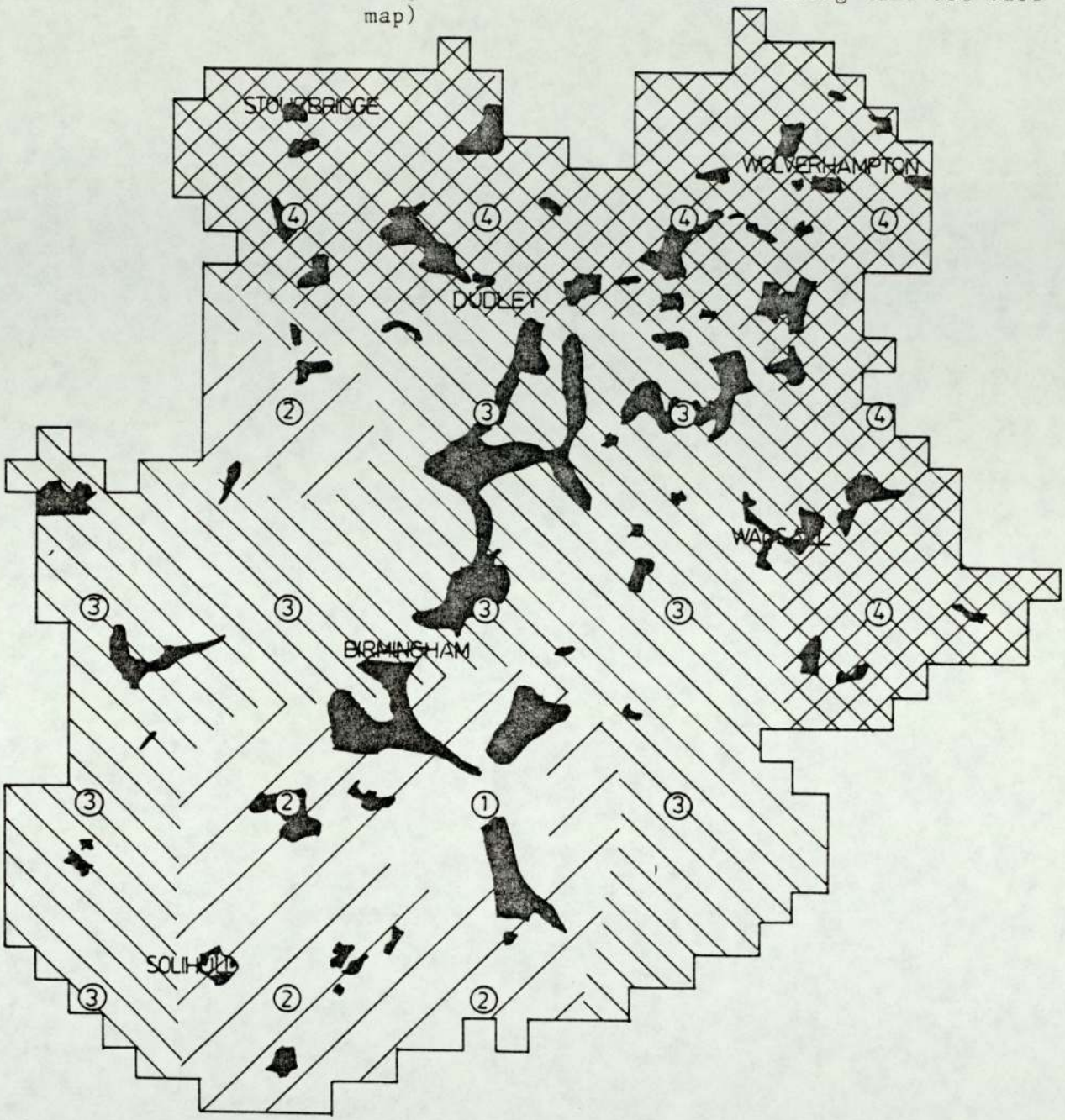
INDUSTRIAL LAND USE

FIGURE 5.3.8: ESTATE AGENTS' CODED ESTIMATES OF AVERAGE RENTS FOR A FACTORY UNIT IN THE STUDY AREA
(figure 5.3.8(a) with transport base map)



CODE	1 — 2 — 3 — 4 — 5
DEFINITION	HIGHEST RENTS — LOWEST RENTS

FIGURE 5.3.8: ESTATE AGENTS' CODED ESTIMATES OF AVERAGE RENTS FOR A FACTORY UNIT IN THE STUDY AREA
(figure 5.3.8(b) with manufacturing land use base map)



N° of respondants 15

CODE	1 — 2 — 3 — 4 — 5
DEFINITION	HIGHEST RENTS — LOWEST RENTS

INDUSTRIAL LAND USE

While the highest rents on figure 5.3.8 are still found in the east and the lowest in the north and west, the pattern differs from figure 5.3.7. Again the peak value occurs near the M6 beside Gravelly Hill and the Tame Valley, and an area of high rents surrounds this reaching in the east to Chelmsley Wood and in the south to the airport and railway station at Elmdon. Apart from the peak rent in the Tame Valley, the existence of manufacturing land use seems to have no bearing on the level of factory rents.

Replies to the map questions were analysed to investigate whether the knowledge and experience a respondent held of a sample location influenced the value he attached to it. The information presented in table 5.3.6 on the location of respondents' offices and activities, was used as the measure of their knowledge and experience. The developers appeared to favour districts where they operated in preference to others, although this was untrue of the estate agents. In neither case did respondents value locations near their offices differently to locations further afield.* These results are reassuring because if respondents felt land close to their bases to be more attractive or more in demand than land at a distance, a subjective element may have entered into the replies and distorted their value. The developers' attraction to districts where they were already involved simply indicates that they undertake developments where they feel them to be most suitable. No variation in replies was apparent with the size of development which developers tackled.

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*This was untrue of one respondent who was removed from the analysis because of his partial replies to this question.

The three map questions have individually failed to clearly ascribe the advantages of locations to the presence of transport facilities or existing land use patterns. They have gathered three types of information:

(i) the attractiveness of land for factory/ warehouse development (DQ8).

(ii) the spatial demand for warehouse units (EAQ8), and

(iii) the estimated rents at different locations for a factory unit (EAQ9).

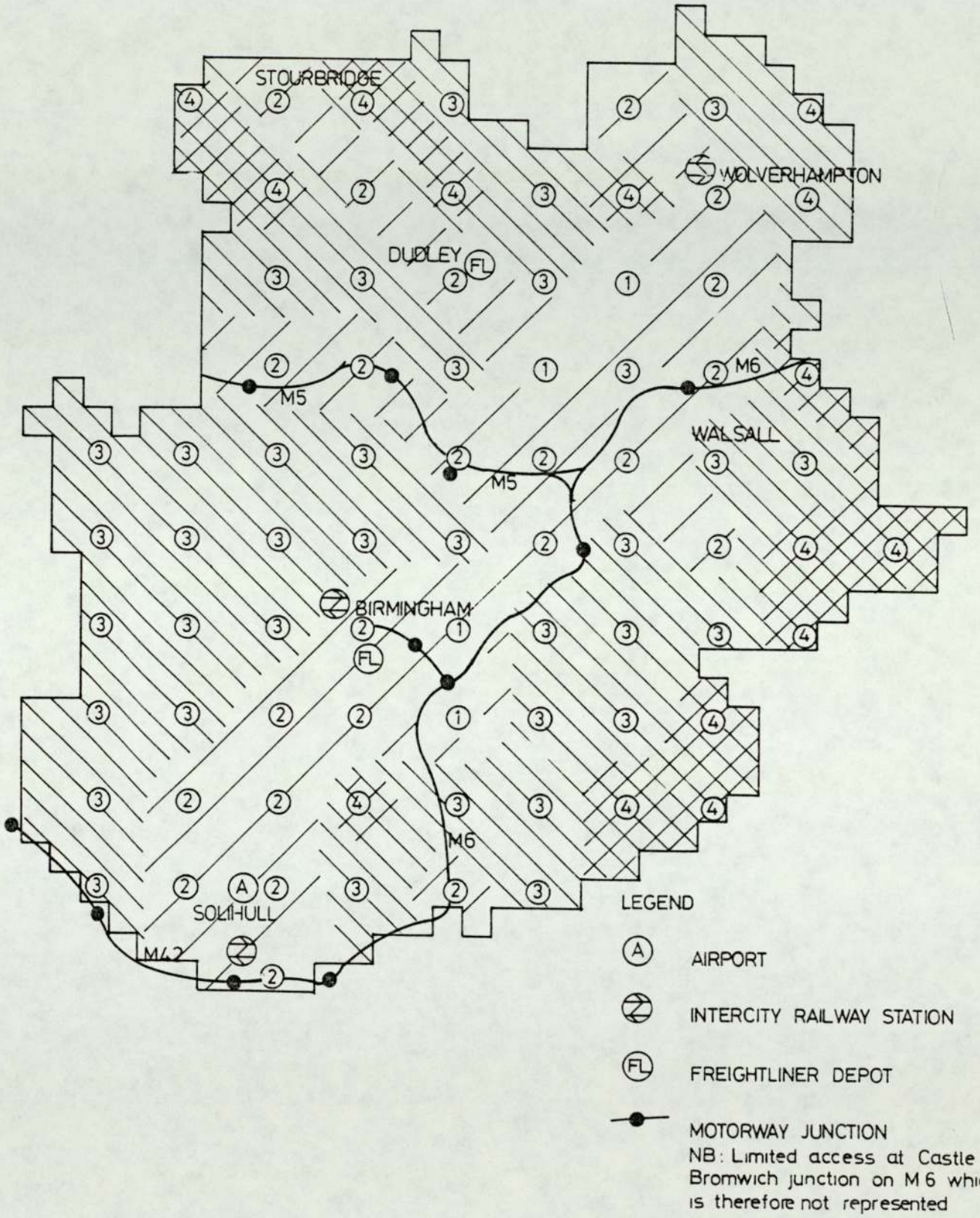
So far the results have been interpreted on the assumption that a sample square response also measures the attributes of land in its neighbourhood up to some four kilometres away where the contour line may be drawn. If however, local variations occur within this area, or if its identified location factors have a more restricted sphere of influence, then the three 'sub-sample grids' will lack sufficient detail to explain the results. Now, it is possible to reduce the area over which the evaluations of a sample square response are attributed, by combining the results of the three separate questions. Thereby, the number of sample points on a map is raised to seventy eight to enable a far more geographically precise interpretation to be drawn. The difficulty with this procedure is that it combines the responses to different questions; and as the rank correlation analysis of the first key question showed, there is limited similarity between the results for factory and warehouse location and the responses of estate agents and developers. Against this evidence it is emphasised that estate agents and developers both work together in the same market and should be familiar with its features.

