The Geography of Petrol Retailing in the North-west Midlands.

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Contents :

Abstract :

The Geography of Petrol Retailing in the North-west Midlands.

This dissertation attempts the spatial analysis of petrol retailing in one sector of the U.K. during a particularly difficult marketing period between 1973 and 1977. In order to achieve the major aim, the identification of viability, all outlets are classified by function and are allocated qualitative scores in terms of their locational factors and site-attributes. Their approximate thresholds are calculated and matched with their annual sales so that viable stations may be recognised. It should be stressed that the concern is entirely with the retailing of petrol, and excludes any consideration of allied activities such as repairs or sales of vehicles.

The dissertation is in the field of Retail Geography, being placed in context during the course of the first chapter. Although many retailing activities have been studied elsewhere in both regional and spatial settings, it is believed that this is the first attempt to analyse petrol retailing in this manner.

The national development of the activity from its origins at the end of the nineteenth century to the present time is described, following which the evolution of outlets in the North-west Midlands is considered. It will be demonstrated that the study-area may be regarded as typical of the country in general as the development and evolution of its retail petrol network closely mirrors that of the nation.

The 1977 network is subjected to statistical measurement, especially in terms of the spacing of outlets, whilst brand representation is also considered as a manifestation of company policies. Discounting, so prevalent in recent years, is examined in its spatial connotation.

The period covered by this dissertation is undoubtedly the most competitive in the whole history of petrol retailing, having experienced rationalisation on a hitherto unprecedented scale. Petrol sales are rapidly becoming increasingly concentrated in the control of the supplier companies.

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John I. Jones,
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Preface :

This dissertation seeks to investigate the origin, development and structure of petrol retailing in terms of its spatial expression on the landscape. In order to satisfactorily consider this spatial dimension, the North-west Midlands was selected as a study-area so that the evolution of an outlet-network and the inter-relationship of stations could be traced and examined in a specific location.

The aims of the investigation were as follows :-

(a) to establish the process of network evolution and to compare developments within the study-area with those in the U.K. in general ;

(b) to consider the extent to which developments in the North-west Midlands might be representative of the rest of the country ;

(c) to examine the relationship between retail outlets and their customers, in a spatial sense ;

(d) to analyse the nature and extent of competition in the retail sector in terms of site, facilities and selling price ;

(e) to classify all retail outlets according to specific criteria and to determine their individual thresholds ;

(f) to consider the respective numbers and spatial distribution of viable and non-viable outlets.

As the topic of study in this dissertation has not previously been examined in a spatial context, it is hoped and intended that this study might, at least to a limited extent, serve to remedy an existing deficiency within geographic literature. Although those company-employees responsible for the establishment of new stations have studied the process of site-selection and economists have considered the nature and effects of company policies, no geographical analysis of petrol retailing has yet emerged in the U.K. It must be stated that while many British geographers have made retail studies their chosen field, not one has looked at petrol retailing as a specific activity. As will be explained in Chapter 1, the only geographer known to have investigated petrol retailing is Claus, and while his work has been entirely in Western U.S.A. and Canada, it does not incorporate a specific area of study.

Chapter 1 is, of necessity, a review of the theoretical content of retailing geography, together with a justification for treating petrol retailing as a special case. While the similarities between this and other forms of retail activities are largely apparent, the differences between them are stressed in this context.

A review of the origin and development of petrol retailing in the U.K. since its inception in 1885 is made in Chapter 2. Although rather a lengthy section, such a feature is unavoidable owing to the lack of published material of a comprehensive nature. As this chapter cannot therefore 'build-upon' many existing and readily-available sources, it must itself include a fully-detailed account of the development of the activity. As a result, this is the longest chapter in the dissertation, and concerned entirely with trends of a national scale.

In contrast, Chapter 3 is concerned more with the development of petrol retailing within the selected study-area, although comparisons are made with the nation as a whole. The major aspect of study here is the evolution of the network of outlets, and in particular to assess whether national events were reflected in a specific regional setting. Thus, there is concern regarding the establishment and termination of outlets over the years, and a search for underlying patterns is made. The central theme is always the spatial distribution of outlets within the North-west Midlands itself.

By applying various forms of statistical measurement to the network of stations, their spatial inter-relationships are the subject of study in Chapter 4. Apart from the measurement of spacing, outlet distribution is considered in terms of brand, brand-change and terminations. Of particular significance is the relationship between outlets and vehicles, and especially the question of the required degree of provision in the study-area.

Chapter 5 attempts the categorisation of outlets according to their functions and sources of income, and proceeds to a detailed classification based on locational factors and site-attributes in order to identify their potential for sales. Such potentials are considered in detail for outlets subdivided on the basis of ownership, operation and company groups.

The final chapter assesses the threshold, throughput and commercial status of every outlet active in the study-area at the end of 1977. This is an attempt to establish the numbers of viable stations, and also the required number in terms of the area's vehicle population. The nature and extent of price competition is also examined in view of the widespread adoption of discounting over the last several years.

A central and recurring theme throughout this dissertation is the view that the study of any type of retail activity in terms of theoretical concepts is of academic interest only. The attitude taken is that the most important consideration is the identification of viability requirements, and the understanding of factors leading to the creation of a network of viable outlets having a close relationship to both numbers and distributions of customers.

The total population of outlets in the study-area is defined as those which are situated where they are accessible to the total number of vehicles. As the motorway system is characterised by restricted access, the decision was taken to exclude motorway service areas from the study. This can be defended essentially on the grounds that such areas can only be visited from the motorway itself, so that the outelts are not as accessible as other stations. Also, it is long-distance traffic that forms the bulk of custom, so that links between these outlets and the areas in which they are located are tenuous in this sense. Strictly, they do not form part of the local network of stations as they are not on roads that form part of the local pattern. Further, any comparison of sales would allow these stations to overshadow most other outlets, the 3 M6 service areas within the study-area, viz. Sandbach, Keele and Hilton Park, selling an aggregate of almost 10 million gallons annually.

The commencement of the period of study in 1973 approximately coincided with the rapid escalation of selling prices and the resultant turmoil which has characterised the retail petrol market since that time. As terminations have outnumbered openings since then, the study has been conducted during a period of great change in this activity. It is probable that events, which should have occupied decades, have been telescoped into a few years, so that the period of study will have spanned the period of greatest transition in the history of petrol retailing in the U.K.

Chapter 1 - The Theoretical basis of Retail Geography, and a justification for treating Petrol Retailing as a special case.

The development and scope of Marketing Geography and Retail Geography as distinct areas of study have been traced in publications by Scott (1970)[1] and, more recently and also more fully, by Davies (1976)[2]. The title of the latter work, however, "Marketing Geography, with special reference to retailing", and of the former, "Geography and Retailing", convey some of the ambiguity that exists in the basic terminologies of these fields. It seems clear that marketing geography describes

> "that aspect of geography which is concerned with tertiary economic activities and particularly the distributive trades,"

and is therefore obviously inclusive of more than the study of retailing.[3] Davies states that studies in marketing geography may be conducted at either a macro- or a micro-scale, the former

> "being mainly concerned with the international aspects of commerce and trade",

the latter being at the level of the "daily trading practices conducted by small business firms."
In this sense, micro studies may be regarded as retail geography as their

> "core focus of attention will be the distributive trades of retailing and related wholesaling and service activities, considered primarily from the standpoint of their consumer catchment areas and the business centres within which they are located."

This would seem to supply a basic definition of retail geography, which, in this sense, would form part of the wider field of marketing geography.

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1. Scott, P. "Geography and Retailing" Hutchinson. 1970.

2. Davies, R.L. "Marketing Geography, with special reference to retailing" Retailing & Planning Associates, Corbridge, Northumberland. 1976.

3. Davies, R.L. op. cit. page 1.

It is generally accepted that marketing geography originated in the work of Applebaum in the 1930's in the U.S.A.[4], although it seems that his work might be better described as retail geography owing to his basic concern with the identification of principles that could be utilised in actual business practice. Applebaum defined marketing geography as being

"concerned with the delimitation and measurement of markets and with the channels of distribution through which goods move from producer to consumer. 5

By 'markets' he meant catchment or trade areas of stores and centres, and by 'channels of distribution', the organisational systems of stores and centres utilised by the distributive trades. This would seem to match the concept of retail geography very closely, as his concern was clearly with the customer and customer-demand, and also with the actual retail sites or shops.

Davies introduces a brief account of the pioneering work of Applebaum with the sub-title, 'The Specific American connotation of Marketing Geography', thus implying that other nations have interpreted the field rather differently. In this respect, only a few pages later in the same book, he states that

"the emphasis in this book is on the spatial characteristics of retailing activities rather than the full spectrum of the distributive trades, not only because retailing is the dominant land use, but also because there has been much less geographical research into wholesaling and related service activities."

This, it must be stressed, is contained within the first chapter of a book bearing the title 'Marketing Geography', so that it seems fairly evident that within the U.K. at least, the term 'Retail Geography' is of equal validity in describing the area of study in question. Hence, for the purpose of this dissertation, it is the latter title that is preferred.

However, the same type of dichotomy is apparent in Berry's work, although in this instance both terms are incorporated into the title.[6] He commences a chapter on 'Marketing Geography' with the statement that

"Marketing geography carries the retail interests of the geographer into practice within metropolitan areas, in the service of private business enterprises."

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4. Applebaum, W. "<u>Marketing Geography</u>" Syracuse University, for the Association of American Geographers. 1954.
5. Davies, R.L. op cit page 2.
6. Berry, B.J.L. "<u>Geography of Market Centers and Retail Distribution</u>" Prentice-Hall. 1967.

It seems evident that what was being described above was essentially the process of retailing set in a spatial dimension. Thus, in company with Davies and Scott, Berry's major concern was with the study of the retail aspects of marketing geography.

All three authors devoted sections in their respective works, cited above, to explain the usefulness and application of Central Place Theory within marketing or retail geography. As Berry states,

"For a scientific understanding of the geography of retail and service business, it is necessary to predict these regularities from a theory."

In this context, 'regularities' refers to the location of retail outlets. The theory that is being referred to is Christaller's Central Place Theory, which, although formulated in Germany during the early 1930's at about the time of Applebaum's pioneering work in the U.S.A., did not become widely available in English until 1966, although having been originally translated in an unpublished form in 1957.[7]

It has to be realised that Central Place Theory cannot fully explain the location of retail outlets, as it covers the whole field of service activity. However, by virtue of its major concern with the size, spacing and hierarchical ordering of centres particularly concerned with the provision of goods and services to surrounding populations, it is not surprising that Christaller's work is accepted as being the foundation-stone of all theoretical aspects of retail geography. In its most basic sense, the theory predicts that centres existing to provide services for a surrounding area will locate at the point of minimum aggregate travel. If such a centre enjoys relative equal accessibility from all points within its hinterland, and if demand and purchasing are evenly distributed, then the hinterland will be of a hexagonal shape. In such instances, according to Christaller, trading or catchment areas of points of retail outlet should adopt a hexagonal shape.

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7. Baskin, C. "Central Places in Southern Germany", Prentice-Hall. 1966.
(a translation of Christaller, W. "Die zentralen Orte in Suddeutschland", Verlag. 1933)
also Baskin, C., unpublished Ph.D. thesis, University of Virginia, 1957.

In Christaller's theory, a flat featureless plain with an even distribution of consumers possessing uniform purchasing characteristics was postulated, who, furthermore, were subjected to uniform transport costs. It is probable that catchment areas of a circular shape would develop, but if such an arrangement were to appear, one of two results would ensue, viz. either small interstitial areas would remain unserved, or alternatively, circles would intersect. This is illustrated in figure 1.1, where it can also be seen that by joining points of intersection, a hexagonal pattern is created.

However, in reality, there are rarely areas of uniform population distribution, nor, for that matter, of uniform purchasing power. The current study, being concerned with the retailing of petrol, is faced with a very uneven distribution of population. Again, it can hardly expect to meet a uniform distribution of purchasing power if the actual consumers themselves are unevenly distributed, although it is probable that the basic difference here will be between urban- and rural-dwellers who differ in terms of levels of car-ownership, as will be considered in the early part of Chapter 3. As the concern is with the retailing of petrol, and as all purchasers must travel to points of sale by vehicle, it may be regarded as a case of uniform transportation costs. This is probably the clearest example of individual sales decreasing with increasing travel costs, as part of the commodity purchased is required to achieve the essential transportation to and from the retail outlet. It would seem, in the case of petrol retailing, that both population distribution and the distribution of demand for the commodity could be subsumed in terms of the location of the vehicles themselves. As petrol would only be purchased by consumers in order to achieve travel by means of road-vehicles, the distribution of demand becomes essentially the distribution of cars and vans. Thus, it is probable that the catchment areas of retail outlets can be identified and delineated largely by means of plotting the locations of customers. This will be attempted in the course of Chapter 6 for a selected sector of the study-area, when it can be seen whether or not an expected pattern results.[8]

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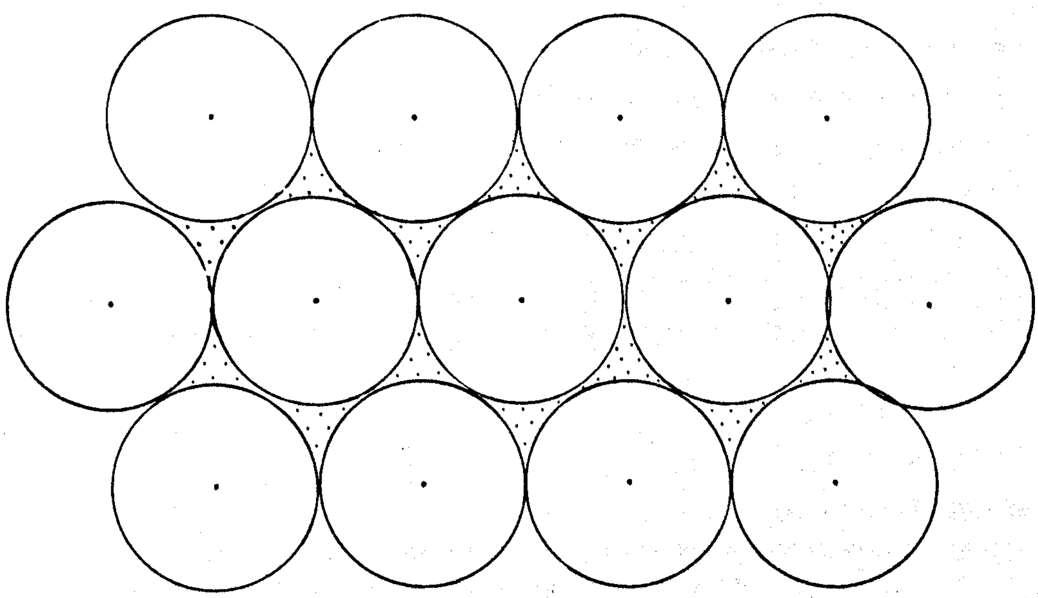
8. Although this would exclude the significance of casual or non-regular custom, seldom does this form more than some 30% of total sales.

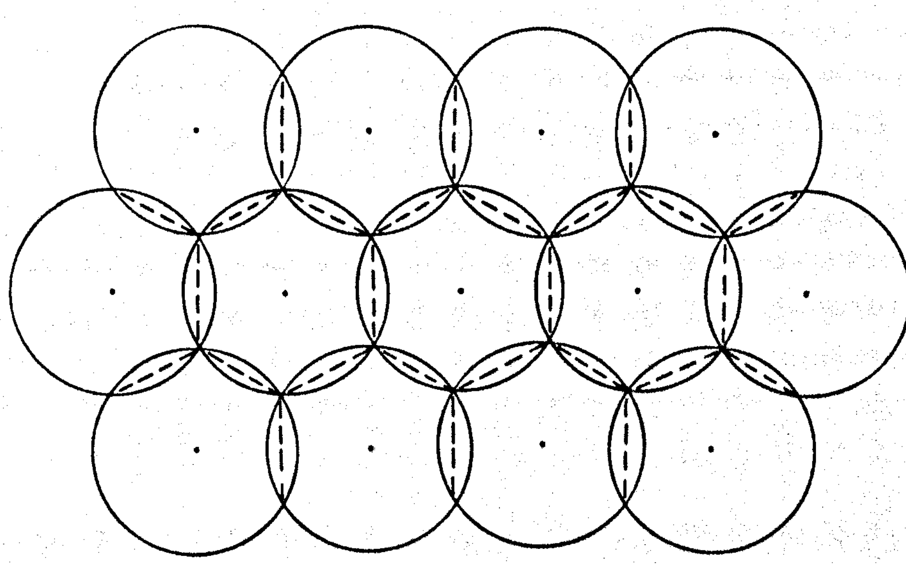
FIGURE 1.1 THEORETICAL CATCHMENT AREAS

1.1-A CIRCULAR CATCHMENT AREAS – CLUSTERED



INTERSTITIAL AREAS

1.1-B OVERLAPPING TO FORM HEXAGONS



(after Christaller)

The work of Losch,[9] developed contemporaneously but quite independently of that of Christaller, is largely supportive of the latter. Although confirming the hexagon as the most advantageous shape for catchment areas, Losch found that these could vary so greatly in size that, in such cases, a nesting pattern did not necessarily emerge. Christaller had claimed that

"the market areas of the lower-order centres nest within the market areas of the higher-order centres."

It is difficult, at this stage, to predict the relevance of nesting catchment areas in a study of petrol retailing, as such a study is concerned only with the one commodity and not with the variety of goods and services normally available in a central place. However, as both Christaller and Losch had claimed that rational consumers would normally frequent their nearest retail outlet for a particular good, as long as price was uniform, then it could be expected that the catchment areas of such outlets should form hexagons. Such hexagons might then vary greatly in size if price-cutting were to be introduced, as has in fact happened in the case of petrol over the past several years. It is then possible that a number of small catchment areas, belonging to less-successful outlets, might be found to nest within the larger market area of a more-successful point of sale.

In spite of this, it is not necessarily a hexagonal pattern that results when prices are allowed to vary. As Davies suggests, after Berry and Garrison,[10] it is not always

"a formal arrangement (of) hexagonal trade areas" that appear when "certain centres may now earn excess profits while others become deficient in profitability."

Admittedly, although it was not price-cutting that Davies was referring to in this instance, it would seem that this practice would result in similar consequences for resulting catchment areas. Clearly, while price-cutting can greatly increase throughput, it does not necessarily imply profitability, as will be shown in Chapter 6.

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9. Losch, A. "Die raumliche Ordnung der Wirtschaft" Verlag 1944, translated by Woglom, W.H. & Stolper, W.F. as "The Economics of Location" Yale 1954.

10. Berry, B.J.L. & Garrison, W.L. 'Functional Bases of the Central Place Hierarchy' Economic Geography 34 (1958). (this is referred to in Davies, R.L., op cit, p. 27).

Both Christaller and Losch were concerned in the identification of the range of a good, viz. the catchment area of a central place from which customers travelled to the centre in order to purchase that good, at a given price. Clearly, if price were to be adjusted upwards or downwards, it could be reasonably expected that sales might decrease or increase respectively, so that the concept of uniform price is of considerable significance. Such a range, in terms of customer residence, will have an upper or outer limit, beyond which potential purchasers will either regard the travel costs as prohibitive, or alternatively, they will be located in closer proximity to adjacent centres. In conceptual terms, the former is 'the ideal limit' of the range of a good, whereas the latter is 'the real limit'. However, both of these limits could be extended for a particular centre if a price-reduction was introduced, and, as such a practice has recently characterised the petrol retailing market, such an occurrence should be borne in mind as a means of enlarging the range of a good.

Although of considerable commercial significance, the outer limit is not as important as the inner or lower limit. The latter "encloses the minimum amount of purchasing power necessary to support the supply of a good from a centre." 11

This limit is termed the 'threshold' or 'threshold population' for the good, and , quite clearly, it is this level which will determine whether or not a particular retail outlet is able to maintain commercial viability, as will be further considered in Chapter 6.

With regard to petrol retailing, the threshold of an outlet may be regarded, not in terms of human population, but on the basis of the number of vehicles needed for the outlet to reach the required volume of sales for it to flourish. As mean annual consumption per vehicle is known, the calculation of total numbers of cars within the threshold of an outlet should be predictive of its approximate potential sales amount, as long as price-levels are fairly uniform for all adjacent outlets. Further, as it would appear possible to identify minimum sales volumes required for outlet-viability, it should be also possible to estimate the relative degrees of success and failure for individual outlets primarily on the basis of their threshold vehicle populations. This will be attempted in Chapter 6, when the effects of competition by means of price-cutting will also be considered.

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11. Scott, P. op cit page 14.

A number of research projects have attempted to estimate threshold for a variety of goods and services. As part of an overall consideration, the threshold of petrol retailing outlets has been included in at least two of these, but each one refers to work conducted in the U.S.A. In the first place, writing in 1958, Berry & Garrison identified the threshold of filling stations in Snohomish County, Washington, as being 196 people.[12] This seems incredibly low, especially in comparison with Dunbier's 1964 estimate of 859 people for service stations in Phoenix, Arizona.[13]

The essential differences between filling stations and service stations will be demonstrated in Chapter 5, but, in essence, their major division is in terms of their relative degrees of dependence on petrol sales. The former is entirely dependent on this source of income, whereas the latter may have two or even three substantial activities which generate revenue. In its American connotation, as in the U.K., the service station undertakes the repair and maintenance of vehicles in addition to selling gasoline, and may also trade in used cars. As the rate of car-ownership in Arizona is one vehicle for every 2 persons, the threshold for the Phoenix example can be expressed as 430 vehicles. In this form, it is somewhat higher than the British threshold, which, as will be demonstrated in Chapter 6, was slightly over 300 vehicles during the early 1960's. [14]

The concept of the inner limit of the range of a good, viz. the threshold, was initially produced by Berry & Garrison as a development of one aspect of Christaller's Central Place Theory. It is possibly the most important single aspect of the theoretical basis of retail geography, largely because it provides a form of comparison for the performance of retail outlets. It becomes even more important in its particular application to petrol retailing in this study, if only because of the very high termination rate of retail outlets since 1973,[15] thus implying that many sales points failed to attract or hold a sufficiently large threshold for the maintenance of commercial viability. This will be amplified in the course of Chapter 6, where it will be further argued that the task of theory and its subsequent application to empirical situations is, not only to explain spatial distributions, but also to identify the relative degrees of commercial success and failure.

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12. Berry, B.J.L. & Garrison, W.L. '<u>A Note on Central Place Theory and the Range of a Good</u>' Economic Geography 34 (1958)

13. Fielding, G.J. "<u>Geography as Social Science</u>" Harper & Row. 1974.

14. See pages 230-237, 243-244 and 275. 15. see pages 94 and 190.

A more basic thesis of Central Place Theory, developed again largely by Berry & Garrison from Christaller's original work, is the recognition of a hierarchy of central places. Although many have argued against the existence of a stepped hierarchical ordering of central places, the body of opinion seems to uphold its existence.[16] It will become apparent in Chapter 3 that, within the study-area, such an arrangement existed both in terms of human population and in the numbers of private vehicles. It will also be demonstrated that there was a relationship between the latter, in particular, and the numbers of petrol retail outlets in such central places or settlements in the late 1940's. Whilst it is clear that the larger the settlement, the greater the number of outlets, this is essentially a function of threshold.

There is little scope for the application of general interaction theory in this particular case, as it is unlikely that many journeys are made for the sole purpose of purchasing petrol. All available evidence strongly supports the claim that visits to petrol stations are normally made as parts of multi-purpose trips.[17] The most frequent categories of purchase, in ranking order, are :-

1. during trip for general shopping purposes ;
2. returning from work ;
3. going to work ;
4. during multi-purpose trip ;
5. specific trip to petrol outlet.

Again, when journeys are made specifically to petrol stations, the majority of customers are visiting for additional purposes. Although normally purchasing petrol during such visits, the principal purpose is usually for vehicle repair, maintenance, car-washing or the buying of d-i-y- or t.b.a. items.[18]

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16. Scott, P. op cit page 14.

17. Household survey conducted by Telford Development Corporation, 1972, and Claus, R.J. "Spatial Dynamics of Gasoline Service Stations" Tantalus Press, Vancouver, B.C. 1969.

18. Do-it-yourself items include fan belts, plugs, filters, brake pads, contact points, etc., while t.b.a. stands for tyres, batteries and accessories.

As the overall situation is characterised by an infrequency of journeys made solely or specifically for the purchase of petrol, it is therefore meaningless to attempt applications of gravity models. However, as part of an investigation into threshold and range, and also the hierarchy of settlements as retailers of petrol, some aspects of interaction theory will be involved. Whilst a hierarchy of centres in terms of petrol sales can be expected to exist, they are to be explained more by differentials in their resident vehicle populations and their significance for other activities rather than due to their importance as places to visit for the specific purpose of purchasing petrol.

Of far greater relevance to the topic under review is a consideration of competition in all its forms. As Berry states, competition may exist in three basic forms, viz.

"adjustments of location in space, changes in quality of product, and price." 19

As actual outlets are not in reality capable of moving, this may be alternatively expressed as a consideration of the relative quality of active sites. A system of assessing all such sites will be attempted in Chapter 5, when all relevant locational characteristics will be allocated qualitative scores in order to achieve a comparison of the entire population of active stations within the study-area.

With regard to the second form of competition, "changes in quality of product", whilst it has to be accepted that there are no inherent differences between similar grades of petrol supplied by the various companies,[20] it is possible that human perception regards some branded products as superior to others. As the numbers of motorists not prepared to buy lesser-known brands is declining,[21] it is the total product-mix of stations that is of greater significance in determining commercial success or failure. In this sense, some are totally reliant on petrol sales for their income, whereas others will offer a wide range of additional goods and services in association with their sales of petrol. This aspect will be considered in association with site characteristics in Chapter 5, when a classification of outlets will be attempted.

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19. Berry, B.J.L. op cit page 86.

20. 'Which', July 1964.

21. According to the Motorists Diary Panel, fewer than 20% of all consumers were still resistant to the purchase of petrol from stations retailing lesser-known brands in 1975, and this has since continued to fall.

The third item to be specified by Berry is certainly capable of adjustment. In fact, a major characteristic of the 1973-1977 period has been the extent of inter-station competition in the form of price-discounting. Again, this aspect will be examined in the course of Chapter 6, but it can be confidently stated at the outset that it has been of very great importance particularly during recent years.

Whilst it could be argued that, in general, price competition is of more significance to economists than to geographers, in the particular case of petrol retailing, this is not altogether true. The reason is that whereas stations can neither move to alternative locations nor readily achieve a substantial degree of product-differentiation, it is in price-discounting that they are able to enter into competition with each other. Admittedly, sites are capable of improvement and their whole product-mix can be altered, but it is in terms of price-cutting that they can speedily respond to changing circumstances. Thus, it might be expected that price reductions might overcome the handicap of a poor location, and also that a good location might be capable of further improvement by means of such a practice. In summary, at this point, it is worth stressing that competition in each of these three forms will be subjected to analysis in Chapters 5 and 6.

The study of spatial competition derives originally from the work of Hotelling, when the behaviour of two firms or outlets in a linear market was demonstrated.[22] It was shown that, in order for each to maximise its catchment area, the ideal solution was for each to locate adjacent to each other at the centre of such a linear market. This would imply that two petrol stations located along a length of roadway should be sited close together. However, in reality, when faced with a multi-linear market, such a solution could not apply. As outlets would have to be located along roads, and, as the road-pattern is generally complex with a multitude of inter-connecting links, Hotelling's solution is invalid, although useful in directing attention to the problem of site-selection.