Furthermore the location of factory developments alongside warehouse developments is evident in many parts of the conurbation. Overall, accepting that rents are a measure of demand, the answers to the three questions all provide evidence of locations in the conurbation which are favoured for industrial development and occupation. Therefore the three sets of results were combined and can be seen in figure 5.3.9 as the familiar five point coded responses. It is emphasised that the validity of this practice is less than the foregoing exercises, although the value may be greater.

The combined response again shows the previously identified corridor of favoured land running from north west to south east, but other corridors are also apparent bounding the M5 and running southwest through Dudley and Brierley Hill, and westwards further north. Peaks occur around Spaghetti Junction on the M6 and at Bilston and Wednesbury. Consolidating the original responses has produced some anomalies such as the codes of "4" immediately south of Wolverhampton and due east of Birmingham which are adjacent to codes of "1" and "2". Also the codes of "2" in the southwest corridor lie next to codes of "4". It is uncertain whether these are accurate representations of local variations or whether they are caused by the differences of the combination. The code of "3" near the highly favoured Wednesbury was subject to a high variance of response with one reply coding it "1" and so it is uncertain whether this is out of place. Elsewhere in the responses the degree of variance was generally slight, except for a few cases already mentioned. The code "5" is missing from the sample squares because of the virtual absence of such responses.

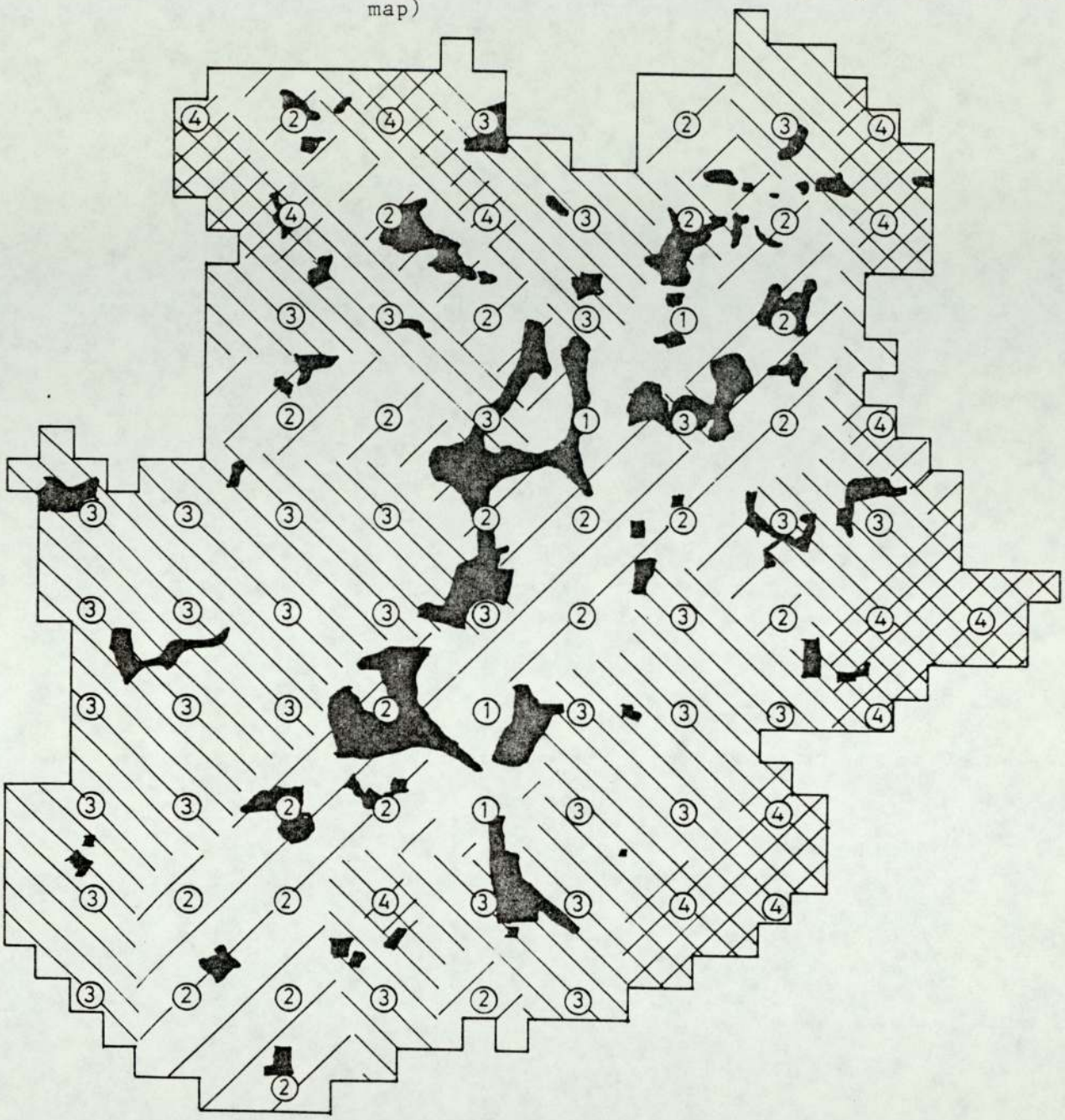
The preferred locations very closely bound the motorways and their access points as shown on figure 5.3.9a.

FIGURE 5.3.9: RESPONDENTS' ASSESSMENT OF THE FAVOURABILITY OF THE STUDY AREA FOR INDUSTRIAL LOCATION
(figure 5.3.9(a) with transport base map)



CODE	1 — 2 — 3 — 4 — 5
DEFINITION	VERY FAVOURABLE — VERY UNFAVOURABLE

FIGURE 5.3.9: RESPONDENTS' ASSESSMENT OF THE FAVOURABILITY OF THE STUDY AREA FOR INDUSTRIAL LOCATION
(figure 5.3.9.(b) with manufacturing land use base map)



CODE	1 — 2 — 3 — 4 — 5
DEFINITION	VERY FAVOURABLE — VERY UNFAVOURABLE

INDUSTRIAL LAND USE

The only instances of less favourable codes adjoining motorway junctions are found on the M6 near Wednesbury where the response was subject to high variance, at Great Barr which lies on the contour line, and on the southern M42, all of which concerned the median code "3". In the last case the code is the result of high variance responses to the factory rents question where three out of eight respondents coded it "1". This is a site beside a motorway but far removed from traditional industrial areas where a warehouse development might perhaps be more suitable. Transport facilities fail to account for the corridors of favoured land running southwest and westwards.

Favoured locations on figure 5.3.9.b relate poorly to the patterns of existing manufacturing land, despite the absence of factories in the peripheral code "4" areas. The peak values contain little manufacturing land.

The reporting of results of the second key question has largely been confined to discussing various patterns and associations rather than measured comparisons. This is due to the 'attitudinal' nature of the results, the limited sample size and the innovatory nature of the survey, which limited the value to be gained from more complex analysis. However, a final investigation of the map question replies is possible by relating them to the access values assigned to the grid of sample squares in the earlier research method. As both sets of information come from a separate exercise the extent of comparison must be limited but, nevertheless, worthwhile.

Table 5.3.7 presents the comparison. From each map question and the final combination, it lists the coded values alongside the means of the access values for squares of that code from the access surface.

TABLE 5.3.7: COMPARISON OF MAP QUESTION RESPONSES AND ACCESS SURFACE VALUES

CODE	OCCURRENCE OF CODE	MEAN VALUES OF THE ACCESS SURFACE
The attractiveness of land for factory/warehouse development (DQ8)		
1	3	6
2	15	8
3	17	10
4	5	14
5	-	-
The spatial demand for warehouse units (EAQ8)		
1	-	-
2	4	8
3	10	10
4	4	16
5	-	-
Estimated rents for a factory unit (EAQ9)		
1	1	2
2	4	8
3	9	9
4	6	10
5	-	-
Combined assessment of favourability for industrial location		
1	4	5
2	23	8
3	36	10
4	15	13
5	-	-

In all cases this shows that respondents' estimates of high attractiveness, high demand and high rents are directly related to high access values. Consequently it appears that access to motorways is directly related to the favourability of land for industrial location.

5.3.3 SUMMARY AND INTERPRETATION

The survey of estate agents and developers was undertaken on the assumptions that these groups held considerable knowledge of how and why industrial location decisions were made, and that they took an active part in location determination. Indeed, responses to the questionnaires help support these assumptions. One respondent observed that most firms looked to developers to provide them with premises under 50,000 sq ft and especially below 10,000 sq ft. However, in conversation, estate agents insisted that they had no influence on location decisions, but merely serviced the market mechanism by matching demand with supply. In this case they are in an extremely advantageous position to report on location determinants. However, it is believed that estate agents do have an active influence in their role as salesmen and through their involvement with developers at the project planning stage. Estate agents are loathe to admit this, it is suggested because of a desire to be seen as a passive service activity, and not be publicly associated with 'insensitive property companies'.

The core of the survey centred on two key questions. The first assessed various location factors. A "traditional industrial area" was seen as the main requirement for a successful factory location, although it was closely followed by "local skilled labour" and "proximity to motorways".

For a successful warehouse location "proximity to motorways" was most important, although a "traditional industrial area" was also an advantage. This is in close accordance with the second research hypothesis, which postulates that warehouses are more attracted to motorways than factories. Property developers felt that sites with a main road frontage had a major advantage. Little significance was attached to rail services, 'greenfield' sites, nearby commercial centres or low land values. In view of the assumption that other actors have a key role in determining new industrial locations, these results lead to the conclusion that there is probably a causal relationship between the presence of the main factors and industrial development. However, much depends on the interpretation of the terms used to describe factors. For example what does "proximity" mean in "proximity to motorways"; what are the skills and the extent of "local skilled labour"; and more fundamentally, what is a "traditional industrial area". Furthermore these results derive from an isolated assessment of each factor. In reality a host of conflicting forces exist at any point, and with this in mind the second key question was designed.

Analysis of the second key question mapped out the conurbation's attractiveness for industrial development, the demand for warehouse units and the level of factory rents. By combining these responses, unfavourable locations were identified around the northern and western periphery of the study area. Favourable locations ran across the conurbation in a northwest to southeast corridor, incorporating peaks at Bilston and Wednesbury, and around Spaghetti Junction on the M6. Smaller strips of favoured land bounded the M5, ran through Dudley to the southwest, and followed the A449 south out of Wolverhampton.

Two base maps showed a reasonably good association between favoured locations and motorways, but a poor association with manufacturing land use.

Further investigation showed that the assessment of favourability was directly related to the motorway access values from the access surfaces. In the real situations provided by the map question, the presence of particular factors will coincide with many other spatial attractions and detractions. Therefore a precise match between preferred locations and the existence of one important factor should not be expected. In terms of industrial developments, a major factor identified above, will seldom be a sufficient condition but will often be a necessary condition. With this in mind the second key question was successful in being able to construct usable spatial representations of favourability, and in relating these to the presence of motorways. Its results convincingly strengthen the relationship between motorways and industrial development.