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22. Hotelling, H. '<u>Stability in Competition</u>' Economic Journal 39 (1929)

Of greater relevance to the real situation in which many outlets exist in a multi-linear market is the work of Devletoglou.[23] He demonstrated that outlets would normally seek to disperse within an area having a uniform population or car distribution, but that clustering would become apparent when such distributions were uneven. Thus, in an area such as the North-west Midlands, in which both human population and vehicle distributions are certainly not uniform, a measure of clustering could be expected within a generally dispersed pattern of outlets.

However, as Devletoglou illustrates, it is a desire to obtain the maximum possible catchment that underlies the selection of sites, the belief being that consumers will patronise their nearest retail outlet. Assuming the latter condition to be applicable, he shows that a zone of indifference will exist in which distance to a number of outlets will only differ marginally from each other, so that consumers in such localities will not necessarily make use of the site offering the shortest journey. This would normally be postulated in cases where retail outlets were dispersed, as in figure 1.2A, but the same type of situation could occur when such outlets were located close together. A frequent occurrence in petrol retailing is for several stations to locate fairly close together along a busy length of road, as is illustrated in figure 1.2B. In such cases, and especially in view of the fact that relatively few journeys are made specifically for the purchase of petrol, it is extremely difficult both to predict and to establish station catchment areas. It is really of very little purpose to a customer to identify the station that is nearest to his home, or to his workplace, if his regular journey involves the use of this length of road, as any of these stations might be equally convenient.

An attempt will be made in Chapter 6 to predict the catchment areas of actual stations by making use of the principle of minimum aggregate travel. This will then be tested against reality by means of a survey conducted within one of the medium-sized towns of the study-area, and it will be demonstrated at that stage that this principle is not of great relevance at the present time when price-discounting results in considerable variation in selling-prices.

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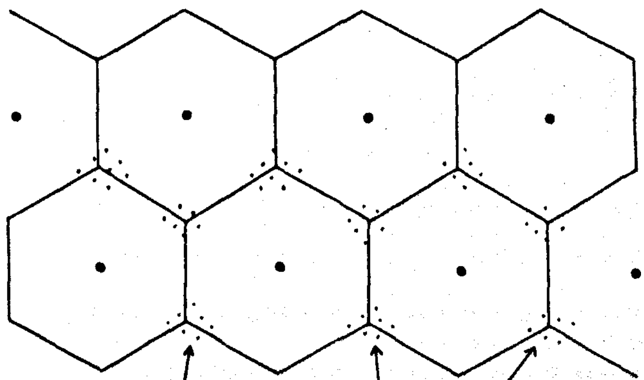
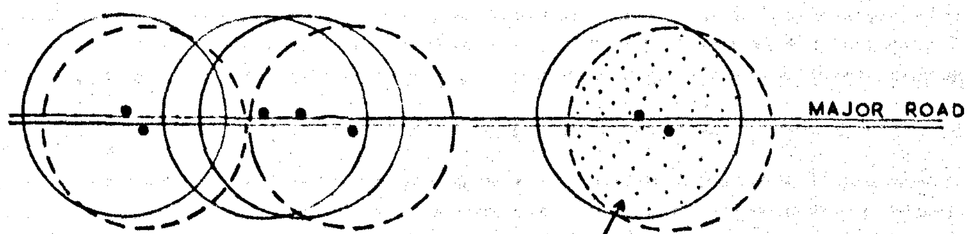
23. Devletoglou, N.E. '<u>A Dissenting view of duopoly and spatial competition.</u>' Economica 32.

FIGURE 1.2 CATCHMENT AREAS - ZONES OF INDIFFERENCE

1.2-A HEXAGONAL AREAS



1.2-B OVERLAPPING CATCHMENT AREAS



(after Devletoglou)

Petrol Retailing as a special case :

It can be reasonably claimed that petrol should be regarded as a special case within the general field of retailing geography as its purchase is characterised by several distinctive features, as follows :-

(1) Petrol can only be purchased in comparatively small amounts as there are strict safety regulations regarding its storage.[24]

(2) As it can basically only be 'placed' in vehicles, part of the actual commodity is consumed in travelling to and from the point of sale.

(3) It is not required for its own sake, but for the travel that it makes possible.

(4) Petrol has no substitute or alternative as yet, although it may in future experience competition from electric storage batteries or other forms of fuel.

(5) As a general product, it is highly inelastic in its demand, although some of the very large price increases of recent years have resulted in short-term reductions in its sale. However, individual brands must be regarded as highly elastic, as a differential pricing system would result in a rapid change of allegiance to the least expensive.

(6) Customers, until recently, tended not to be well-informed about price and quality. However, in view of the steep price rises since 1974, such a situation has changed appreciably.

(7) Individual outlets offer no choice between brands, as, apart from motorway sites, multi-brand stations no longer exist. Thus, a motorist wishing to choose a particular brand has to select in terms of an actual station.

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24. Private individuals are only legally allowed to store a maximum of 4 gallons, and these must be in separate 2-gallon containers.

These characteristics together constitute many differences between the selling of petrol and retailing in general. Most other items that are in common usage, such as foodstuffs, can be bought in large quantities and stored in the home, and may even be delivered to the door by the retailer. Such outlets would also normally offer a range of competing brands. Other items of greater similarity to petrol, such as gas or electricity, are in fact brought to the consumer, and are generally paid for on a quarterly basis rather than at the time of delivery.

However, in spite of its unique nature, the retailing of petrol has attracted very little attention from geographers. Apart from estimates of the thresholds of various groups of filling and service stations as part of comprehensive surveys of retail outlets in general, only three publications have been written from a geographical standpoint with a specific concern for this activity. These are studies of petrol retailing within Western U.S.A. and Canada, but they are not even claimed to be representative of other parts of those countries let alone of other nations.

The first study, published in 1969, was largely concerned with the effects of policy decisions by the supplying companies.[25] It sought to explain the process of site-selection by reference to such policies, and to assess the degree of success attained by competing firms in selecting and maintaining high-gallonage sites within one small area of California, namely Santa Clara County, some 60 kilometres south of San Francisco. Its major theme was the comparison of the performance of actual stations in terms of longevity and throughput with their placement on a site-rating scale. The latter was an attempt to quantify scores for each station on the basis of external factors such as types of neighbourhood and its business potential. Although one result of such an investigation was the gaining of knowledge about individual stations, including their locational characteristics, such material was regarded by Claus as incidental to the light shed on company-attitudes and -policies, this being the major purpose of the study. Unfortunately, the locations of these sites were not presented cartographically, nor were they really considered in their spatial dimensions.

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25. Claus, R.J. "Spatial Dynamics of Gasoline Service Stations" Tantalus Press, Vancouver, B.C. 1969.

During the course of Chapter 5, all stations in the study-area will be classified in terms of their sites and facilities, but not specifically on the lines developed by Claus for use in the North American West. As urban-zonation in the U.K. is much less-distinct than in the latter area, a separate method has been devised which is claimed to have more relevance in this country.

In the second publication, Claus & Rothwell regarded their work as a manual of site-selection and development, this being shown as the sub-title.[26] Whilst essentially continuing the theme of Claus' earlier work, the 1970 study also provided a detailed assessment of all possible external factors and internal site variables. Claus & Rothwell claimed that the former will determine the type of station to be developed, together with its potential lifespan, while the latter will more-directly influence the throughput achieved at that station. Thus, the study sought to demonstrate a method of assessing the overall performance of stations, but, although written in the context of Western U.S.A. and Canada, there was no reference to an actual study-area such as that incorporated in the earlier work.

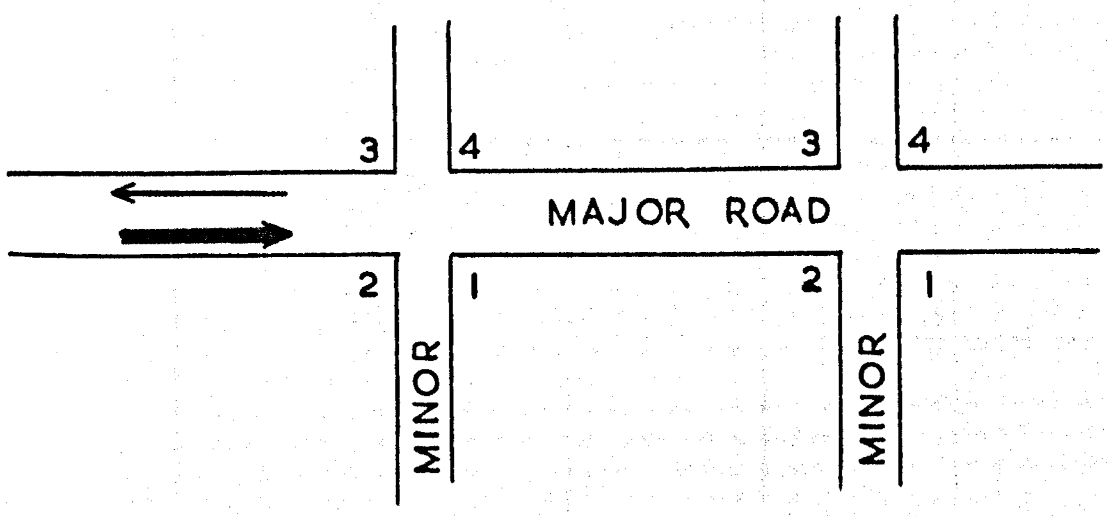
The theme was therefore restricted to a textual discussion, and, apart from a consideration of typical sites, the actual locations of active stations were not examined. Claus & Rothwell classified sites into 5 groups, and, although set in an American context, each type can be recognised in the U.K. :-

	American type	British equivalent
(a)	neighbourhood	neighbourhood - serving a local clientele, such as a large housing estate ;
(b)	downtown	town centre ;
(c)	main street	major road in an urban area ;
(d)	shopping center	hypermarket and car-park sites ;
(e)	freeway	motorway service areas.

These were further sub-divided by the authors into those that occupied conflux or linear sites respectively. In their British connotations, all but category (e) could be similarly allocated according to whether or not they occupied sites at or near road junctions.

26. Claus, R.J. & Rothwell, D.C. "Gasoline Retailing : a manual of site-selection and development." Tantalus Press, Vancouver, B.C. 1970.

It must be remembered that the classification was developed for a society that was highly suburbanised and mobile, and where vehicle-ownership was at approximately twice the current British rate even in the late 1960's. Furthermore, the spatial pattern of road networks in and near urban areas was basically a grid system of intersecting highways, so that zones of conflux of traffic were much more clearly defined. The favoured location for petrol stations in such a network can be clearly demonstrated to be on the corners of major highway intersections, as follows :-



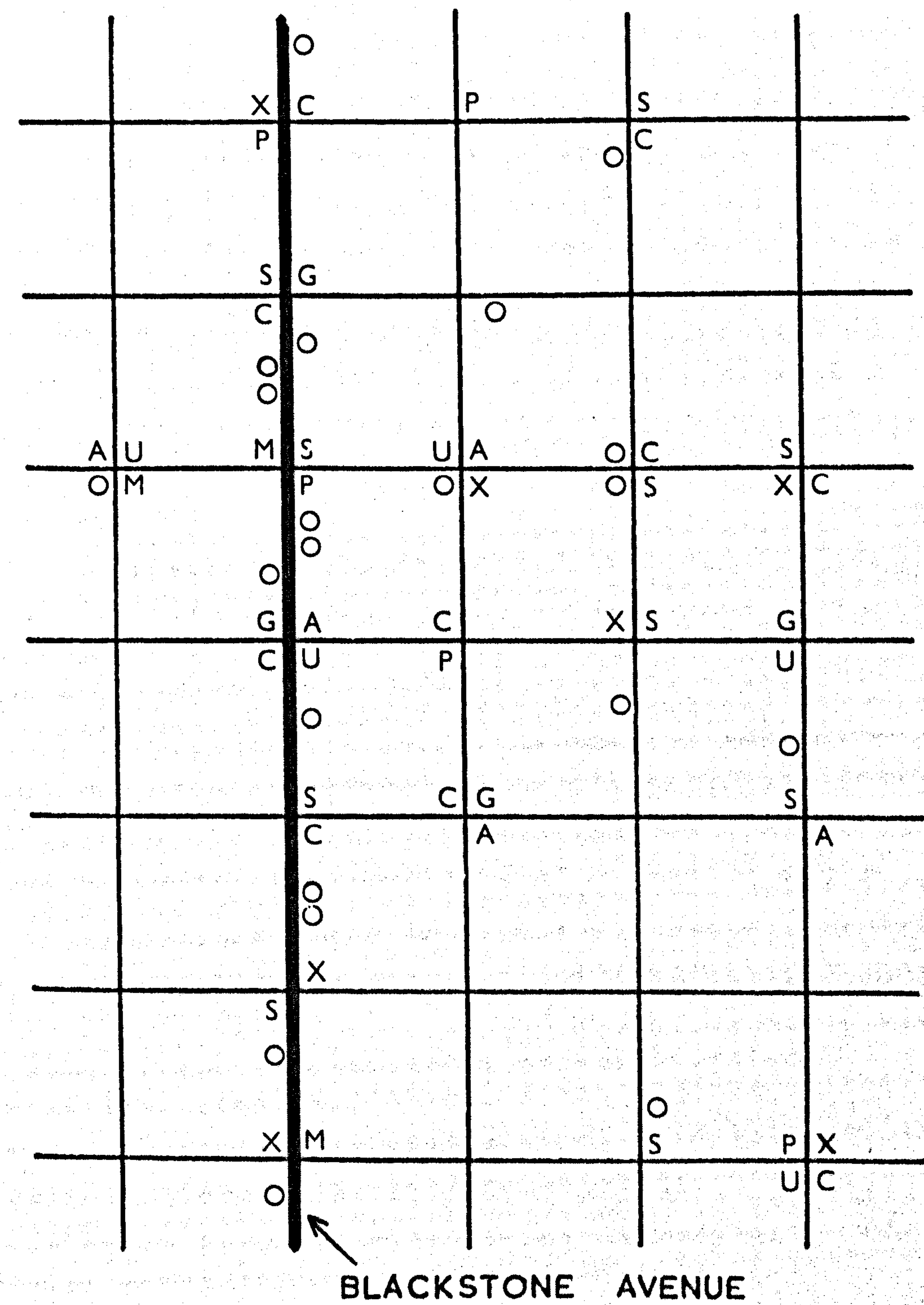
Order of preference for station development.

1. Major flow, after intersection ;
2. Major flow, before intersection ;
3. Minor flow, after intersection ; 4. Minor flow, before intersection.

Figure 1.3 shows a sector of a typical city in the West of the U.S.A. in which major highways run in one of two directions, either north-south or east-west, and intersect at right angles. Within the individual blocks, streets will deviate from this rectangular form, but such streets carry only very localised traffic. It is perfectly apparent that the major companies regard the corners of major intersections as the most desirable sites, as most of these developments retail nationally-known brands. In contrast, it is only the busiest of the north-south arteries, Blackstone Avenue, that has additional sites located between main intersections, and it is noticeable that most of these sell local or lesser-known brands. A detailed consideration of siting in the study-area will be subsequently undertaken,[27] although there is no direct comparison that can be made between British and American developments as the former lacks the rectangular street-patterns of the latter.

27. see Chapter 5, especially pages 176-179.

FIGURE 1.3 OUTLETS IN PART OF FRESNO, CALIFORNIA



Major brands, parts of national networks:-
A. Arco ; C. Standard (Socal) ; G. Gulf ; M. Mobil ; P. Phillips 66;
S. Shell ; U. Union 76 ; X. Texaco.

Local brands are all marked O.

0.5 0 0.5 1

MILES

A third book by Claus, this time in joint authorship with Hardwick,[28] was published in 1972. Much of the material originally presented in the earlier works was repeated, but this time in a form aimed at the city-planner, whose decisions, they saw, affected "automobile-oriented establishments ......the automobile and the automobile-travelling public."

In view of his pioneering studies, Claus must be regarded as the first geographer to specifically concern himself with petrol retailing as a distinct field of study, although most of his comments and conclusions relate only to Western U.S.A. and Canada. Strangely, he has neither sought to develop nor to apply existing theories of location to this activity, as he has been essentially concerned with an investigation of site characteristics as manifestations of individual company policies. A number of other authors, mainly American, have studied aspects such as price-competition and price wars, but such studies have invariably been from the standpoint of the economist.

The most comprehensive of these is the work of Cassady & Jones, who investigated price wars in the Los Angeles Basin during the 1950's.[29] This proved conclusively that such situations normally arose out of the aggressive actions of one of the major brands attempting to increase its share of the market by reducing its selling price. The subsequent chapter will demonstrate that recent price wars in the U.K. had very different origins, while the actual nature and effect of price-cutting will be examined in detail in Chapter 6.

Again, a number of books exist that are concerned with the process of site-selection in general, and including petrol stations as one form of retail outlet. The most useful of these, by Nelson, is widely regarded as a manual within the field of retailing, and provides much useful material for the understanding of selection procedures.[30] Whilst mainly concerned with the location of stores, other types of outlets including petrol stations are briefly mentioned. The latter are classified as 'suscipient outlets', meaning that motorists are impulsively attracted to make purchases during the course of journeys made for other purposes.

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28. Claus, R.J. & Hardwick, W.G. "The Mobile Consumer : automobile-oriented retailing and site-selection." Collier-Macmillan. 1972.

29. Cassady, R. & Jones, W.L. "The Nature of Competition in gasoline distribution at the retail level." University of California. 1951.

30. Nelson, R.L. "The Selection of Retail locations" 1958.

Nelson defines the requirements of petrol stations as follows :-

(a) access to high volumes of vehicular traffic ;

(b) a location at a point of conflux ;

(c) adequate frontage, with spacious entry and exit lanes ;

(d) good visibility so that the approaching driver may see the station in adequate time to stop ;

(e) adjacency to other non-competing types of drive-in businesses.

Each of these requirements, apart from (e), will be assessed in Chapter 5 when outlets will be classified both by function and by quality of sites and facilities. It must be stressed, however, that as the U.K. does not as yet possess a great range of drive-in businesses, this item can hardly be as significant as is the case in the U.S.A.[31]

Although not concerned with the selection of sites, a British study published in 1969 attempted to establish guide-lines for the capital valuation of petrol stations.[32] Whilst not being specifically related to a particular study-area, the work was generally applicable to the whole of the U.K., this being a more homogeneous unit than the U.S.A. As the main theme of this work was the presentation of methods of assessing the value of petrol stations, it was hardly surprising that the principal indicator was found to be throughput. However, a discussion of factors that could influence throughput was also included, these being the various items that will be subsequently introduced in Chapter 5. At the time of publication, 1969, the study concluded that the larger supplying companies would not have been interested in owning a site with a throughput of less than 200,000 gallons per annum, although they were prepared to supply petrol to private dealers irrespective of amounts sold. Whereas mean station throughput at that time was under 100,000 gallons, compared with the 1977 value of almost 168,000 gallons, the corresponding mimimum throughput for a company-owned station in the latter year would have been some 300,000 gallons. The degree to which company-owned stations in the study-area conformed to this requirement will be considered in Chapter 6.

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31. American cities, particularly in the West, exhibit extensive low-density residential tracts based on car-ownership and -usage. In addition to out-of-town shopping centres, flanked by car-parks, their major arteries tend to be lined with drive-in establishments such as food stands, liquor shops, banks, cinemas and, of course, gas stations.

32 Estates Gazette. "<u>The Valuation and development of petrol filling stations</u>."

Several government-sponsored investigations have been conducted during recent decades, the first of which, published in 1949, being still of considerable interest.[33] The main brief of this investigation was to consider

"the number, capacity and distribution of petrol stations in urban and rural areas"

together with a consideration of minimum standards of service that should be provided by various types of stations. It would have appeared that the Waleran Committee was charged with establishing relationships and formulae between the numbers and types of stations, on the one hand, with the numbers and distributions of vehicles on the other hand. Had this been undertaken and completed, and then enacted, an extremely valuable facility would have been provided to guide the planning authorities when faced with requests for locating new stations during subsequent years. However, no such definite relationships were identified, whilst even the principal recommendations were not accepted by the government of the day. In spite of these deficiencies, much information relating to the numbers, distributions and standards of stations in the late 1940's was contained in the Report, so that it will be examined and utilised during the course of Chapter 3 when the evolution of stations within the study-area will be traced.

The Monopolies Commission Report of 1965 must be regarded as one of the most important publications with regard to petrol retailing.[34] This was a comprehensive report that covered all aspects of the activity, and in particular included an exhaustive investigation into the system of tenancies and supply contracts. Its major significance was its acceptance by the government and the subsequent enactment of its recommendations regarding the regulation of relationships between dealers and their suppliers. Thus, whilst providing explanations for many aspects of petrol retailing, the real value of the Report was its effect within the trade itself. It will be further discussed in Chapter 2 when the origin and development of petrol retailing in the U.K. will be examined.

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33. Ministry of Transport. "Report of the Technical Committee : Petrol Stations" (The Waleran Report) H.M.S.O. 1949.

34. Monopolies Commission Report : Petrol. H.M.S.O. 1965.

As marketing conditions have become more difficult, especially since the onset of price wars not only between the various supplying companies but also between neighbouring stations, since late-1973, a second reference was made by the government to the Monopolies Commission in February 1976. This was essentially in response to an apparently discriminatory policy whereby companies were believed to be supplying petrol on over-generous terms to their own high-gallonage outlets, whether fully-owned or tenanted, at the expense of the smaller privately-owned stations. If this were so, it would be a case of unfair practices being used to accelerate the closure of independent outlets so that an ever-increasing proportion of total petrol sales would pass through company-controlled stations. Clearly, a type of monopoly situation would eventually be attained, in which the companies could more-easily determine selling prices.

The Monopolies Commission was therefore asked in February 1976 to investigate three specific practices :-

(a) price discrimination by the oil companies between retailers ;

(b) promotional schemes, including trading stamps ;

(c) the establishment of new retail outlets through new licensing or tenancy arrangements.

Although it had originally been expected that the Report would have been published in late-1977, this date was put back to July 1978, but even this proved unattainable. As it is now unlikely that the eventual Report will be issued before the early part of 1980, it cannot be incorporated in this dissertation.

Another report, in 1970, summarised an investigation into the overall profitability of petrol retailing.[35] Although it classified stations according to their general locations, such as city centre or suburban, it did not consider actual sites nor facilities. Logically, it could hardly have resorted to such a detailed survey as it was not so much concerned with total throughput and viability as with the identification of operating costs in terms of general location, although station throughput was recognised as the principal factor involved. A concluding comment suggested that many stations were operating their forecourts at a loss and that others were insufficiently profitable, but no definite indication of minimum requirements for the maintenance of viability were made.

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35. National Economic Development Office. Economic Development Committee for Motor Vehicle Distribution & Repair : Petrol Forecourt Survey. H.M.S.O. 1970.

However, some very useful statistical material was provided for the 562 stations sampled, and this will be subsequently utilised in Chapter 6 in relation to the degree of commercial viability amongst the stations within the selected study-area of the North-west Midlands. One interesting aspect is that the statistical tables indicated that the Midlands could be regarded as being quite typical of the U.K. as a whole, particularly in terms of average throughputs and operating costs. Further, during the course of Chapter 3, it will be shown that the study-area may quite fairly be regarded as typical of the country in other respects, such as the relative proportions of urban and rural populations and levels of car-ownership.

A further enquiry, on the same issue as the 1970 N.E.D.O. investigation, was undertaken by the Price Commission during 1973 and 1974.[36] This was essentially in response to the rapid increase in marketing costs and the decrease in total sales which characterised that period of time. The terms of reference, originally specified during conditions of statutory maximum price control, were subsequently revised following the removal of the latter in December 1974, as follows:-

"to examine and report on the level and adequacy of margins and discounts accruing to retailers from sales of motor fuel."

Again, this report will be utilised in assessing the viability of stations in the study-area in Chapter 6, but, its overall conclusion reiterated the findings of the 1970 study, namely that the majority of forecourts were operating either at a loss or were generating a very small margin of profit. In particular, it identified loss-making stations as being mainly either in city centres where operating costs were high, or in rural areas where total sales were low, both these types of locations being quite prominent within the study-area. This meant that the majority of stations making an adequate profit were situated on 'A' roads in suburban locations.

Whilst consultants were employed to investigate the retailing activities of private dealers, based on a sample of 248 stations, the Commission itself surveyed 97 company-operated outlets. Surprisingly, although the latter tended to have larger throughputs than the former, margins of profitability were not markedly greater. Further, for stations having similar locations and throughputs, those in private ownership were slightly more profitable.

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36. Price Commission. "Motor Fuel Retailers' Margins : Final Report" H.M.S.O. 1975.

The bulk of the Report was devoted to the level of profit margins, with very little consideration for their adequacy. This was a deliberate decision as the Report stated :-

"At first sight it would be possible to attempt to assess adequacy by considering the rate of return on the capital employed in the motor fuel retailing businesses. We decided at the outset that any such approach was impractical, first because of the great difficulty of arriving at reliable measurements of the capital employed ; and second, because, even if a measurement of capital employed had been feasible, there would still remain no self-evidently right rate of return on that capital." 37

In view of such a difficulty, it was concluded that the mean net profit margin of 2% to 2.5% per gallon, achieved in mid-1974, was, in all probability, a normal rate of return.[38] However, if this was so, the majority of forecourts were almost certainly insufficiently profitable at that time, in view of their low throughputs.

The Report went on to consider the prospects for petrol retailing, and concluded that as there were so many outlets operating just above or even below subsistence levels, then the future trend was likely to be towards a greatly reduced total number. In this way, it was believed, marketing conditions would eventually lead to a situation in which a sparser distributive network would exist, and in which larger units with lower operating costs would predominate. The Report drew a parallel here with other types of retail outlets, such as the grocery trade, in which the trend was very clearly towards larger stores. However, unlike most other categories, there was not only a general decrease in total numbers of petrol outlets, but also a decline in the total amount of product sold.

Thus, as the less-profitable stations were not likely to experience any real recovery in the immediate future, the Report considered that terminations would probably continue at a substantial rate for many years. This has certainly so far proved correct, as will be further considered in Chapter 3, total numbers of petrol outlets having fallen from 32,662 in 1974 to 29,751 at the end of 1977.

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37. Price Commission. op cit page 21.

38. As the price of 4-star petrol in July 1974 was 51 pence per gallon, this represented a net margin of one penny.

The final Report to be mentioned, commissioned and published not by the government but by a private body, was issued in 1977.[39] This sought to analyse recent developments within petrol retailing set against a background of decreasing numbers of stations, and, in particular, to consider the growth in company-owned outlets and the trend to self-serve stations. Much of the Report is devoted to a consideration of methods of diversifying petrol forecourts so as to increase their overall viability. In relation to this aspect, many ancillary activities such as automatic car-washes and tyre-fitting bays were examined as possible means of attracting customers in order to stimulate petrol sales. This Report will be subsequently utilised in Chapter 5 when the various features and facilities of stations in the study-area will be analysed.

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39. E.I.U. Special Report No. 39. "Selling to the Motorist: Petrol Forecourts as retail outlets in the U.K." Economist Intelligence Unit. 1977.

Chapter 2 - The Development of Petrol retailing in the U.K.

This chapter attempts to describe and explain the development of petrol retailing in the U.K. from its origins in 1885 to its present state of difficulty in the late 1970's. The material is derived from very few published sources, as a complete history of the activity has yet to be written. Several relevant documents exist, however, mainly in the form of government-commissioned reports and the various Acts of Parliament that concerned petrol retailing, together with gleanings from 'The Times' newspaper from 1885 onwards. This has been supplemented by personal interviews granted by some of the major companies, together with replies to a number of questions submitted to every company at present supplying petrol, and, in particular, the very useful unpublished history of the Esso Company.

The whole period has been divided, logically it is claimed, into 5 phases according to changes that occurred in the spatial structure of the activity over the years. This is a classification made by the writer, and, whilst it is possible that others would sub-divide differently, the 5 phases recognised contain substantially contrasting characteristic features in terms of numbers and distributions of outlets.