Motorways may provide locational advantages over a small adjacent area, or over an entire conurbation of region. The results of this survey appear to indicate a fairly localised attraction. The corridor of favoured locations around the M5 extends only approximately one kilometre on either side. Furthermore, some respondents have emphasised frontage benefits, except in cases where access is restricted. One comment emphasised the need to be within fifteen minutes travel time of a motorway or good roads, while another held that offices benefitted from being within five miles of a motorway. The difficulty with assessing the spatial extent of influence lies in determining where a benefit becomes significant rather than just noticeable.

On this evidence, the influence appears to be most marked up to a distance of three to six miles from the motorway.

The use of a manufacturing land use base map in the second key question was intended to represent the two major factors of "local skilled labour" and a "traditional industrial area".

However this base related very poorly to the favoured locations. It is suggested that this was due to a failure of the base map to accurately represent what the respondent interpreted as the factors. In the case of labour supply, skilled workers are able to travel over long distances to work, and therefore their supply is not localised to existing manufacturing locations. In the case of "traditional industrial areas", there is no doubt that the land use map does identify land which has traditionally been used for manufacturing. However this land is often part of the depressed inner city and despite offering potential industrial linkages, it also suffers from congestion and obsolescence. The list of location factors in the first key question intended the factor to be a proxy for industrial linkage, but also as a representation of inner area locations to counterbalance the image of peripheral and suburban locations contained in "greenfield site". It is possible that in the minds of respondents the term "traditional industrial area" referred either to the whole conurbation, or to those areas where industrial property development has proved successful. Consequently the land use map was inappropriate.

A final point worth noting is the emphasis given to unquantifiable 'image' factors. This was most noticeable in the open ended questions, in the additional comments provided, and in conversation, where the

words "prestige", "image", "fashion" and "environment" occurred frequently. No doubt these terms are used to cover the combinations of varied factors and conditions which exist at any site but cannot be broken down into individual determinants. This complexity in the location decision was emphasised by one respondent among the developers, who wrote:

> "there is only one way in which a site can be appraised and that is by the actual feel for the situation when on site, which I suppose comes about through many years of experience".

5.4 OTHER ACTORS - INTERVIEW SURVEY OF LOCAL AUTHORITIES

Local authority actors are involved in industrial location in two guises. Firstly, their planning departments prepare strategic and local plans for the authority, and then implement these, partly through the development control system. Secondly, estates departments or industrial development units initiate developments on behalf of their authority, and assist local industry and undertake promotional activities. This chapter investigates these roles and their impact on the two research hypotheses by an interview survey.

The West Midlands conurbation incorporates the six district councils of Birmingham, Dudley, Sandwell, Solihull, Walsall and Wolverhampton, and forms the major part of the West Midlands County Council. Hence, seven local authorities lie within the study area, and because of this small 'population', it was decided to conduct interviews with them all. Every authority, with the exception of Solihull, contained an industrial unit district from the planning department, and this provided thirteen sources of information. Interviews were arranged with an officer from each source in the autumn of 1978. It must be noted that in the following discussion the events, policies and attitudes reported refer to this time. Other components of the research method have necessitated contacts with the local authorities, and relevant information drawn from these meetings is also presented here. Furthermore, several general observations are also included in this chapter for completeness. All interviews were loosely structured around the topics

shown in Table 5.4.1. These were not direct questions but merely indicate the subject areas covered. Sometimes more than one officer was drawn into the conversation, and the length of interview ranged from one hour to half a day. The research is indebted to the cooperation of respondents. Their views must be interpreted as personal and not those of their employers.

5.4.1 THE PROBLEMS AND POLICIES OF THE AUTHORITIES

Major differences were apparent in the perception of industrial and economic problems faced by the authorities. The traditionally residential and largely rural district of Solihull appeared to have little concern for industry located within or wishing to move into its area. At the time of interview, representatives of the Walsall and Sandwell authorities considered their districts to be rather prosperous, requiring policies to limit and not encourage industrial growth. Both respondents believed their unemployment rates to be below average, and faced with a definite land shortage, their councils had concentrated on the requirements of indigenous industry which wished to expand or was forced to relocate. Both authorities had also adopted policies which discriminated against new warehouse developments, because the low employment densities associated with this activity were considered an inefficient use of limited land resources.

The land shortage within the conurbation is compounded by large scale dereliction, which despite the availability of land clearance grants, makes development costly and difficult.

TABLE 5.4.1: THE INTERVIEW STRUCTURE

1. What problems affect local industry and what policies have been adopted to deal with them?

2. To what extent is your local authority involved in industrial promotion, assistance and property development?

3. What proportion of new industrial development is speculative?

4. What sort of industrial units are most in demand and by what sort of firm?

5. Where is demand for industrial units highest and is this related to the presence of motorways?

6. Is industrial development particularly encouraged or discouraged at certain types of location?

7. Specify the differences between factories and warehouses with regard to the above points?

Both Wolverhampton and Dudley identified this as a particular problem. In Wolverhampton where it coincides with a very old capital stock of buildings, the council has adopted a strategy "to promote both indigenous and incoming industry", thereby attacking both physical obsolescence and economic problems. Officers of Dudley Council described the district's diversified industrial base, its limited dependence on the troubled motor vehicle industry, and its healthy 'seedbed' of new and small firms. It was agreed that these factors accounted for Dudley having one of the lowest unemployment rates in the County. Furthermore, despite dereliction and subsidence, Dudley "has more space in which to accommodate increases in population, housing and industrial activity than any other part of the West Midlands conurbation" (Dudley Official Guide, 1977/78, 20). The Council was, however, aware of disturbing economic trends within the region and the district, and had initiated policies to further broaden its industrial base and generate small firms. Officers of Birmingham and the County drew attention to these economic trends and described steps they had taken to attract investment, help local industry find suitable premises, and assist small firms. Overall, only Wolverhampton had a positive interest in the development of warehouses, while other authorities were opposed or indifferent. Walsall, Birmingham and the County stated that some locations were particularly suited to warehousing, and that it could serve as a useful buffer between housing and a disruptive activity such as heavy industry.

The promotional activities of the West Midlands County are undertaken on behalf of its constituent districts who cooperate mainly in

the provision of information. At the time of interview at least two of the conurbation districts had set up industrial development or information units in name only, solely because they had been required to do so by the County. Other district councils were more enthusiastic and cooperative, and most were willing to rely on County resources to publicise their districts to the rest of the country and abroad in the hope of attracting 'footloose' investment. Birmingham City Council, however, both worked with the County and followed an independent course in its promotional activities.

5.4.2 THE IMPORTANCE OF OTHER ACTORS

The important planning role of the local authorities can be studied by examination of the policies laid down in structure plans and other documents which have been reviewed in section 4.0.2. A basic principle behind these is generally to avoid non-conforming uses such as a foundry amidst a zone of houses. Although this is no longer rigorously enforced, basically incompatible uses, such as housing with heavy industry or an airport, are separated as much as possible, often by a buffer of light industry or warehousing. Environmental problems such as motorway noise are more simply alleviated for neighbouring house dwellers by fencing, embankments or vegetation. A comprehensive policy, which suggests that a certain use is best beside a motorway, is not appropriate due to a variety of local conditions and limited land availability within the conurbation. The respondents quoted a relatively common problem around motorway junctions of a planning application for a scrap and breaker's yard to be used by motorway wreck removers. Such applications are generally refused because

they are incompatible with all but heavy industrial uses. Applications for other forms of industrial development are granted in a large proportion of cases because prior consultation with the authority mostly prevents applications for uses totally unsuited to a location.

Interviews showed that the role of the conurbation authorities in the development process varied greatly from districts such as Solihull which provide limited lists of vacant sites and premises for the County; to those such as Wolverhampton which operates seven industrial estates. At the time of interview, Wolverhampton, Dudley and Sandwell operated their own estates; Walsall owned plots of land on estates from 300 to 6000 sq yds , and Birmingham allocated between 25 to 30 small plots of land each month to small firms within the city. Dudley and the County had both sought to develop estates of nursery units, although the latter had been frustrated by IDC refusal. Dudley's development was undertaken jointly with the developers, Mucklow, and resulted in units just under 1000 sq ft. At the time this was the smallest size built because private developers had preferred the 1200-3000 sq ft size range. The County compiles a register of vacant land and premises for use by firms within the area and those wishing to move in.

The uses of publicity by local authorities have been described in section 2.3. The brochures, leaflets and advertisements, produced by Birmingham and the County in particular, can be used to illustrate the key elements involved in marketing the conurbation as an industrial location. The emphasis placed on communications is particularly interesting.

> "This is the centre of gravity for the nation's transport. The M5, M6 and the new M42 ensure you and your goods quick and easy access to all parts of the country. Travel Inter-City with British Rail; use the facilities of the Freightliner terminals at Dudley and Birmingham, for your products. For international trade use Birmingham Inland Port which offers customs clearance and containerised freight trains, or alternatively Birmingham Airport with extensive connections to other parts of the British Isles and Europe. Increased international traffic for the airport is bringing a new terminal building linked to the new Birmingham International rail station and the National Exhibition Centre ...."
>
> (West Midlands for Industry, The New County of Opportunity Industrial Information Service, WMCC)

As in similar publicity from other bodies elsewhere in the country, there is a strong emphasis that this is the optimal location for the benefits which major transport facilities offer industry. Claims are definitive such as "the very centre of the national motorway network", although generally unsupported and often unsupportable. Other comments refer particularly to thelocation of sites within the West Midlands.

> "The WMCC has details of well sited industrial estates located throughout the County. Many of these are close to the M5 and M6 motorways which run through the conurbation and the present road pattern provides convenient access to the motorway network from all parts of the County".

These statements are often made in introductory paragraphs and show the importance which is attached to major transport facilities by the authorities.

As all respondents held some knowledge of the conurbation property market, they were questioned about the amount of new industrial development which was undertaken speculatively by developers. The answers obtained supported the understanding of whether the initial location decision was predominantly in the hands of the eventual occupier, or of an other actor.

Some interviewees made a general response that "most industrial and commercial (planning) applications are speculative" or that developers have "great importance" for new factory development. However others made estimates that "80%" and "80-90%", and "almost all" new industrial development was on estates; and furthermore "developers are unwilling to allow private companies to do their own development on land bought or leased on estates". The location of industrial estates is the primary choice of the developer and not the firm. One respondent suggested that the importance of the estate lay in the fact that smaller plots of land were rare and often sited where industry would be a non-conforming use.