Thus, the first phase covers the early years of retailing, when petrol was being sold through a variety of outlets, most of which had no other connection with road-vehicles. This was followed by a 20-year period where specialised stations spread rapidly to create an over-provision of outlets throughout the country. The second half of this period witnessed a substantial increase in control over the siting of stations by local authorities especially, but, for the most part, this was a time when the accent was very much on growth which affected all aspects of the activity, including numbers of stations.

The third phase was a period of great difficulty, covering not only the war years but also the years of rationing which continued to 1950. This was followed by another expansionary phase, from 1950 to 1965, during which petrol retailing became a highly-specialised activity, but, in contrast to earlier times, very much under the control of the supplying companies. Whereas this fourth period experienced growth in all aspects, it was followed from 1965 onwards by a time of network contraction and rationalisation, where numbers of outlets were eventually progressively reduced. From 1973, the situation worsened appreciably, as, owing to a very large increase in petrol prices, annual sales no longer increased as they had done for most of the previous 88 years. The years from 1973 could perhaps be seen as a separate period, but, as they largely continued trends already evident in the late 1960's, they have not been sub-divided into a sixth phase in this chapter.

As very little exists with regard to petrol retailing within current literature, this chapter attempts to present a full explanation of its development from 1885 onwards. Thus, of necessity, the chapter is lengthy, as it has not been possible to build upon established works in this field. A full consideration of spatial aspects of the outlet network, although frequently referred to in this chapter, is delayed until Chapter 3 when such an analysis will be made in terms of the study-area.

Phase I : 1885-1919 : The Beginnings of Petrol Retailing.

The invention of the single cylinder internal combustion engine by Gottlieb Daimler in 1885, which followed earlier work by Lenoir in 1860, paved the way for the emergence of one of the twentieth century's most widespread service activities, the retailing of petrol as a fuel for road-vehicles. The Daimler engine could be driven by either petrol or gas, and so offered an alternative to the more commonly-used steam engine. The great advantage of the Daimler engine was its superior power:weight ratio when compared with the steam engine, which needed a sizeable and heavy boiler as well as frequent stops for water.[1] Thus, from 1885 onwards, it became possible to build light locomotives, as cars were described until 1905, that were really light in weight, and the superiority of the petrol engine over steam was clearly shown by its overwhelming success in the Paris-Bordeaux-Paris race of 1895 in which the first four cars had petrol engines. The winning car covered the 1176-kilometre distance at an average speed of 24 k.p.h. (= 15 m.p.h.) From 1895, the majority of light locomotives were fitted with petrol-driven engines, but steam continued in use, especially for motor-buses and lorries until about 1910 and 1920 respectively, when they were discontinued due to discriminatory duties on their unladen weights. In actual fact, steam was not completely abandoned as a form of power in small vehicles as the introduction of the flash-boiler heated by liquid fuel, in the early years of the twentieth century, allowed a reduction in body-weight. Further, such engines were not subject to the rapid cylinder wear and harmful carbon deposition that so typified the petrol engine at that time. The greater success of petrol-driven cars was largely due to the introduction by Henry Ford in 1913 of mass-production by assembly-line techniques. This led to a lower purchase price and their eventual near-monopoly of the market for small lightweight private vehicles.

During the 1890's, many types of power-units were tried, including gas, oil and paraffin, also gravity and hydraulic mechanisms were used, but none of these was comparable to the efficiency and greater reliability of the petrol engine. This advantage was further compounded with the adoption of the Maybach spray-carburettor, invented in 1893, which provided a controlled supply of ignitable petrol-air mixture to the internal combustion engine. By 1900, very few light locomotives were being powered by forms other than the petrol engine.

1. Caunter, C.F. The History and development of light cars. H.M.S.O. 1957.

Their development was somewhat restricted in the U.K. during the late nineteenth century as their use on public roads was governed by legislation of a more stringent nature than that obtaining in either France or Germany.[2] It was not until 1896 that such vehicles were allowed to travel at speeds of up to a maximum of 22 k.p.h., or 14 m.p.h., this being raised to 32 k.p.h. (20 m.p.h.) in 1905. Before 1896, the maximum speed of travel allowed had been 6 k.p.h. (4 m.p.h.), with the added requirement that the vehicle had to be preceded by a man on foot. Thus, British-designed and -built vehicles did not emerge in any substantial number until the closing years of the nineteenth century, but petrol-driven vehicles had been produced by Butler in 1887, by Rootes in 1892 and by Knight in 1895. Although numbers of privately owned road vehicles were very small during the 1890's, reaching a total of only just over 8,000 by 1903 when registration and licensing were introduced,[3] the majority of such cars were foreign-built imports, from France especially. As a result of such small numbers it is not very surprising that there were only 4 companies supplying petrol in the U.K. before 1900.

Starting in 1888, the first supplier of petrol in the early British market was the Anglo-American Oil Company, a firm that had been retailing other petroleum products since the 1860's.[4] Its only serious rival was the Hackney Wick firm of Carless, Capel & Leonard, who introduced a motor spirit in 1893 distilled from imported American crude oil. This product, originally developed to fuel Daimler motor-launches, was found to be eminently suitable for light locomotives, and was exclusively used by all participants in the first Brighton Run on 14th November 1896. This was, in fact, the first motor spirit to be given the name 'Petrol', this being the trade-name first used by Carless, Capel & Leonard in 1893.[5] In technical terms, this was the first "double distilled deodorised spirit" to enter the market, and was apparently of a somewhat better quality than Anglo-American's motor spirit of that time.

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2. Plowden, W. "<u>The Motor Car and Politics in Britain</u>." Penguin. 1973.
3. Plowden, W. op cit page 47.
4. Bull, G. <u>Esso Petroleum company history</u>. unpublished. 1962.
5. Liveing, E. "<u>Pioneers of Petrol</u>" Witherby. 1959.

During the mid-1890's, the firm of Carless, Capel & Leonard seems to have been the leading retailer of motor spirit, although the total market would have been very small. Towards the end of 1896, Anglo-American regained their earlier pre-eminence when they began to distribute Pratt's Motor Car Spirit, an improved American product. Its introduction of this spirit in sealed 2-gallon cans in 1899 further compounded its increasing hold on the growing British market. A lower quality cheaper Russian motor spirit had been available since 1892, but this product does not seem to have been a significant competitor. A more challenging arrival was the Shell Transport & Trading Company that began to market in 1897, but even this firm took almost ten years to reach a market share similar to that already held by Anglo-American. This latter entry at least meant that the two companies that were to dominate the British market during the twentieth century were both active before 1900, viz. Anglo-American, which changed its name to Esso in 1951, and Shell.[6]

As motor spirit was supplied in relatively small lightweight cans, there was no requirement to invest capital in installing either underground bulk storage tanks or delivery pumps, so that retailing could be conducted at cycle repair shops, ironmongers' shops, chemists' shops, by sellers of kerosene for lamps and stoves, by blacksmiths and by travelling hawkers. Thus, at this stage of time, it is probable that very few purpose-built points of sale emerged, apart from the sideline activity of petrol sales at motor vehicle repair shops, or motor garages, which in all probability developed from the business of repairing cycles. It should be stressed that a system of distributing petroleum products by rail to a variety of outlets throughout the country already existed before the arrival of motor spirit on the market. There would therefore have been no real need to do other than to make use of such an existing system. Records retained by Carless, Capel & Leonard reveal that 290 outlets retailed 'Petrol' in 1899, these being composed largely of ironmongers, cycle agents and small engineering workshops, but with a number of grocers in their ranks as well. By 1904 they were supplying 1,250 outlets, and by 1906 the number had reached over 1,500. Reference to figure 2.1 will illustrate this company's network within the study-area, but it can be confidently assumed that numbers of outlets supplied by Anglo-American and Shell would both have been greater.

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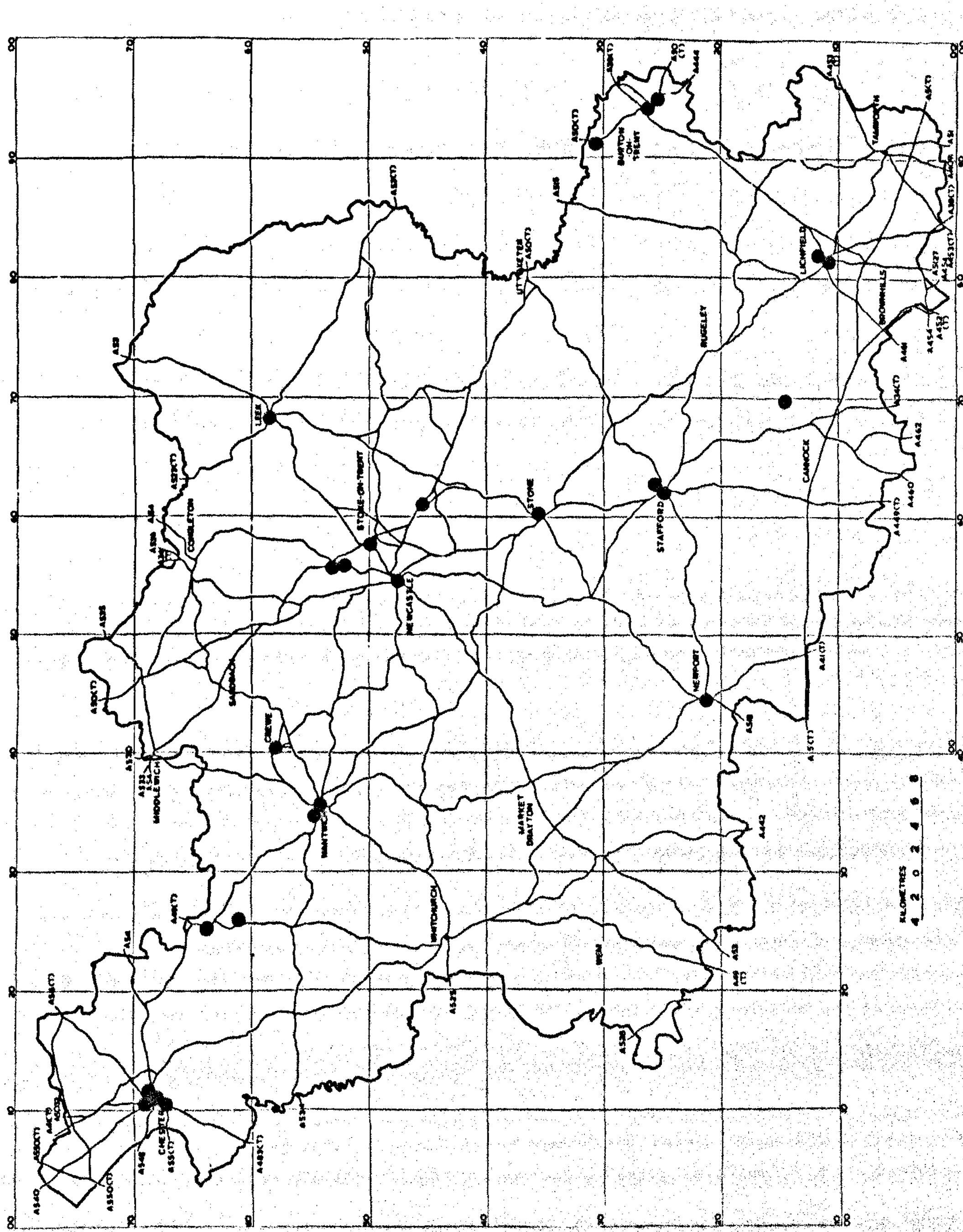
6. Information supplied by the actual oil companies.

FIGURE 2.1 'CARLESS' PETROL OUTLETS - 1906



(Compiled from records kept by Carless, Capel & Leonard)

A few other companies had made their appearance by this stage, as will be referred to below, so that a conservative estimate could be made that by 1906 there must have been at least 5,000 outlets retailing motor spirit throughout the whole country, although the majority would have probably stocked more than one brand. Admittedly, most would have been shops where such sales would have formed a very minor sideline, but in view of the fact that only some 23,000 private cars were in use, a ratio of 5 cars per outlet would appear a fairly reasonable estimate. It is also known that in 1908 the average car covered an annual mileage of some 12,000 miles with a petrol consumption of 15 m.p.g.[7], thus suggesting a mean throughput per outlet of about 4,000 gallons, excluding commercial sales. For purposes of comparison, mean throughput per station in 1977 was almost 168,000 gallons, and those outlets selling below this amount were in some difficulty if they relied solely on petrol sales for their commercial viability.

The normal systems of delivery were by rail, either (a) in wooden cases containing sealed 2-gallon cans, or (b) in 60-gallon steel casks from which the retailer filled 2-gallon cans, in each case the customer being charged for the can which could, naturally, be repeatedly used. As early as 1903, regulations had been issued regarding the safety aspects involved in the storage of cans of motor spirit. These allowed private individuals to hold up to 60 gallons for their own use, but, for retailers, licences had to be obtained from local authorities. Further, retailers had to satisfy their suppliers that a stock would always be maintained, but seldom would this have exceeded 50 or 60 2-gallon cans.[8]

Although, in 1906, small underground storage tanks of 65-gallon capacity were being offered for sale, it is unlikely that very many were installed as this was the approximate quantity held by retailers in casks or cases at little extra charge to themselves.[9] Again, in 1908, the first petrol pump made its appearance in the U.S.A., but it was not generally adopted in the U.K. until the early 1920's. The first kerbside petrol pump to be installed in this country was in 1912, in Shrewsbury, being supplied from a 2,000-gallon storage tank, but such installations met with considerable local authority and police opposition during the 1910's and did not proliferate until after 1921.

7. Information supplied by Shell.
8. Liveing, E. op cit.
9. Bull, G. op cit.

Numbers of vehicles increased appreciably during the opening decade of the twentieth century, growing almost 7-fold from 8,465 in 1903 to 53,169 in 1910, with a further 36,242 motor cycles on the roads by the latter year. Again, by 1910, there were in existence some 45,000 kilometres (28,000 miles) of main road, compared with the 1977 total of 333,256 kilometres (208,285 miles) of surfaced road for a car population of about 14 millions. Total imports of motor spirit rose from 9 to 55 million gallons during the same period, 1903-1910, in addition to the product distilled in this country from imported crude oil. Not all of this fuel was consumed by private vehicles as there were also about 30,000 lorries and over 24,000 buses in 1910, although not all of these were petrol-driven.[10] However, when it is realised that the average car travelled 19,000 kilometres (12,000 miles) with an average consumption of 24 k.p.g. (15 m.p.g.) at this time, giving average annual purchases of some 800 gallons per vehicle, it is not surprising that the market proved sufficiently attractive for other retailing firms to enter. During this decade, a total of ten companies joined the four already in existence in the distribution and sale of branded motor spirit, these being, in order of entry :-

(1) Glico, the Gas Lighting Improvement Company, who introduced a brand called Redline in 1902, actually refined on their behalf by Carless, Capel & Leonard. The company was known as Redline-Glico until 1924 when it was taken over by Anglo-American.

(2) Burmah in 1902.

(3) Ocean Oil Company in 1906, eventually ceasing to market in 1957.

(4) Major & Company in 1906, acquired by Burmah in 1968, but still retailing in the East Midlands as a subsidiary of that company.

(5) British Petroleum (B.P.) in 1906, formed by the amalgamation of the General Petroleum Company, the Consolidated Petroleum Company and Anglo-Caucasian Oil, none of which had previously retailed motor spirit. This company was formed for the sole purpose of marketing Shell products, which it did until 1917 when Shell Marketing was created. However, B.P.continued to retail motor spirit, as will be referred to below.

(6) Aboo in 1907, which continued in existence until June 1969 when it was merged into Atlantic Richfield.

(7) Homelight Oil Company in 1907, acquired in 1911 by B.P.

(8) Lobitos in 1908, acquired by Burmah in 1962, but the Lobitos brand continued under Burmah ownership until 1969.

(9) Dominion Oil Company in 1909, acquired by National Benzole in 1939.

(10) Munster Simms in 1910 in Ireland, merged into Shell in 1965.

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10. Caunter, C.F. op.cit.

Apart from Shell and Esso, only Burmah and B.P. have survived to the present period, most of the rest having been merged into one of these four groups as is shown in figure 2.2. Although Carless, Capel & Leonard continued to market until 1939, they did not reappear as petrol retailers after World War II, preferring to concentrate on their major activity, namely industrial chemicals. However, their part as one of the pioneers is clear, and to them goes the credit for the term 'petrol'.

It is probable that the price of petrol during the 1900's caused less concern than at any time since, as only the wealthier elements of the population could possibly have afforded a car before the 1920's. However, the first case of price-cutting in the retail petrol market occurred in 1907, immediately following the formation of B.P. as the selling agency for Shell products. Clearly, a period of aggressive marketing developed between the Shell and Pratt's brands in particular, with some minor retailers such as the Homelight Oil Company also participating, where prices were reduced by as much as 3d (about 1½ new pence) on a shilling gallon of petrol.[11] Although a tax of 3d per gallon was introduced for the first time in 1909, prices remained low until 1912 when the effective selling price rose from 1s. 1½d. (or about 5½ new pence) to reach 1s. 7d. (8p.), and again increased to 1s. 9d. (almost 9p.) in February 1913, as is shown in figure 2.3.[12] During this year, both Anglo-American and B.P. began marketing a second-grade of petrol at 1p. per gallon below the price of their premium grade, thus following the action of the Carless firm, who, in 1906, had introduced a cheaper grade called 'Movril' in addition to their standard grade of petrol.[13]

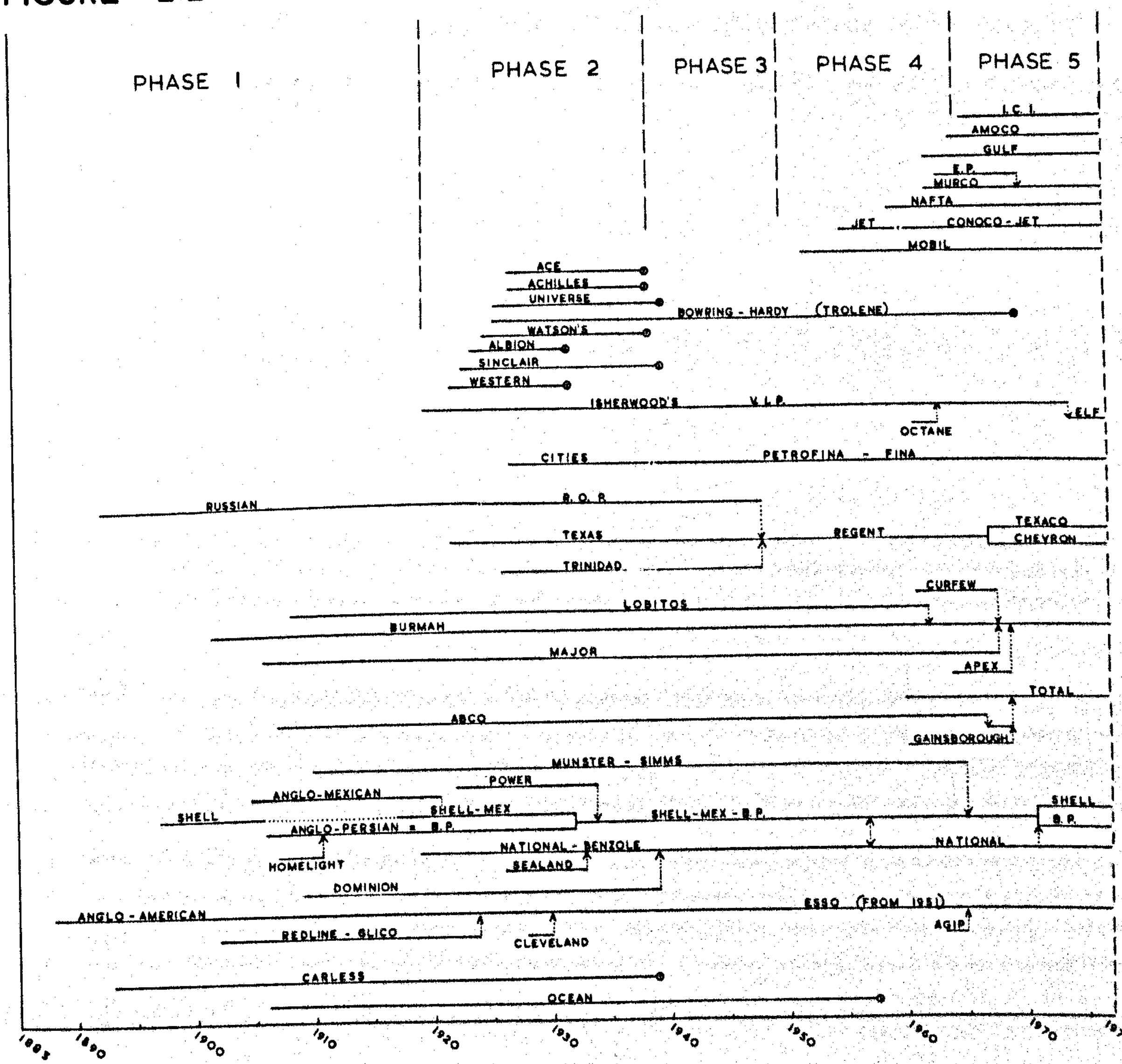
Further tax increases took the price of a gallon of petrol from just under 9p. in February 1913 to 10½p. by September 1915, this rising by another 2½p. in August 1916, by which time petrol for civilian use was becoming scarce. It was not until March 1917 that rationing was eventually introduced, at a monthly allocation of 10 gallons per car. Rationing had not been necessary during the earlier years of the war as it was not until 1917 that the military came to require large quantities of petrol. Also, civilian demand was much

11. Service Station, March 1921.

12. Subsequent prices will be given in new pence only.

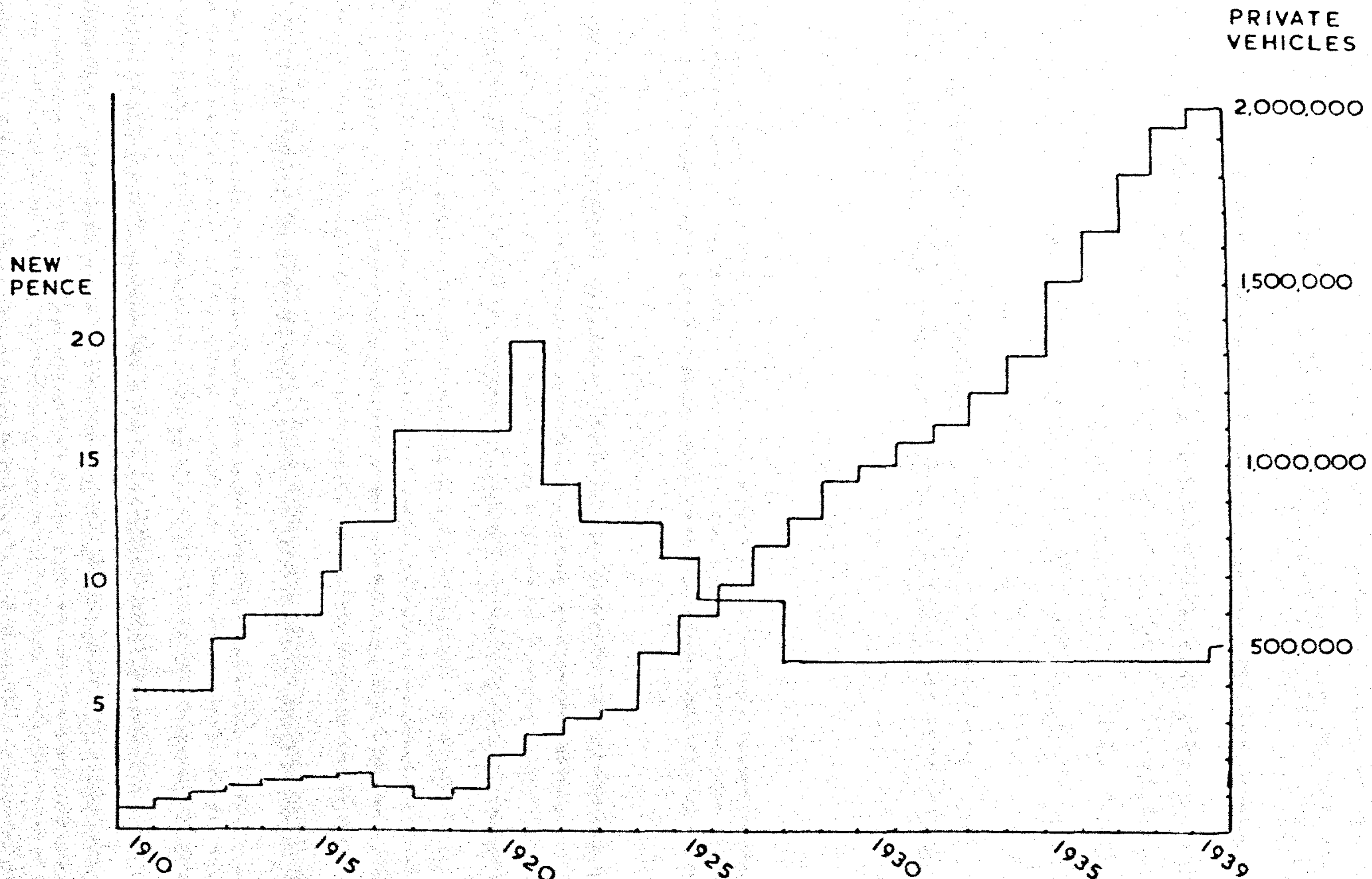
13. Liveing, E. op cit.

FIGURE 2.2 RETAILING COMPANIES :- 1885 - 1977



(Sources: Petroleum Year Book, Service Station and information from oil companies)

FIGURE 2·3 PRIVATE VEHICLES & PETROL PRICES 1910 - 1939



(Sources: numbers of vehicles obtained from Basic Road Statistics ; prices obtained from Institute of Petroleum lists) less than it had been before 1914 as so many motorists would have been in the Armed Forces. The cost of petrol continued to escalate with increases of 3½p. in September 1917 and another 3p. in January 1920, taking the cost of a gallon of premier grade to around 20 new pence.

It is apparent that prices had begun to increase before the outbreak of war, and this continued throughout the decade. Competitive marketing was abolished late in 1914 by the government becoming the sole importer of refined products, with the existing companies continuing to distribute motor spirit to retailers, but without their individual brand insignia. Each company was allocated a quota based on its 1913 sales total, this continuing until the shortages of 1916 which led to the creation of the Government Petrol Supply Commission to administer the system of rationing.[14] It was not until May 1919 that supplies became sufficient to allow the abolition of rationing, this being followed in October of the same year by the re-introduction of branded petrol.

During the immediate pre-war years private motoring had been gaining in popularity, as suggested by the increase in the total number of licensed cars and vans which had risen, as is shown in figure 2.3, from 53,169 in 1910 to 132,015 in 1914. Numbers of motor cycles had increased during the same period from 36,242 to 123,678, and commercial vehicles had approximately doubled their numbers. Total imports of motor spirit doubled, whilst receipts from the fuel tax rose from £321,000 in 1910 to £841,000 in 1914, at a constant rate of 1p. per gallon for private vehicles but with commercial vehicles receiving a rebate of ½p. per gallon. In addition to the quantity of imported spirit, a certain amount was being distilled both from imported crude and from Scottish oil shales, the latter enjoying a market advantage in terms of price, when, in 1919, the Budget imposed an increased duty on imported materials.[15]

The 1910's were characterised by fewer entries into the retail market when compared with the previous decade, although the additions were of a very significant nature. In 1917, the Shell agency was taken from B.P. with the creation of the Shell Marketing Company,

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14. The Times. 26.4.1916 ; 25.5.1916; 9.6.1916 ; 29.3.1917.
15. The Times. 10.5.1919.

this allowing Shell to market its own motor spirit for the first time since 1907. In spite of this, B.P. continued to retail by virtue of its share in the government-regulated market, and received its quota of imported refined products for distribution according to its 1913 sales. However, in 1917, the company was acquired by the Anglo-Persian Oil Company, which, in turn, changed its name in 1935 to the Anglo-Iranian Oil Company, and again in 1954 when it reverted to the original B.P. Meanwhile, in 1911, this company had bought the Homelight Oil Company, with which it had experienced a price war in 1907.[16] In 1915, the Anglo-Mexican Company had entered the British market, but after a difficult six years of operation, including the war years, was amalgamated into Shell to form Shell-Mex.[17] At a later stage, in 1932, Shell-Mex entered into a marketing merger with the Anglo-Persian Oil Company to form the Shell-Mex/B.P. Group, an arrangement that was to continue until 1971 at which point separate marketing organisations were created. The two moved even further apart in January 1976 with each company marketing only its own product, and both delivery and storage systems also being separated.