5.4.3 INDUSTRIAL DEMAND, LOCATION AND TRANSPORT FACILITIES

At the time of interview demand within the conurbation was greatest for units smaller than 10,000 sq ft; with a basic unfulfilled demand existing for the smallest nursery units. Medium and large firms are more inclined to build their own premises, although little activity was apparent at this scale. Any requirement for the larger premises or sites was usually from firms outside the conurbation wishing to set up branch plants. One respondent considered labour factors to be important in these immigrant moves.

The experience of the County's Industrial Information Service was that firms generally asked for locations near motorways, although more localised factors such as labour and bus services could also be very important. For example, in Walsall industrial suburbanisation was said to be in part due to labour availability in the north of the district.Birmingham's Estates Officer suggested

that high industrial demand occurred around motorways because of accessibility advantages and because of factors affecting prestige and the "feel" of the site. These latter, rather intangible factors, enable the firm to project its image and even advertise in a prestigous and visible location such as a motorway junction frontage. In dealing with a major project such as building the Birmingham Middleway, the authority will generally put out a tender for the development of adjoining land which it owns. Proposals will be chosen because they are "prestigous, showcase" projects, for either offices, shops or industry.

From the seven authorities surveyed, five were certain enough to state that motorways had a definite locational impact on industry in their areas. The remaining two, Walsall and Solihull, felt they lacked sufficient knowledge to comment. Respondents were generally of the opinion that warehouse locations followed a similar pattern to factory locations but found it difficult to identify their special features.

An officer of Birmingham observed that the highest demand for industrial land in the city was along the Aston Expressway, with many firms specifying a need to be "in the Aston area", or "in the Spaghetti area". Apparently demand and rents reach a peak at the city end of the Expressway, although high demand also occurs along the Middleway, and to the north east of Spaghetti along the Tyburn Road and at Minworth. A combination of good access into the city centre and to the motorway was quoted as the major determinant of demand. Rubery is the nearest point in Birmingham to the South West of the country, and lies only about two miles from the M5. Here firms with links to the South West have located, many of them on the Frankley Industrial Estate.

Nearer the city centre an area of high demand occurs around Lawley Street and the nearby Arden Industrial Estate. This is beside Birmingham's Inland Port and Freightliner terminal, although respondents reported few firms mentioning these facilities, in contrast to evidence from Dudley. The level of demand was demonstrated in this part of the city when 35 acres was recently re-zoned from residential to industrial use because of environmental reasons. Within eighteen months the entire area had been disposed of for development.

The district of Dudley has relatively good access to the M5 at Quinton near Halesowen, and at Oldbury via Birmingham New Road. The former location, however, coincides in part with the conurbation's green belt. The respondent expressly mentioned these two areas as being the most preferable industrial locations in the district, although their position nearer to the centre of the conurbation than the rest of the borough may also have an influence. It was stated that the area between the M5 and Halesowen could become a "major growth point" in the absence of green belt constraints. Furthermore, the Dudley Freightliner terminal was an "important" attraction with "quite a number" of firms specifying it as a locational consideration. This may also explain the popularity of locations around the New Road.

The only district in the conurbation through which no motorway passes is Wolverhampton. The nearest motorway is the M6 in Walsall. Officers of the town, however, looked forward to the construction of the M54 to the north which would link Telford to the national network.

This proposed route would intersect with the A449 just outside the district boundary and would provide the "best and quickest" route to the town centre from the motorways. It was envisaged that this would bring great benefits to the borough.

Sandwell had noticed a "sizeable impact" from the motorways although this was not necessarily localised. Sandwell's central position within the conurbation may provide it with certain advantages due to improved local linkage. This factor and the districts national and regional accessiblity were cited as reasons why firms which had emigrated to Telford some years before, were now wishing to return and in some cases actually had returned. Sandwell's centrality, and the four motorway junctions lying within its boundary, make it a good example to use for describing the types of development which occur around such junctions. Table 5.4.2 contains a list of such developments, which was compiled through the interviews and by exploration of the motorway environs. This record is not meant to suggest that the motorway was responsible for these developments, but it is possible that their locations may have been influenced. The list includes factory and warehouse estates, as well as offices, shops and hotel developments, and the names of certain large companies located in the area. Most developments are within one mile of the junctions, whilst three actually adjoin. These three are office and hotel properties which appear to have been definitely attracted because of their proximity in relatively undeveloped parts of the district. It is suggested that prestige and frontage factors were significant in their location decisions.

The districts of Solihull and Walsall are not as fully discussed because of their respondents' uncertainty of the significance of transport facilities.

TABLE 5.4.2: DEVELOPMENTS AROUND MOTORWAY JUNCTIONS - AN INVESTIGATION OF SANDWELL

Junction	Type of Development	Distance from Junction
Junction 1 M5	Intersection House - Offices	Adjacent
	Europa Lodge - "the only quality hotel in the district".	Adjacent
	Summit Crescent and Roebuck Lane Industrial Estates.	½ mile
	Securicor and Group 4 Offices	¾ mile
	Spon Lane Estate (including RCA central distribution depot)	1 mile
	Galton Bridge - outline planning permission for a warehouse, office and marina complex.	1 mile
Junction 2 M5	Park Lane Industrial Estate	½ mile
Oldbury	Brades Road Industrial Estate	1 mile
	Springfield Industrial Estate	1 mile
	Savercentre hypermarket to be built in the Oldbury redevelopment	1 mile
	Burnt Tree House, 40,000-50,000 sq ft of offices	2½ miles
Junction 7 M6	Crest Motel (in Walsall district)	adjacent
Great Barr	Scott Arms area - permission for an office development given during the early seventies boom, at major crossroads.	½ mile
Junction 9 M6 Wednesbury	Large number of industrial estates for warehouses and factories including the Tandy distribution centre.	1-2 miles

However, it is notable that the Solihull District which contains substantial transport infrastructure also has adjacent and nearby industrial developments. The Elmdon Industrial Estate stands beside the M42, Birmingham Airport and Birmingham International Station, and shares its site with the large International House office development. Further south beside junction 1 on the M42, a planning application has been made for a major industrial estate and related developments at Monkspath. In the north, just outside the County boundary lies Coleshill Industrial Estate near the M6/M42 intersection.

5.4.4 SUMMARY AND INTERPRETATION

The interview survey of local authorities was able to explore their involvement in the development process and tap their knowledge of location demand and decision making. Considerable differences existed between the authorities in terms of their identification of particular problems and the policies adopted for their solution. Every authority had some involvement in the development process (apart from through the planning system) but this ranged from the minimal to the extensive. Actual development work was undertaken by ones such as Dudley and Wolverhampton, and thorough promotion exercises were carried out by the County and Birmingham. Publicity material paid great attention to the advantages of good motorway links to other regions, and of the easy access to the motorways within the conurbation. It was discovered that no overriding planning policies or decisions operated to influence the patterns of activity around motorways. Respondents confirmed the importance of the developer in making the initial site selection for a majority of new industrial developments.

The survey supported the first research hypothesis by identifying

points of high demand and particular developments which coincided with motorway junctions and some other major transport facilities. It was a majority opinion among respondents that motorways held a strong attraction for industry. The spatial extent of this attraction was less certain, although localised benefits such as prestige and image were mentioned. The second research hypothesis was less satisfactorily resolved. Opinion was unable to separate the behaviour of factories and warehouses, except insofar as warehousing was often used to provide a screen for unsociable manufacturing activities. Most authorities were opposed to warehousing development because of associated low employment densities.

6.0 CONCLUSIONS

This research project has sought to determine whether motorways have an impact on new industrial location within urban areas. Although transport has traditionally held a key theoretical role as a determinant of location and urban form, the interest of recent research in this area has waned, principally due to the development of behavioural theories and the assumption that movement in the age of the automobile is too fluid to constrain spatial patterns. Against this background of an attributed lack of importance for transport in these matters, the present research has re-examined the role of motorways in industrial location.

The review of various research areas in section 2.0, sought beyond the familiar 'cost basis' of many motorway impact studies, to highlight the variety of non-quantifiable but still material benefits resulting from these routes. Such benefits may influence industrial location because executive decision makers value their personal considerations and act on perceived rather than actual information. The case for re-examining the research area is further strengthened by the special features of motorway routes. For example, unlike most roads, the benefits which motorways confer are concentrated at a limited number of access junctions. In addition, they produce what has been described as a differential impact on short and long distance accessibility, for they improve inter-regional links, while generally having no effect on local routes. A further dimension is added to the research area by the growing involvement of estate agents, developers and local authorities in industrial development. The current importance of these actors encourages study of their roles and knowledge. Lastly, if it is assumed that motorways can influence spatial patterns, then this has implications for urban structure and policy initiatives.

Reviewing these matters led to the formulation of the two research hypotheses, namely

(i) new industrial locations are attracted to the vicinity of motorway junctions,

and following from this main hypothesis

(ii) this attraction is stronger for warehousing than for manufacturing industry.

To evaluate these hypotheses a two tier research method was adopted. The first tier examined detailed changes in the industrial location patterns of the West Midlands conurbation through an analysis of surfaces representing land use, planning applications and access to motorways. The second tier questioned estate agents, developers and local authorities about their roles and the factors they considered important in location choice. This overall design enables associations discovered between variables in the first tier to be either explained or refuted through the identification of causal relationships in the second tier. The results of both tiers are presented separately in section 5.0. In this final section they are consolidated into comprehensive findings drawn in response to the hypotheses. The chapter then attempts to relate these findings to the matters discussed within the earlier review of the research areas, outlined on the previous page. Finally, the various implications of the conclusions for policy and other areas are discussed.

6.0.1 CONSOLIDATING THE RESULTS

The first hypothesis was tested by analysing manufacturing land use surfaces representing existing usage in 1964 and new usage between 1964 and 1975. Evidence was found to show that during this period a great increase in land use density occurred within one minute's travel time of the motorway junctions. Beyond this point there was no discernable difference between new and existing patterns. The second part of the

research method established that estate agents and developers regarded proximity to motorways as a major advantage for factory locations and this was also the majority view of the local authorities. These surveys also indicated that warehouses were similarly attracted to motorways. Therefore, within the terms of the research method, evidence of both association and causal relationship exists to support the primary hypothesis that new industrial locations are attracted to the vicinity of motorway junctions.

This conclusion can be elaborated in various respects. Firstly, the influence of motorways appears to be remarkably localised. A logarithmic regression function was found to accurately depict the pronounced peak of new land use density at motorway nodes. Respondents gave support to this description with evidence of frontage benefits such as the prestige and image given to the occupier of a prime roadside site. A consensus emerged from the second tier investigation that the likely limit of motorway influence was no more than 3 to 6 miles from the nodes. However, other things being equal, a closer position would be desired by both developer and occupier. One exception may arise in the case of some sites due to access being restricted because of the congestion or the complex one-way systems associated with major interchanges.

The factory and warehouse planning application surfaces exhibited a peak location density a short distance away from the motorway nodes. This is in contrast to the land use density peak which occurred at the node itself when measured in the earlier part of the study period. Two explanations are offered for this difference. The reason may lie in the inherent nature of the source data, for the land use surface measures areal coverage, and the planning application surface measures the number of potential developments.

Hence the discrepancy could be explained if a junction was surrounded by a small number of very large developments, with a large number of very small developments beyond. Alternatively, the motorway induced locations of the late sixties and early seventies recorded in the land use surface may have depleted stocks of vacant suitable land immediately around the junctions. In consequence, similar locations recorded in the mid-seventies by the planning application surfaces would have been driven to sites slightly further afield and so produced the discrepancy.

Having found substantial support for the primary research hypothesis the influence of motorways on factory locations was then compared with their influence on warehouse locations in order to test the second research hypothesis. The planning application surfaces used for this purpose showed manufacturing locations to peak more markedly than warehousing locations as the motorway nodes were reached, and this is contrary to the hypothesis. On the other hand, the questionnaire survey produced a consensus among the estate agents and developers that motorway proximity was the single 'very major advantage' for warehousing, but only one of several 'major advantages' for manufacturing. It must therefore be concluded that whilst evidence supports the attraction of industrial development to motorway junctions, it is uncertain whether this attraction is strongest among factories or warehouses, and hence the second research hypothesis can neither be accepted nor rejected.

Some tentative suggestions can be advanced to explain this apparent contradiction in the results.

As has been mentioned in previous sections, precise definition of the term 'warehouse' presents difficulties. While some warehouses exist to serve large national suppliers and markets and are strategically located in the main transport systems, others have a predominantly local role. They may store and consolidate loads from nearby sources, or collect produce for an adjacent urban market. Others are tied to a manufacturing plant where their role is to hold surplus stocks according to the state of the business cycle. In those latter cases, the primary concern will be access to the factory or the retailer along neighbourhood roads. It is possible that when development is tied to an existing property it is more likely to be undertaken by the firm, whereas if it occurs in a strategic location it is more likely to be undertaken by a developer.

6.0.2 AN EXPLANATION OF THE FINDINGS

The above section has concluded in support of the primary research hypothesis that new industrial developments do congregate around the motorway junctions of the conurbation. The subsidiary question of the comparable nature of factory and warehouse locations vis-a-vis motorways remains unresolved. These findings raise the fundamental question of why motorways attract industrial development in the manner revealed.

Although evidence exists to discount the importance of transport costs in industrial location, many other advantages may spring from proximity to motorways. For example, with goods of an urgent, perishable or secure nature, motorways will be valued for their speed and reliability. Also a motorway can facilitate effective and efficient linkages between the firm and its suppliers and customers.

Furthermore, a motorway eases route and destination finding and alleviates the fatigue and effort of driving, and this will be especially valued by the business traveller whose time is at a premium. In addition, executives will be attracted by good access to recreational and cultural facilities, and by speedy links between the place of work and desirable but distant residential areas. Indeed, the preferences of the executive are of paramount importance to the behaviour of the firm for he is the location decision taker.

One of the more significant features of motorways is that access benefits are concentrated at the few junctions and not spread along the route. Consequently, the motorway provides a path of access points from which radiate certain advantages, which the results indicate produce highly localised impacts. Industrial location near to the junctions may be partly encouraged by frontage benefits which give a site prestige and offer potential for advertising the occupying company name, image and even products. Such a location would also be found and visited more easily by customers and suppliers. Another feature encouraging proximity is the differential impact of motorways on long and short distance accessibility. When a motorway investment cuts journey times between regions, there results a relative increase in most local journey times. If the motorway produces congestion, then there may even be a real increase in local journey times. Consequently for the motorway user it becomes more advantageous to find a site near to a junction, all other things being equal. The user will also be encouraged to this action by an awareness of the differences between fast uninterrupted travel on the motorway, and slow intermittent movement on most urban roads. Finally, within the city his perception of space and the scale of motorways as landmarks, obstacles

and facilities will draw the attention of the location seeker to their attractions.

Underlying these aspects of the relationship between motorways and location is the fundamental nature of decision making. In the location process, most choices are made against a background of inadequate,false or even distorted information, with the decision maker acting on what he believes to be true. This thesis proposes that the firm has an inadequate appreciation of its locational requirements, and that it is very much lead in these matters by a body of other actors comprising the estate agents, property developers and local authorities. As the majority of moves made by firms into new properties are urgent, there is often insufficient time for new sites to be chosen and premises built. In consequence a large proportion of firms seeking new accommodation will choose units which have been built speculatively by developers, often on estates. In these cases, the fundamental decision of where new industry locates will have been taken by the other actors and not by the firm. The developer selects his sites on the basis of what he believes firms will demand. However, as by the nature of his job the developer is involved in the location process much more frequently than the individual firm, he is more able to accurately identify the determinants of actual location. Indeed in many cases he selects these locations. In such an infrequent, poorly informed decision environment, the firm will be easily swayed by external influences such as publicity or the advice of other actors. It is notable that transport, and especially motorways, take a prominant place in this publicity.

The significance of these other actors has been widely neglected by industrial location research. In spite of this the present project

has successfully tapped their knowledge of the market and firms' locational behaviour, and exploited a spatial awareness seldom found among respondent groups. In consequence of this and the above approach, a behavioural philosophy underlies the results and conclusions reported here.

6.0.3 FURTHER IMPLICATIONS *

The findings of this research project have a variety of implications both within the West Midlands and elsewhere for planning and policy making, for urban form and change and for further research. In this final section these implications will be discussed.

Within the conurbation the research has identified locations which appear particularly attractive for industrial development. A generally high attraction was found to exist around the junctions of the M5 and M6 motorways. However, exceptional interest was discovered in two areas. The first of these was Gravelly Hill, where the largest motorway junction of the study area lies amidst the traditionally industrial Tame Valley. The second area ran from Bilston to Wednesbury, and is close rather than adjacent to motorway access. It also lies in a traditional industrial belt and adjoins the recently closed Bilston steelworks site. Although considerable interest has been shown in the re-development of this site, at the time of the fieldwork the closure decision was unknown, and hence cannot be considered to have influenced the results. The findings do, however, augur well for the site's future. In summary, favoured locations for industry lie close to motorway junctions and are within the industrial heart of the conurbation.

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* This section refers in part to recent publications related to the West Midlands County Structure Plan exercise. These are detailed in appendix 7.D.

Conversely, little sign of location interest was apparent at the urban periphery. In fact, little evidence was found to support the opinion that industrial suburbanisation or decentralisation was occurring within the conurbation. Although the M42 runs through the urban fringe to the east of the conurbation, land around its southern half offered no attraction to industrial location. Even further north, where the motorway passes by the airport, rail station and NEC at Elmdon, the surrounding locations were regarded as no more than 'favourable'. Hence it must be concluded that in spite of excellent communications, this'vulnerable' rural belt on the eastern side of the conurbation is no longer the major industrial attraction that was once feared (see section 4.0.2 above). However, owing to the relatively recent and only partial opening of the M42,it is conceivable that the full potential impact has not been achieved, and the route may yet form a focus for significant decentralisation. By contrast, it is also possible that the M42, lying as it does on the less industrial side of the conurbation, may be too remote from the traditional industrial areas to encourage development.

These findings that prime industrial locations lie well within the conurbation concur with the overwhelming desire of local firms to expand in situ. Unfortunately the majority of existing premises in the established industrial areas are inadequate and offer insufficient room for growth. The significant concentration of new development around motorway junctions in this urban environment implies two possibilities.

Firstly, if developers view motorways as a major location benefit, then the often unrewarding task of land assembly and redevelopment within the conurbation heartland may well be worthwhile in the proximity of their junctions. Secondly, intra-urban relocations may occur over short distances along the motorway route, for this would enable existing links, suppliers and customers to remain accessible to the firm. Generalising further, there would appear to be some support for the view that motorways encourage a restructuring of the urban industrial pattern, with new locations lying in a corridor of nodal concentrations along the motorway route. This is suggested by results from the conurbation heartland, but not from its periphery.

It would be of value if the findings of this research study could be applied to regions beyond the West Midlands. However, as the research method regarded the conurbation as a population in its own right, care must be exercised in generalising from these results. Nevertheless, no fundamental reason seems to exist for doubting that motorways have similar impacts within comparable areas. Although no other urban area in the country has been so thoroughly penetrated by these routes as the conurbation, comparisons may be sought in areas such as Greater Manchester or Leeds/Bradford where motorways run through long established urban areas. However, very often motorways simply brush the urban fringes of towns and cities, and in these cases the impact is in doubt for this study has produced no evidence for a relationship between motorways at the urban fringe and associated industrial growth or decentralisation. Whether this would occur in the absence of inner urban motorway routes is not determined by the research.

The results also hold implications for the West Midlands County Structure Plan. The plan's preferred strategy proposes an economic regeneration to be achieved by devoting the majority of resources to designated "priority areas" covering the established urban parts of the county. To achieve the necessary industrial regeneration the plan proposes to make sites available within these areas, while generally limiting growth outside. New developments will thereby be concentrated into central Birmingham, West Bromwich, Dudley, Wolverhampton, Bilston, Wednesbury, Walsall and Aldridge/ Brownhills. Within this zone the strategy designates a great many principal locations for industrial development, with three particularly large sites. These are at Aldridge/Brownhills, in the Blackbrook Valley to the south of Dudley and on the former steelworks land at Bilston. Only two sites of a similar scale lie outside the priority areas, and these are at Pensnett, west of Dudley, and at Woodgate, southwest of Birmingham.

This last designation is particularly interesting for it is a greenfield site lying immediately alongside the M5 junction at Quinton, and sandwiched between Halesowen and Bournville close to the county boundary. Woodgate is the only major location to offer good motorway access, and from the results of the research it should provide a very favourable environment for development. Despite an almost peripheral location, it does lie close to some established industrial areas. The remaining large sites are all some distance from motorway access and furthermore much of their areas require extensive reclamation work. Consequently, in the absence of motorway benefits these may prove unattractive to developers. The Structure Plan, however, acknowledges that parts of the Black Country are poorly connected to the motorway system, and makes a major attempt

to ameliorate this weakness with a proposal for a 'Black Country Route'. During the 1980's this scheme would link the M6 to the major Bilston steelworks site and in later years a southwards extension might run nearby Pensnett and through the Blackbrook Valley before joining the M5. This would improve access to the motorway network for three of the major concentrations of new industrial development. However this link begs the question of whether the highly localised impacts around motorway junctions may be extended along high quality link roads. This is a question for future research to resolve.