The only other entrant prior to 1920 was National Benzole, which became a subsidiary of the Shell Group in 1957, although it enjoyed major company status for many years before World War II.[18] The years up to 1920 were very much the early years of motoring, and, in the case of petrol retailing, were characterised by a haphazard and piecemeal system of distribution based on very small deliveries, storage and sales. At this time, motorists had to seek and find premises where petrol could be bought in the ubiquitous 2-gallon can. Such a network was so uncertain and incomplete that it was standard practice to carry spare cans of petrol. The following era was to see very significant and far-reaching changes in petrol retailing, this being the period when large numbers of both specialised and non-specialised outlets were to proliferate.

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16. More subtle than price-cutting was Anglo-American's offer to its customers in 1908 of a 25p. bonus for every 100 can-seals collected. The scheme was withdrawn following Shell's counter-offer of 27½p. for 100 of its own seals.

17. Information supplied by Shell.

18. National Benzole began to retail petrol in 1919 as a result of its manufacture as a by-product in its oil-refining and coal-distillation activities. Now known as National, it is a subsidiary of B.P.

Phase II : 1920-1939 : The Inter-war period.

This period has been termed 'The Golden Age of Motoring',[19] as it was an era during which both numbers of vehicles in use and numbers of retail outlets increased at rapid rates. Although the road-network also expanded, from a total mileage of about 176,000 in 1919 to 180,000 in 1939, such a rate of increase was much less than the 20-fold growth which characterised the vehicle population. This resulted in the ratio of private vehicles to road miles increasing from 0.6 to 11, thus indicating the beginnings of traffic congestion. However, the situation in the late 1930's was nowhere near saturation point,[20] although the decline in total annual consumption of petrol that characterised the middle and late 1930's seems to suggest that the novelty of driving was wearing off. Certainly, this decline cannot be explained by the cost of petrol, which increased only fractionally from just under 7p. in April 1928 to 7.5p. in September 1939.

During the 1920's, prices had been drastically reduced, as is shown in figure 2.3, from around 20p. per gallon in January 1920 to under 7p. in April 1928. This period saw a continuous and substantial increase in annual consumption, in contrast to the 1930's where the 1938 total was only slightly greater than that of 1928. It is possible that such price reductions were largely due to the inter-company competition that characterised the 1920's, as many new entrants to the market made their appearance to challenge the existing companies. This will be further considered below, another important factor being the entry in 1924 of cheap unbranded petrols. It is clear that the market was expanding during the 1920's particularly, as is shown in terms of the growth in the numbers of licensed vehicles in figure 2.3.

Although a few kerbside petrol pumps had been installed during the 1910's, it was from 1920 onwards that they became widespread throughout the country. This was largely due to their adoption by Anglo-American, in turn of course quickly followed by their competitors,

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19. This is a common phrase repeated in many issues of 'Service Station' during the inter-war period.

20. By 1977, this value had reached 85.

as it was realised that bulk delivery and storage could effect substantial reductions in costs. That the retailing companies wished to cease can-sales altogether was made clear in October 1926 when the dealers' margin on such petrol was reduced to 0.5p. per gallon, while the margin on pumped petrol was 1.25p.[21] This view was not at that time shared by the average motorist, as deliveries via pumps could not be seen, thus there was considerable mistrust regarding pumps. This attitude was not dispelled until the introduction of a pump in 1928 in which the quantity of petrol could be clearly seen to be draining into a car petrol tank. The gradual changeover from the policy of storing a small quantity such as 50 or 60 2-gallon cans to one where a bulk delivery of 800 gallons into an underground storage tank could be made obviously meant cheaper transportation of petrol, this being partly responsible for the reduction in the price of petrol during the 1920's.

However, the installation of pumps fed from underground storage tanks led directly to the need for a more professional attitude on the part of petrol retailers, as it was essential to sell as much as possible in order to justify the capital investment required for the new equipment. This meant that retailers had to actively seek custom, probably for the first time ever. This was largely achieved by locating outlets in more-accessible positions, where they could at least be seen by motorists. Thus, the early and middle 1920's, especially, saw the rapid proliferation of outlets along main roads, both within and outside towns.

Thus, the 1920's were very much characterised by the passing of petrol retailing from the assortment of non-specialised outlets such as chemists' and grocers' shops, as had been the case until then, to an ever-increasing number of garages, service stations and filling stations. These terms were first defined by Lester in 1925, as follows:-

"Garage - a place in which cars are repaired and maintained, and also having, for the convenience of customers, a petrol pump.

Service station - to all intents and purposes, having all the features of a garage, but being more or less equally concerned with the sale of petrol.

Filling station - a site existing solely for the sale of petrol and oil."[22]

21. Service Station. October 1926.

22. Service Station. May 1925.

It should be stressed that with very few exceptions these outlets were in private ownership, there being at this time no system of tenancy operated by the supplying companies. An important feature of this whole era was the general absence of single-brand sites, very few of these outlets selling fewer than two brands of petrol, and the majority of the larger sites selling three or four competing brands. This system continued until 1939, but began to disappear during the early 1950's, and at present only existing on motorway sites where legislation has ensured its survival.[23]

Another important feature of the 1920's, which continued during the 1930's, was the great increase in the numbers of petrol outlets. Apart from the categories mentioned above, namely the specialised outlets, pumps were installed at a variety of other sites, including village post offices and general stores, and at public houses. Thus, part of an earlier era of retailing was continued in this way, but such sites could not possibly have claimed very much of total petrol sales. More significantly, the sheer growth in the total number of petrol outlets was the important feature of this period. From about 5,000 in 1906, the total had reached 10,000 by 1919, but then increased dramatically to reach 28,000 by 1930 and 35,000 by the end of 1938. That an increase in total numbers took place can hardly be termed surprising, as numbers of cars increased some 20-fold between 1919 and 1939, but it seems apparent that the increase was too great for the market to support. This seems evident from a comparison of average annual throughputs for all types of outlets, where, from a figure of about 4,000 gallons in 1908, a gradual increase was recorded to reach 20,000 gallons by 1919 and 36,600 gallons by 1930, but then came a decline to the 1938 average of only 24,000 gallons.[24]

The changeover from can-sales to pump-sales took many years to accomplish, even in 1929 the former accounting for 20% of the total annual consumption.[25] This share continued to decline during the 1930's, but a small amount was still being sold in cans up to the outbreak of War in 1939, but invariably, through specialised outlets . However, there

23. A motorway station was to possess at least 12 pumps, and no one company was to have more than one-third of the total number.

24. Monopolies Commission Report: Petrol. H.M.S.O. 1965.

25. Service Station. June 1940.

had been another obstacle in the way of the retailing companies' desire to concentrate entirely on pump-sales. This was the opposition to their siting along kerbsides, as they obviously presented impediments to pedestrians in towns. This concern was first expressed by the Metropolitan Police in 1917 when there were very few such pumps in use, and was adopted by most local authorities during the early and middle 1920's.[26] It was eventually resolved by the Roadside Petrol Pump Act of 1927, which allowed local authorities to permit the erection of pumps on roadsides, but on private land only, as long as an effort was made not to obstruct the pavement. Thus, in towns at least, two types of installations were permitted. These were pumps fixed to the walls of buildings, with swing-arms to reach cars at the kerbside, or pumps sited on the kerbside so as to leave a clear space between the kerb and the building. A great many such installations continued in operation into the 1970's, but later legislation has effectively reduced their numbers by now.[27] The problem was minimised outside built-up areas, as normal practice was to locate pumps several yards from kerbsides so that cars pulled off the roadway for petrol.

The later years of the 1920's saw a considerable extension both of central and local government control over petrol retailing. Up to this time, the only requirement had been the need to obtain a vendor's licence and to be able to satisfy the local authority that proper safety measures were being observed regarding the storage of petrol. Then, in 1928 came the Petroleum(Amendment) Act, which, although primarily concerned with storage requirements, gave to local authorities considerable powers to enact bye-laws regarding the siting and appearance of stations. This legislation was hardly unexpected, as throughout the 1920's, much concern had been expressed at the proliferation, in rural areas especially, "of eyesores such as tin shacks, painted in garish colours, with a multitude of display signs and advertisements despoiling the countryside."[28] This Act, which came into force in May 1929, gave to local authorities the power to reject applications for new stations if they failed to comply with certain aspects of model regulations, and the right to order the closure of existing businesses which fell short of these standards.[29] Clearly,

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26. The Times. 13.10.1923 and 9.4.1925.

27. Local authorities now have the right to close premises that have their tanks under existing buildings or under pavements.

28. Service Station. October 1928.

29. The Times. 15.5.1929 - the new regulations were printed in full.

another new departure here was the need for operators to apply for permission to erect or substantially alter a station, as this had not been previously necessary.

However, by this time, about 28,000 outlets were already in existence, so that this legislation came rather late in the day. Many stations that opened during the 1920's would not have been allowed to develop their chosen sites had they had to apply for permission to do so from their local authorities. A number of such stations have continued to the present period, occupying sites that can only be described as unsuitable, if not actually hazardous, to traffic. This aspect will be considered in the following chapter, when the development of petrol retailing in the study-area will be examined, and it will be seen at that stage that such outlets were often located at awkward cross-road junctions or sharp bends. In contrast, it will be seen that most of the outlets that opened after 1929 tended to occupy better-chosen sites.

Actually, before the Petroleum(Amendment) Act became law, retailers were being advised regarding the siting of stations. In 1927, in an authoritative trade journal, dealers were advised to avoid siting their stations on steep hills, at cross-roads, on narrow roads and sharp bends, and also near tram stops.[30] They were also told not to site on long straight sections of road where cars could move at fast speeds. The best sites were described as those which could be termed "natural stopping or slowing places, with adequate visibility, such as village centres or gentle curves on wide roads." 31
In 1928, the same journal considered that stations needed to have an adequate local catchment area, strongly stressing that motorists tended to purchase petrol at the start of a journey or at their destination, or else when slowing for a bend or stopping to eat.[32] Thus, centres of population were regarded as the best locations, as journeys would largely begin and end in such areas, and it would also be there that restaurants would normally exist. In addition, there was a need for stations along major roads outside the built-up areas, the advice being given to site

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30. Service Station. July 1927.
31. Service Station. July 1927.
32. Service Station. June 1928.

such stations in areas having some habitation so as not to have to depend entirely on casual custom. This was stressed in an earlier editorial, which stated that

"no station should be opened unless a sufficient volume of trade existed in the immediate area." 33

Sadly, however, this advice was too frequently disregarded, with the resultant over-provision of outlets throughout the country.

The increase in the numbers of outlets during the inter-war period, and more especially during the 1920's when it was much simpler to develop sites, was to a large extent a response to the increasing numbers of cars. However, the actual increase in outlets was much greater than was really required for this purpose as is revealed by the fall in average throughput per station, as was mentioned above. An important contributory factor to the over-provision of outlets was undoubtedly the desire on the part of the major companies to be represented on as wide a scale as possible. Thus, if one very small catchment area was served by a station selling mainly Shell products, a very common occurrence was for another site to be developed in which another brand such as Pratt's formed the bulk of sales. It was not until the middle 1930's that single-brand sites became at all numerous, this being in response to favourable gallonage rates being charged by the supplying companies for those dealers willing to exclusively stock their product.

By virtue of the Petroleum(Amendment) Act, Section 5, a guide was established for local authorities to frame bye-laws to regulate the position, design, size, colour and screening of petrol stations. They were also granted powers to prohibit their establishment and to require their removal, on payment of compensation, from unsuitable sites. However, very little use seems to have been made of the latter judging from the numbers that still occupy such sites at the present day. The major pre-occupation, and effect, of the bye-laws, seems to have been to improve the appearance of existing stations, as the unsightly corrugated metal sheets had to be painted in specified colours. Further, new stations from 1929 onwards had to be built of brick, stone or concrete, corrugated sheets being prohibited. This had the possibly unforeseen effect of ensuring that new stations necessitated considerable

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33. Service Station. May 1926.

capital outlay, and, as such, would require forethought regarding their siting, as no longer was it possible to erect a cheap hut to serve as a station. Thus, apart from improving the appearance of stations, this legislation resulted in more expense for the dealer and a less-indiscriminate attitude to siting in general.

Another measure of control was introduced in 1929 through the provisions of The Measuring Instruments (Liquid Fuel & Lubricating Oil) Act. This introduced the regular system of visits by the Weights and Measures inspectors of local authorities, now the Department of Trading Standards, to check on the accuracy of pumps. From the introduction by Anglo-American of the first hand-powered pump in 1920, followed a year later by Shell's use of the first British-made pump, the motoring public had been suspicious of such equipment. The combination of local authority inspections and the introduction in 1928 of the 'visible pump', and, a year later, of the first electrically-operated pump, eventually satisfied customers that pumps were indeed reliable. Further, pumped deliveries were cheaper than cans, so that, apart from convenience purchases, the latter declined in face of the growing popularity of the former during the 1930's.

The Town & Country Planning Act of 1932 consolidated all earlier legislation into one measure, ensuring that, in addition to complying with bye-laws and obtaining a vendor's licence, the applicant desiring to open a new station had to obtain planning permission from the local authority. However, this still meant that such authorities could stress different requirements, there being no national uniformity.