To the east of the conurbation, no major concentrations of new industrial development are proposed. Here development will be restricted in order that growth can be concentrated in the priority areas. This means that no additional development is anticipated around the N.E.C. at Elmdon, nor along the length of the peripheral M42 except at Cranmore/Widney in the south. However the findings of the research indicate that this area, especially the south east, does not score very highly in terms of industrial attraction and hence the strategy would not appear to be sacrificing growth opportunities by this approach.

Whereas there has previously been some discrimination against warehouse developments by the conurbation authorities (see 5.4.1), the Structure Plan specifically points to the need to accommodate this activity. The research discovered that the use of warehousing as a buffer zone to screen 'bad neighbours' was common, and it is proposed that this application should continue. Furthermore the strategy suggests that new warehousing sites be made available in peripheral locations with good access to the motorway network. One such site is identified as Minworth on the A38 leading northeast from Spaghetti Junction.

Evidence gained from estate agents and developers supports the feasibility of such locations; however, whether such sites are equally well suited to small scale, locally-orientated warehouses is uncertain.

Turning to more general policy issues, the research has relevance primarily at the local urban scale where it could be applied to the judgement of planning applications in order that a more effective allocation of industrial land use might be made. Similar implications affect the choice of land uses along the frontages of major highways and key junctions. Furthermore, transport planners should bear in mind the industrial development potential of motorway junctions and the possibility that good quality feeder routes might bring this potential into more distant parts of the urban area. Finally, by drawing attention to the importance of estate agents and developers for new industrial locations, the research has identified a mechanism through which policies aimed at influencing land use may be directed.

In drawing this thesis to a close, it is appropriate to refer to the issues uncovered by the exploratory nature of the research, which would benefit from further investigation. Firstly it would be valuable to compare more extensively the impact of motorways in the central urban areas, in the suburbs and at the periphery. Secondly, new research could profitably investigate whether the initial impacts discerned here continued and increased over a longer timescale. Thirdly the locational impacts of individual junctions could be studied to discover differences owing to their importance, arrangement or position in the city. Fourthly the impact of high quality motorway feeder routes could be examined. Fifthly, a detailed investigation of the role of motorways in the location of warehouses

as compared with factories could shed more light on this subject. In all cases and especially the latter, any research would clearly benefit from the availability of more complete data over both space and time. Furthermore, the validity of generalising from the results produced here, could be determined by the study of other urban areas. Finally, any further research on these topics or on industrial location in general, would be more valuable if full attention was paid to the important roles of the 'other actors' in the location process.

7.0 APPENDICES

7.A NOTES ON THE ANALYSIS OF SURFACES

7.B QUESTIONNAIRE SCHEDULES

7.C ORGANISATIONS AND INDIVIDUALS ASSISTING IN THE RESEARCH

7.D NEW DEVELOPMENTS IN THE WEST MIDLANDS COUNTY STRUCTURE PLAN

7.A NOTES ON THE ANALYSIS OF SURFACES

7.A.1 AGGREGATING THE DATA

Section 5.0 describes the construction of the surfaces and the analysis of tabulated data. Transforming these surfaces into the correlation table 5.2.2 was a simple mechanical process, applied to each location surface.

Every location measurement within the surface was arranged against the access value applying to its cell. The location measures for each access value were then totalled. The frequency with which each access value occurred was counted, and this sum was divided into the total location measure for that value, thereby producing a mean location density for a typical cell of each access value. These mean densities form the location variables shown in the correlation table.

The process is shown, for each location surface, in tables 7.A 1 - 4.

7.A.2 THE CHI-SQUARE TEST

The chi-square test was adopted prior to the analysis in order to determine whether significant differences existed between the location variables in the correlation table 5.2.2. Surface F1 was compared with F2, and F3 was compared with W1.

A null hypothesis was proposed that there were no differences between the variables. This would be tested at the 10% significance level, and with 21 degrees of freedom, the null hypothesis would be rejected if the resulting x^2 value fell outside the critical region of less than 29.6. The results of the chi-square test produce an x^2 statistic

of 2.3 for F1 and F2 and 1.3 for F3 and W1. Both are well within the decision criterion for failing to reject the null hypothesis. Therefore it must be assumed that there are no significant differencies between these location variables.

7.A.3 ADDITIONAL ACCESS SURFACES

The possibility of incorporating two additional access surfaces in the analysis was referred to in section 5.1. One of these could measure motorway access in relation to the varying importance of junctions. The other could incorporate the M42. Still further possibilities exist of mapping access to a variety of major transport facilities.

In view of the lack of significant differences, discovered by the chi-dquare test, between the location variables only a single access surface was investigated. The lack of sensitivity in the location data made such an extension of the analysis of limited value. In terms of future work, however, this prospect would be of interest.

TABLE 7.A.1: AGGREGATION OF LOCATION SURFACE F1

INTO CORRELATION TABLE

ACCESS VALUE SURFACE X1	f	LOCATION VALUES - SURFACE F1	TOTAL LOCATION VALUE	MEAN LOCATION VALUES (TOTAL/f)
1(NODE)	5	2,1,1,1,2	7	1.40
2	17	1,3,2,2,4,1,2,3,1,3,1, 0 X 6	23	1.35
3	38	1,1,1,2,1,1,1,4,4,1,3,1,2,3,1,5,1,1,5,8, 1,3,1,0 X 15	52	1.37
4	53	2,2,1,1,3,3,3,1,2,2,4,2,2,2,2,3,2,1,3,2, 2,4,1,4,1,1,3,1,1,3,1,7,3,2,4,3,6,3, 0 X 15	93	1.75
5	52	2,1,3,3,1,4,3,1,2,2,1,1,1,2,4,2,3,1,1,1, 2,1,5,1,1,1,1,3,0 X 24	54	1.04
6	55	2,1,2,2,1,2,1,2,3,3,4,3,1,4,1,1,1,1,1,1, 5,1,3,1,1,1,7,1,2,1,5.3,1.1, 0 X 21	70	1.27
7	60	1,1,1,3,2,1,1,2,3,3,2,2,1,1,1,2,1,1,1,2, 1,2,1,5,3,1,1,5,5,1,0 X 30	57	0.95
8	53	3,2,1,1,3,1,1,3,1,1,3,1,3,3,2,1,4,1,1,2, 3,3,1,5,2,1,1,1,1,3,0 X 23	59	1.11
9	47	1,1,2,1,5,1,1,2,3,2,1,1,1,1,1,1,1,1,4,4, 1,1,2,0 X 24	39	0.83
10	51	3,3,1,1,1,1,1,1,2,2,3,1,2,1,2,1,4,2,3,3, 1,1,3,1,2,1,2,2,0 X 23	51	1.00
11	41	1,2,1,3,1,3,1,1,1,2,1,3,2,1,1,1,1,1,4, 0 X 22	31	0.76
12	35	1,1,1,1,5,4,3,1,2,1,2,3,4,1,1,2,1,1,1,1, 0 X 15	37	1.06
13	31	1,2,3,2,3,1,3,1,1,3,2,3,2,4,1,1,1,1, 0 X 13	35	1.13
14	33	2,1,1,1,1,1,6,2,1,1,1,1,5,1,5,1,1,1,1, 0 X 14	34	1.03
15	29	1,4,1,1,1,3,2,2,1,1,1,1,1,2, 0 X 15	22	0.76
16	29	1,1,1,2,1,1,1,1,1,1,4,1,1, 0 X 16	17	0.59
17	22	1,3,1,1,2,2,1,2,1,2,1,2, 0 X 10	19	0.86
18	17	1,2,1,1,1,2,1, 0 X 10	9	0.53
19	20	1,1,1,1, 0 X 16	4	0.20
20	9	1,1,1, 0 X 6	3	0.33
21	4	0 X 4	0	-
22(MARGIN)	1	0 X 1	0	-

TABLE 7.A.2: AGGREGATION OF LOCATION SURFACE F2

INTO CORRELATION TABLE

ACCESS VALUE SURFACE X1	f	LOCATION VALUES - SURFACE F2	TOTAL LOCATION VALUE	MEAN LOCATION VALUES (TOTAL/f)
1(NODE)	5	2,1,1,1, 0 X 1	5	1.00
2	17	1,1,1,2,1,1, 0 X 11	7	0.41
3	38	1,1,2,1,1,2,1,1,1,1,1,1,1,2,1,1, 0 X 22	19	0.50
4	53	1,1,1,1,1,1,1,3,1,1,1,2,1,1,1,1,1,1,1,1,1,1,1, 0 X 31	25	0.47
5	52	1,1,2,1,2,2,1,1,1,1,1,2,1,1,1,1,1,1, 0 X 34	22	0.42
6	55	1,1,1,1,1,1,1,1,1,1,2,2,1,1,1,1,1,1,1,1,1,2,1, 0 X 34	24	0.44
7	60	2,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1, 0 X 41	20	0.33
8	53	1,2,1,1,1,2,1,1,1,1,2,1,2,1,1,1,2,3, 0 X 35	25	0.47
9	47	1,1,2,1,1,1,1,1,1,1,1,1,1,1, 0 X 34	14	0.30
10	51	1,1,1,1,1,1,1,1,1,2,1,1,1,1,1,1,1,1,1,2, 0 X 33	20	0.39
11	41	2,1,1,1,1,1,1,1,1,1,2,1,1,1,1, 0 X 27	16	0.39
12	35	1,1,1,1,1,1,1,1,1,1,1,1, 0 X 25	10	0.29
13	31	1,1,1,1,1,1,1,1,1,1,1, 0 X 22	9	0.29
14	33	1,1,1,1,1,1,1, 0 X 27	6	0.18
15	29	1,1,1,1,1,1,1,1,1,1, 0 X 20	9	0.31
16	29	1,2,1,1,1,1,1,1,1,1,1, 0 X 19	11	0.38
17	22	1,1,1,1, 0 X 18	4	0.18
18	17	1,1,1, 0 X 14	3	0.18
19	20	1, 0 X 19	1	0.05
20	9	1, 0 X 8	1	0.11
21	4	0 X 4	0	-
22(MARGIN)	1	0 X 1	0	-

TABLE 7.A.3: AGGREGATION OF LOCATION SURFACE F3

INTO CORRELATION TABLE

ACCESS VALUES SURFACE X1	f	LOCATION VALUES - SURFACE F3	TOTAL LOCATION VALUES	MEAN LOCATION VALUES (TOTAL/f)
1(NODE)	5	1,2,3, 0 X 2	6	1.20
2	17	4,2,1,23,2,3,3,8,4, 0 X 8	50	2.94
3	38	1,2,3,1,2,2,10,1,25,9,1,16, 0 X 26	73	1.92
4	53	3,6,2,1,3,3,2,2,4,3,4,1,6,1,1,27,1,2,12,5, 15, 0 X 32	104	1.96
5	52	21,3,4,2,1,3,7,1,1,1,4,1,1,3,11,1,1,3,1,2, 0 X 32	72	1.39
6	55	2,8,1,4,3,1,5,19,3,1,2,2,14,1,4,1,1,6,1,2, 5,1, 0 X 33	87	1.58
7	60	1,7,6,2,4,1,1,1,2,1,1,1,3,4,1,1,20,2,8,1,5, 2, 0 X 38	75	1.25
8	53	1,1,1,3,2,2,2,1,1,4,11,3,12,1,1,1,2,1,1, 0 X 32	51	0.96
9	47	2,8,5,1,1,6,4,1,1,1,1,18,13,5,1,1,1,5,2, 0 X 38	77	1.64
10	51	9,3,1,1,4,1,2,1,3,4,4,1,9,1,5,2,13,11,4,1,1 7, 0 X 29	88	1.73
11	41	1,3,3,4,12,2,2,2,1,1, 0 X 31	31	0.76
12	35	1,1,6,4,6,2,6,3,11,1,2, 0 X 24	43	1.23
13	31	4,1,6,2,3,5,1,3,5,1,6, 0 X 20	37	1.19
14	33	4,1,1,1,1,3,8,3, 0 X 25	22	0.67
15	29	1,2,1,1,2,7,1,2, 0 X 21	17	0.59
16	29	1,2,3,1,2,2,1,2,2,1, 0 X 19	17	0.59
17	22	2,1,2,1,3,1,1,2, 0 X 14	13	0.59
18	17	2,2, 0 X 15	4	0.24
19	20	1, 0 X 19	1	0.05
20	9	0 X 9	0	-
21	4	0 X 4	0	-
22(MARGIN)	1	0 X 1	0	-

TABLE 7.A.4: AGGREGATION OF LOCATION SURFACE W1 INTO CORRELATION TABLE

ACCESS VALUES SURFACE X1	f	LOCATION VALUES - SURFACE W1	TOTAL LOCATION VALUES	MEAN LOCATION VALUES (TOTAL/f)
1(NODE)	5	1,1,1, 0 X 2	3	0.60
2	17	3,11,6,3,3,3,6,1, 0 X 9	36	2.12
3	38	2,1,2,2,1,1,1,7,2,3,1,13,1,2, 0 X 24	39	1.03
4	53	3,1,6,3,2,2,11,1,2,3,2,4,1,3,1,2,2,2,1,9,1, 1,2,7,1,9, 0 X 27	82	1.55
5	52	13,1,4,4,2,2,3,1,1,9,2,1,3,1, 0 X 38	47	0.90
6	55	2,2,1,1,4,1,1,2,9,2,1,3,1,2,1,1,2,3,4,2,1, 1,1,1, 0 X 31	49	0.89
7	60	1,10,1,1,2,1,4,2,1,1,2,1,16,6,1,4, 0 X 44	54	0.90
8	53	1,2,2,3,1,3,1,8,3,8,1,4,1,1,1,8,2, 0 X 36	50	0.94
9	47	5,3,2,2,6,7,1,3,3,4,2,1,2,1,2,1,1, 0 X 30	46	0.98
10	51	14,6,2,2,4,2,1,5,5,1,1,1,1,2,10,3,3,1,1, 0 X 32	65	1.27
11	41	2,1,2,1,1,4,5,1,1,1,1,4,1,1,1,1, 0 X 25	28	0.68
12	35	1,2,3,4,1,3,5,4,2, 0 X 26	25	0.71
13	31	4,7,6,3,1,3,8,2,1, 0 X 22	35	1.13
14	33	4,1,1,1,1,2,1,2, 0 X 25	13	0.39
15	29	1,8,6,2,1,2,2,2,2, 0 X 20	26	0.90
16	29	3,3,2,1,2,1,1,1,1,1,3, 0 X 18	19	0.66
17	22	1,1,2,1,4, 0 X 17	9	0.41
18	17	2,1,1, 0 X 14	4	0.24
19	20	0 X 20	0	-
20	9	1, 0 X 8	1	0.11
21	4	0 X 4	0	-
22(MARGIN)	1	0 X 1	0	-

7.B QUESTIONNAIRE SCHEDULES

This appendix presents the schedules sent to estate agents and developers for the questionnaire survey of these actors reported in Section 5.3.

The following pages consist of:

(i) questionnaire covering letter,

(ii) questionnaire sent to estate agents, and

(iii) questionnaire sent to property developers.

Each subject was also sent a large map of the study area on which to mark some responses. This map is figure 7.B.1 and is included in the end pocket.

Joint Unit for Research
on the Urban Environment
University of Aston in Birmingham

Gosta Green,
Birmingham B4 7ET.
Telephone: 021-359 3611. Ext:
Telex 336997.
Director: Frank Joyce MA(Oxon) DipSocAdmin

SWH/CAD

3rd November 1978

Dear

The Determination of Industrial and Office Location: Survey of Factors Identified by Estate Agents and Property Development Companies

I am a PhD student in the Joint Unit for Research on the Urban Environment carrying out research, sponsored by the Science Research Council, into the preferred locations of industry and offices in the West Midlands. An essential component of this study is a questionnaire survey to elicit and utilise the expertise of estate agents and property development companies for assessing the suitability of particular locations for development. Your firm is being asked to co-operate in this study because of its important position in the regional property market. The research report will reveal the significance of key location factors to different actors, and will be circulated to interested bodies, including those assisting in this study.

In order to keep to the research timetable, I would be most grateful if you could return the completed questionnaire and map by Thursday 7th December in the enclosed stamped addressed envelope. If you have any queries regarding this study I would be pleased to answer them. I thank you in anticipation of your reply.

Yours sincerely,

S.W. Haywood

Enc.

QUESTIONNAIRE FOR ESTATE AGENTS

Please print your answers to ensure legibility.

1. PLEASE GIVE THE NAME AND ADDRESS OF YOUR FIRM:

.....

.....

.....

2. PLEASE TICK ALL THE FOLLOWING CATEGORIES YOU HOLD IN YOUR REGISTER:

NEW FACTORY UNITS .....

NEW WAREHOUSE UNITS .....

NEW OFFICES .....

LAND FOR FACTORY, WAREHOUSE OR OFFICE DEVELOPMENT .....

3. PLEASE ESTIMATE WHAT PROPORTION OF YOUR CLIENTS APPROACH YOU FOR LAND AS OPPOSED TO PREMISES IN THE ABOVE CATEGORIES .....%

4. PLEASE INDICATE HOW THE FOLLOWING LOCATION FACTORS INFLUENCE THE MARKETABILITY OF LAND OR PREMISES FOR MANUFACTURING AND WAREHOUSE USE.

Fill in the spaces below using the code. Ignore cost and attributes of the building or site itself.

CODE	1	2	3	4
DEFINITION	Very major advantage	Major advantage	Minor advantage	No advantage

(a) MANUFACTURING		(b) WAREHOUSING
.....	TRADITIONAL INDUSTRIAL AREA	.....
.....	PROXIMITY TO MOTORWAYS	.....
.....	'GREENFIELD' SITE	.....
.....	LOCAL SKILLED LABOUR	.....
.....	MAIN ROAD FRONTAGE	.....
.....	PROXIMITY TO RAIL SERVICES	.....
.....	NEAR TO A COMMERCIAL CENTRE	.....

5. ARE ANY IMPORTANT FACTORS MISSING FROM THIS LIST? (Please specify)

.....

.....

.....

.....

6. PLEASE LIST THE KEY LOCATION FACTORS THAT WOULD MAKE AN OFFICE DEVELOPMENT MARKETABLE. Ignore attributes of the building itself.

.....

.....

.....

.....

7. PLEASE TICK THOSE DISTRICTS BELOW WHERE YOU HAVE RECENTLY BEEN INVOLVED IN THE MARKET FOR FACTORIES, WAREHOUSES OR OFFICES. Use the attached map for reference.

ALDRIDGE	.....	STOURBRIDGE	.....
BIRMINGHAM	.....	SUTTON COLDFIELD	.....
BROWNHILLS	.....	WALSALL	.....
DUDLEY	.....	WARLEY	.....
HALESOWEN	.....	WEST BROMWICH	.....
SOLIHULL	.....	WOLVERHAMPTON	.....

OTHER (Please specify): .....

.....

8. PLEASE MARK ON THE ATTACHED MAP THE RELATIVE DEMAND FOR WAREHOUSING UNITS AT THE LOCATION OF EACH YELLOW SQUARE. Write the appropriate code on the squares.

CODE	1	2	3	4	5
DEFINITION	Prime Demand	High Demand	Average Demand	Low Demand	No Demand

9. PLEASE MARK ON THE ATTACHED MAP THE AVERAGE RENT YOU WOULD EXPECT TO CHARGE FOR THE PROPERTY DESCRIBED BELOW IF IT WAS LOCATED IN THE CENTRE OF EACH GREEN SQUARE.

Newly built 10,000 sq.ft. factory unit with ancillary offices. Tenant on lease with provision for regular rent reviews and responsible for all repairs and insurance.

10. FORM COMPLETED BY: .....

POSITION IN FIRM: .....

QUESTIONNAIRE FOR PROPERTY DEVELOPMENT COMPANIES

Please print your answers to ensure legibility

1. PLEASE GIVE THE NAME AND ADDRESS OF YOUR COMPANY:

.....

.....

.....

2. PLEASE TICK ALL OF THE FOLLOWING TYPES OF DEVELOPMENT YOU UNDERTAKE:

FACTORY UNITS	.....	INDUSTRIAL ESTATES	.....
WAREHOUSE UNITS	.....	NURSERY FACTORY UNITS	.....
OFFICES	.....	REFURBISHMENT	.....

3. PLEASE ESTIMATE THE AVERAGE SITE SIZE OF INDUSTRIAL DEVELOPMENTS (FACTORIES OR WAREHOUSES) YOU UNDERTAKE: ..... ACRES.

4. PLEASE INDICATE HOW THE FOLLOWING FACTORS INFLUENCE THE SUITABILITY OF A LOCATION FOR A DEVELOPMENT OF THE ABOVE SIZE. Fill in the spaces below using the code. Assume that sufficient land with planning permission exists and that construction costs are fixed.

CODE	1	2	3	4
DEFINITION	Very major advantage	Major Advantage	Minor Advantage	No Advantage

(a) FACTORY DEVELOPMENT		(b) WAREHOUSE DEVELOPMENT
.....	TRADITIONAL INDUSTRIAL AREA	.....
.....	PROXIMITY TO MOTORWAYS	.....
.....	'GREENFIELD' SITE	.....
.....	PROXIMITY TO RAIL SERVICES	.....
.....	LOCAL SKILLED LABOUR	.....
.....	MAIN ROAD FRONTAGE	.....
.....	LOW LAND VALUES	.....

5. PLEASE LIST ANY OTHER IMPORTANT FACTORS:

.....

.....

.....

.....

6. PLEASE LIST THE KEY FACTORS THAT WOULD INFLUENCE THE SUITABILITY OF A LOCATION FOR OFFICE DEVELOPMENT. Assume sufficient land with planning permission and fixed constructions costs:

.....

.....

.....

.....

7. PLEASE TICK THOSE DISTRICTS BELOW, WHERE YOU WOULD AT PRESENT CONSIDER UNDERTAKING A FACTORY OR WAREHOUSE DEVELOPMENT, OR HAVE DONE SO IN THE PAST. Use the attached map for reference.

ALDRIDGE	.....	STOURBRIDGE	.....
BIRMINGHAM	.....	SUTTON COLDFIELD	.....
BROWNHILLS	.....	WALSALL	.....
DUDLEY	.....	WARLEY	.....
HALESOWEN	.....	WEST BROMWICH	.....
SOLIHULL	.....	WOLVERHAMPTON	.....

OTHER (Please specify): .....

.....

8. PLEASE MARK ON THE ATTACHED MAP THE RELATIVE ATTRACTIVENESS OF EACH LOCATION SHOWN BY A COLOURED SQUARE FOR ONE OF YOUR AVERAGE-SIZED FACTORY/ WAREHOUSE DEVELOPMENTS. Write the appropriate code on the coloured squares. Assume that sufficient land with planning permission exists, and that construction costs are fixed.

CODE	1	2	3	4	5
DEFINITION	Very attractive	Attractive	Neither attractive nor unattractive	Un-attractive	Very un-attractive

9. PLEASE INDICATE THE PERCENTAGE OF YOUR DEVELOPMENTS WHOSE LOCATIONS ARE DETERMINED BY CLIENTS, RATHER THAN BY YOURSELVES .....%

10. FORM COMPLETED BY: .....

POSITION IN COMPANY .....

7.C ORGANISATIONS AND INDIVIDUALS ASSISTING IN THE RESEARCH

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Mr R W Bartham, Millard Developments Ltd
Mr Bartleet, Technical Services Dept., Sandwell M.B.C.
Mr Stephen Berg, Industrial Development Officer, Wolverhampton M.B.C.
Mr J M Batsford, Shipway Doble and Earle
Mr M J Bellfield, Bellfield & Co
Mr D Bottwood, LCP Developments Ltd
Mr J Bradbeer, Shipway Doble and Earle
Mr J M Briant, Alexander Stevens & Co
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Mr R Harris
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Mr R A Macey, Grimley & Son
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Mr K MacDonald, West Midlands C.C
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Mr Alan Patterson, Planning Dept., Birmingham City Council
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Mr J B Pendle, W.A. Blackburn Ltd
Mr G Pitchford, James & Lister Lea
Mr D A Price, Sir Owen Williams & Partners
Mr D Richardson, Richardson Developments Ltd
Mr Riley, Planning Dept., Solihull M.B.C.
Mr Robson, Estates Dept., Walsall M.B.C.
Mr K G Salway, Collins Son & Harvey
Mr I J Sanderson, Bryant Properties Ltd
Mr S W Sapcote, W Sapcote & Sons Ltd
Mr D Scarrett, Birmingham Polytechnic
Mr D Scriven, Scriven & Co
Mrs B M D Smith, C.U.R.S., University of Birmingham
Mr D H G Smith, Jack Cotton & Partners
Mr B Stead, Transportation Services Dept., West Midlands C.C
Mr B Storey, Transportation Services Dept., West Midlands C.C
Mr A J Taplin, Bellfield & Co
Mr P W Thorneycroft, Elliot Jones Martin
Mr A C Thornton, McLean Investments Ltd
Mr S D Wainwright, Laing Properties Ltd
Mr W Wheeler
Mr Whitehorn, Technical Services Dept., Sandwell M.B.C.
Mr R J Whittaker, McLean Investments Ltd
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7.D NEW DEVELOPMENTS IN THE WEST MIDLANDS COUNTY STRUCTURE PLAN

This appendix summarises the latest developments associated with the structure planning exercise which has now been underway for some years. In 1978 the reports of survey and strategic choices were published, and after public consultation , draft proposals appeared in October 1979. Further public participation resulted in the plan itself which was published in October 1980. This underwent an examination in public in the spring of 1981 and is now awaiting the approval of the Secretary of State for the Environment. The proposals contained in the plan cover the ten year period up to 1991. A list of the above documents can be found at the end of this appendix.

The structure plan establishes a strategy for regenerating the older urban part of the county, which it designates as "priority areas". Into these areas resources are to be concentrated. Figure 7.D.1 presents the boundary of these areas within the conurbation and also shows the various proposals which are relevant to this research. These include those locations which are identified for new industrial development, and a major road scheme.

To achieve its overall strategy, the plan aims to concentrate development and growth within the priority areas by the provision of numerous sites, whilst elsewhere in the county new developments will be limited. One of the major concentrations for new industry is on the site of the former steelworks at Bilston where a major redevelopment is envisaged. Many of the locations identified within the study area suffer from dereliction and problems of layout, which would present substantial reclamation and land assembly

difficulties before redevelopment could occur. A recent study[1] has discovered that the scale of these difficulties frustrate many of the expansion plans of indigenous industry. Despite suffering from old, inefficient and cramped premises, these firms place a high priority on remaining in their neighbourhood, but because of the absence of suitable premises their growth is curtailed.

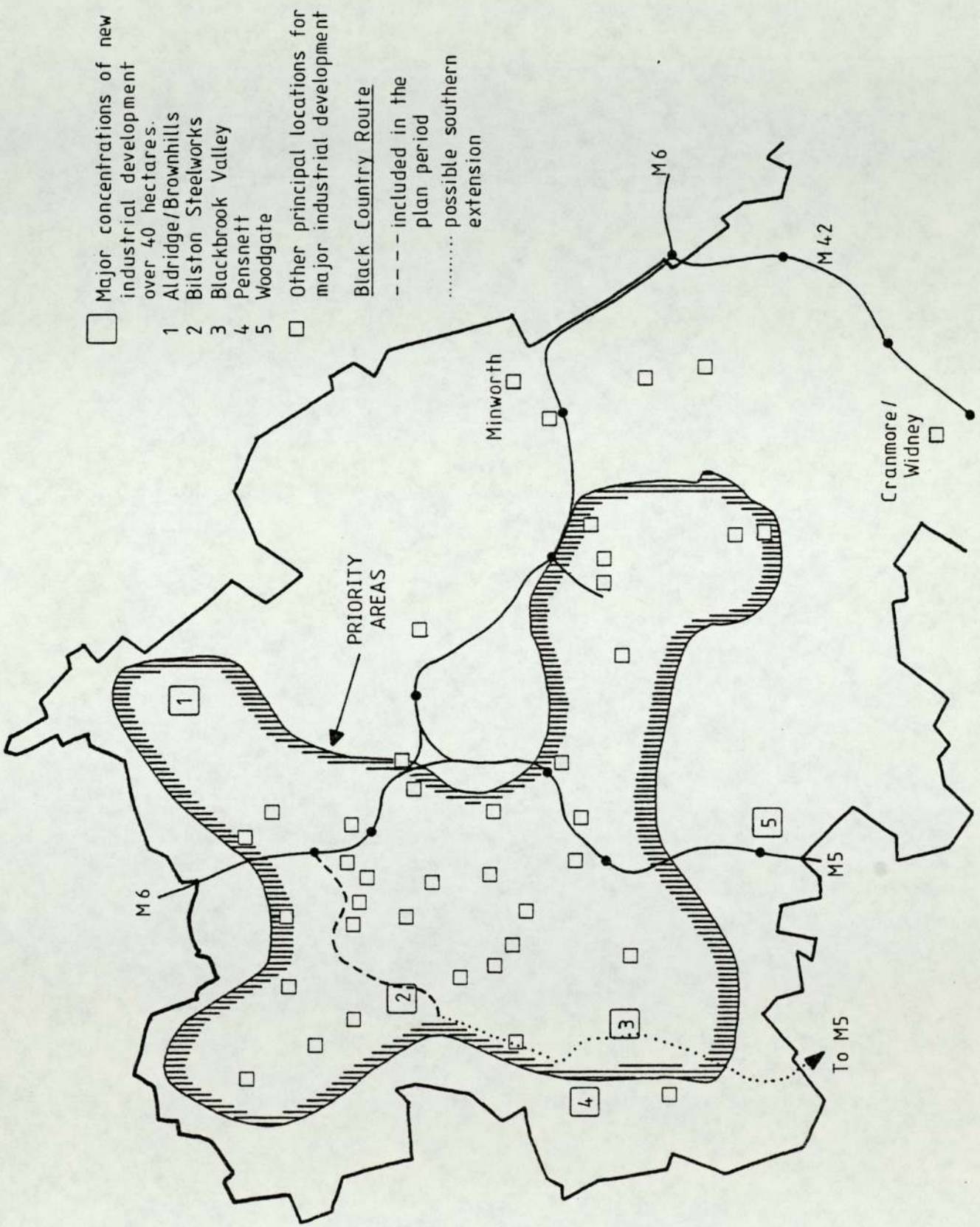
The structure plan proposes the building of a 'Black Country Route' in order to improve access between this part of the conurbation and the motorway network, and this is shown in Figure 7.D.1. Only the first stage of the scheme will occur in the plan period, and it will link Bilston and the former steelworks site to the M6 at junction 10. It is proposed that the second stage will run due south through Dudley, to eventually meet the M5 outside the county boundary. This would, in addition, provide a link eastwards when the planned M42 is built to the south of Birmingham. As can be seen from the map, the entire Black Country Route will pass by many of the designated new industrial locations. An initial economic appraisal[2] of the road predicts that it will bring benefits of improved access locally and to the motorways, that it will increase the opportunities for warehousing activities, and that it will encourage the expansion of existing firms.

---

[1] Williams, H.E., et al; 1980, 'Industrial restructuring in the inner city', Inner Cities Research Report No 2, HMSO, London.

[2] JURUE, 1981, An Initial Economic Appraisal of the Black Country Route, University of Aston in Birmingham.

FIGURE 7.D.1: SELECTED PROPOSALS FROM THE WEST MIDLANDS COUNTY STRUCTURE PLAN



WEST MIDLANDS COUNTY STRUCTURE PLAN

PUBLICATIONS

June 1978: "Strategic Choices"

June 1978: "Reports of Survey - Population and Housing"

"Employment"

"Transportation"

"Social Conditions"

"Environment"

"Inner Areas"

"Shopping"

"Minerals"

"Land Resources"

"Financial Resources"

October 1979: "Draft Proposals for Alterations"

October 1980: "County Structure Plan"

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MOTORWAYS AND INDUSTRIAL LOCATION

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WITHIN A CONURBATION

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FIGURE 7.B.1: STUDY AREA MAP SENT TO ESTATE AGENTS AND DEVELOPERS