An improvement took place in 1935 in the form of the Restriction of Ribbon Development Act, by which an important measure of control passed from the larger number of local authorities to the much smaller number of highway authorities, these being the counties and county boroughs. From this time, apart from having to satisfy the local authority as had earlier been necessary with regard to bye-laws, the applicant now had to obtain the consent of the highway authority to establish a means of access from the road. This applied in cases where proposed buildings, including pumps, were to be erected within 220' of the middle of the road. This distance was well-chosen, as to build a station at a greater distance from the road meant not only greater expense for the purchase of land but also decreasing visibility and decreasing attraction for the motorist to leave the highway. Certainly, within the study-area, no station is situated more than 220' from the middle of the road, so that it is probable that few attempts were made to circumvent the terms of the Act.

The aims of this Act were clearly stated, being a desire to prevent interference with the free flow of traffic, the preservation of landscape amenities, and the protection from development of all land that might be required for new roads. A little later, in 1937, it was decreed that compensation could not be paid to those stations whose business was reduced as a result of road developments. Such cases would include those affected by road-widening schemes and those stranded on sections of road by-passed by new lengths of highway.[34]

Other changes, at this time, served to aid existing stations, the first, in April 1935, being the introduction of 30 m.p.h. zones in built-up areas. The effect of this was to reduce driving speeds and make it more likely that motorists would stop for petrol. This aspect will be further considered in Chapter 5 where it will be shown that stations located along sections of road where traffic can move at considerable speed are disadvantaged when compared with those located within statutory speed limits. Again, in 1936, the Petroleum(Transfer of Licence) Act established the procedure of guaranteeing a licence to a new operator when a station changed ownership. This had usually been allowed, but at least it legalised an uncertain situation and thus helped station operators in this respect.

It can, therefore, be seen that the inter-war period consisted of two separate stages of development, the first, up to 1929, being the uncontrolled spread of pump-equipped stations throughout the country, often unsightly and badly-located and, to some extent, distrusted by motorists. The 1930's, on the other hand, were characterised by a slower growth in numbers of outlets, but, in general, these later openings were properly constructed and better-located. These claims will be examined subsequently in Chapters 3 and 5, in relation to sites within the study-area. However, the inter-war period, by virtue of so much development and fundamental change, can rightly be regarded as the years in which petrol retailing in the U.K. became established as a serious marketing activity in its own right, instead of just being an appendage of other forms of businesses.

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34. Service Station. May 1937.

Another aspect of the changing structure of petrol retailing which should not be overlooked was the considerable number of new companies that entered during this period, reflecting clearly the attraction of a growing market. The return of branded petrol after the wartime situation took place in October 1919, giving a period of 20 years of intense rivalry and competition until brands once again disappeared in September 1939 on the outbreak of World War II.

This period was dominated by a small number of national companies who were the only ones supplying petrol throughout every part of the country. These were known as the major companies, and consisted of Anglo-American, Shell, B.P. (known as Anglo-Persian until 1935, then Anglo-Iranian until 1954), National Benzole, Redline-Glico and Carless.[35] The first three named companies claimed to hold almost 90% of total annual sales in the early 1920's, leaving very little to be shared amongst another 18 companies. In addition to the majors, others which had entered the market before 1914 and continued throughout the inter-war period were Burmah, Ocean, Major, Aboo, Lobitos, Dominion and Munster Simms, each of these being represented in particular regions only, e.g. Burmah in Central Scotland and Aboo in the London area.

Reference to figure 2.2 will help to clarify the rather complex sequence of entries and withdrawals that occurred during this period, but, by year of entry, the following are the companies and brands that appeared in the market to supplement the earlier entrants :-

(1) Isherwoods in the Manchester area in 1920, this firm being the forerunner of VIP, being eventually bought in 1974 by Elf.

(2) The Medway Oil & Storage Company with the 'Power' brand in 1922, this company being merged into Shell in 1934.

(3) The Texas Oil Company in 1922, having originally entered as an oil distributor in 1916 under the name 'Texaco'. The name was changed to 'Regent' in 1948, the firm later separating into 2 companies, Texaco and Chevron, in 1967.

(4) The Western Petroleum Company in 1922, this company withdrawing from the market in 1932.

(5) The Sinclair Union Petroleum Company in 1923, this firm going into liquidation in 1940.

(6) The Albion Oil & Petroleum Company in 1924, this company withdrawing from the market in 1932.

(7) Russian Oil Products (ROP) in 1924, a subsidiary of the Russian government. This company practised price-cutting, selling at about 1p. per gallon below theprice of major company products. By 1928, its policy had gained it fourth place with about 6.5% of the market. It was merged into Regent in 1948.

35. It is probable that these companies had been 'agreeing' prices since 1928. Monopolies Commission Report. op. cit.

(8) Watson's Petroleum, in the London area, in 1925, this company continuing until 1939.

(9) Bowring Hardy in 1926, this company later becoming Stevinson Hardy and retailing the 'Trolene' brand until its withdrawal from petrol retailing in 1970.

(10) Trinidad Leaseholds in 1926, marketing 'Trinidad'. This company introduced the brand 'Regent' in 1930 on acquiring the business interests of Burt, Boulton & Haywood, and was merged in 1948 with the Texas Oil Company.

(11) Sealand Petroleum in 1926, continuing until 1959, although bought by National Benzole in 1933.

(12) Universe Petroleum in 1926, this company going into liquidation in 1940.

(13) Cities Service Petroleum in 1927, marketing the 'Citex' brand, and bought in 1939 by Petrofina of Belgium.

(14) Ace Petroleum Company in 1927, marketing 'Ace of Spades', and continuing until 1939.

(15) The Ragosine Petroleum Company in 1927, marketing 'Achilles', and continuing until 1939.

(16) The Cleveland Petroleum Company in 1928, which followed a price-cutting policy so successfully that it was able to obtain representation throughout England and Wales by 1930. It was then incorporated into Anglo-American during that year, although the 'Cleveland' brand was not withdrawn until early 1973.

(17) The Aero Petroleum Company in 1929, who continued to market 'Aero' until 1965 when the company was incorporated into the Atlantic Richfield Group.

In addition, there were several very small-scale companies supplying a limited number of outlets in particular localities, such as Emco and TOPin South London, but, apart from these, there were at least 29 companies concerned in the marketing of petrol in the U.K. All of these companies had entered the market by 1929, a noteworthy feature being that not one company entered during the 1930's, apart from some very small local brands.[36] One reason for this is that the growth in annual consumption from 1930 onwards was very slight, another pertinent factor being the greater difficulty involved in the opening of new stations. As for existing stations, a great majority would already have been dispensing two or more separate brands, so that there may have been little incentive to stock further brands, especially as supplying companies were beginning to offer gallonage rate reductions to those dealers prepared to sell one brand only.

36. see figure 2.2.

In fact, the 1930's were years of contraction in so far as the numbers of suppliers were concerned. Anglo-American bought Cleveland to add to its 1924 purchase of Redline-Glico, Shell-Mex bought Power in 1934, and National Benzole bought Sealand in 1933. Also, Trinidad Leaseholds formed a close association with The Texas Oil Company in 1930, the two companies jointly marketing under the 'Regent' brand until 1939. In April 1935, Anglo-American changed its brand name from Pratt's to Esso, having earlier, in 1931, declined a take-over from the Shell Group.

With regard to the price of petrol during the inter-war period, the era commenced with a gallon costing 19p. to the customer, which despite a recommendation by the Government Petrol Committee that it should be reduced to 14p., actually increased in August 1920 to 21p. as is indicated in figure 2.3. A reduction of 2.5p. per gallon took place in January 1921 due to the removal of tax, this being followed by a number of company-inspired reductions to give a price of 14p. by August 1921. Following the entry of cheaper Russian petrol in 1924, accompanied by a substantial number of new entrants, many of them engaging in price-cutting activities, prices fell to under 7p. by April 1928. Even the re-introduction of tax, at about 1.5p. per gallon at that time, did not cause any price change, the competitive nature of the market probably restricting any possible increase. Successive tax increases to 2.5p. and to 3.3p. per gallon in April and September 1931 respectively still did not lead to any increase, the next rise not taking place until September 1939, and that only took the price of a gallon of premier grade to 7.5p.

Although, by 1928, the major or national companies together with the largest of the regional or independent companies, were following a form of 'gentlemens agreement' regarding prices, the activities of many local companies in cutting prices probably kept prices down when otherwise they would undoubtedly have risen. The re-introduction of tax after 1928 helped the smaller companies to undercut the majors, and thus effectively prevented the latter from increasing their prices. Actually, in 1929, an agreement had been concluded between the major companies to restrict the numbers of stations supplied by each of them in relation to the numbers that they had been supplying in 1928. This could have been a significant cause of the slower growth in the numbers of outlets during the 1930's, as the smaller companies lacked the capability to expand to any great extent. Throughout the inter-war period, the dealer received on average about 1p. per gallon sold, irrespective of the actual price charged to the motorist, so that petrol retailing at that time enjoyed what was probably its most profitable period.

In summary, the inter-war period had seen both the emergence and consolidation of petrol retailing as a serious and viable business enterprise in the U.K. By the end of the era, in 1939, there were some 22 competing companies supplying about 35,000 outlets in all, these stations being subject to a considerable amount of control by the local authorities. Even at this time, however, at least 85% of all stations were split-sites, selling several competing brands, meaning that the major companies were certainly represented at far more sites than at any time since.[37] Out of 35,000 outlets in 1938, the Esso brand was being sold at 13,344 stations, yet only some 1,500 of these stocked only that brand. This situation was to change dramatically during the early 1950's when brands made their re-appearance after the war years and the resultant period of rationing.

37. Bull, G. op.cit.

Phase III : 1939-1950 : The Years of Austerity

As soon as World War II commenced, restrictions on the sale of petrol were introduced. In contrast to World War I when rationing was delayed for three years, immediate arrangements were made for its distribution under wartime conditions. Clearly, very much more petrol was being consumed by 1939 when compared with the 1914-1917 era, but the main difference was that military demands for petrol would obviously be much greater during the Second World War.

On September 4th 1939, the Petroleum Board, consisting of the major companies, was formed to arrange the most equitable system of distribution for civilian usage. There was to be no competition between the companies, and prices were fixed by the Ministry of Fuel & Power at 9p. per gallon from December 1939, this continuing to June 1948. Only one grade of petrol was available, namely 'Pool', and, from September 16th, each private vehicle was allowed sufficient petrol for 200 miles per month, actual amounts varying according to engine capacity. Rationing continued on this scale until its complete withdrawal in July 1942, from then until June 1945 only being available for essential car-usage. These measures had the desired effect of reducing the numbers of licensed private cars from just over 2 millions in 1939 to 717,500 by 1943, but such a result clearly led to hardship amongst dealers.

Whereas income from pre-war petrol sales had never been large, a margin of 1p. per gallon represented a reasonable return, certainly on the average annual station throughput of 24,000 gallons. However, once rationing was introduced, sales were obviously greatly reduced, with a resultant fall in dealers' incomes. Although many outlets closed during the first two years of war, those that remained suffered greatly as many cars were laid-up and there was a corresponding decline in repair work. Under the terms of The Defence(General) Regulations of 1940, the number of outlets remaining open was reduced to the minimum necessary. Although causing some inconvenience to customers even in a curtailed market, this action re-inforced the belief that there had been too many stations in existence. A further unpaid task of the dealer was the collection of petrol ration coupons, with severe penalties for errors, thus the continued viability of stations became somewhat precarious.

Although there were no increases in petrol prices after December 1939 for the duration of the war, costs of motoring escalated due to higher vehicle taxation. To partially compensate for reduced sales, dealers were granted an extra 0.3p. per gallon from January 1940. It is certain that many dealers would have become bankrupt had it not been for the large number of closures due both to government action and the mobilisation of personnel. By the end of the war, the number of surviving outlets totalled 28,000, a number that had originally been exceeded in 1930, the numbers of private vehicles also being similar to the total for that year.

As soon as the war ended, the basic ration of petrol was restored on the scale previously available during the period up to July 1942. The allowance was further increased in September 1945, making it possible for a motorist to drive up to 400 miles per month, but only the one grade , 'Pool', could be purchased. On the dissolution of the Petroleum Board in June 1948, the major companies reverted to their earlier agreement of 1929 regarding the numbers of stations that they could each supply.[38]

Although it had been expected that brands would re-appear after the abolition of the Petroleum Board, this did not take place due to a government decision against the extra cost and loss of quantity involved in refining a petrol of superior quality to 'Pool'. However, from March 1949, the ration was doubled to allow some 800 miles per month, de-rationing finally taking place in May 1950, unfortunately coinciding with a price increase to 15p. per gallon due to an extra 4p. duty being placed on petrol. That the last period of rationing offered an adequate amount is suggested by the fact that consumption rose by only 10% following the abolition of rationing. At this time, although each company supplied the same petrol at the same price as all other companies, a measure of competition re-appeared in terms of the service offered at stations. Each company was free to try to increase its market share with the 'Pool' grade, so that, apart from a lack of individual brands, for the first time since 1939 the situation was rapidly nearing normal business conditions once more.

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38. Anglo-American had to shed business as a result, being allowed to supply only 13% of all stations instead of the 19% that it had managed to recruit. The agreement was terminated in 1949, when a return to free trading took place.

The only new entrant into the market during this period was Fina in 1946, although it only shared in the distribution of 'Pool'. It had actually purchased Cities Service Petroleum in February 1939, so that perhaps it should really be seen as a pre-war entry despite the fact that it had not developed under its own distinctive livery before the outbreak of war. Clearly, it was hardly surprising that new companies did not appear during the immediate post-war years as rationing continued until May 1950.

The immediate post-war years, as stated above, saw increases in the allocation of petrol for private vehicles, and, with the rise in car-usage and the demobilisation of personnel, came renewed openings of stations. The number of outlets rose to 29,600 in 1946, this trend showing every sign of continuing its upward curve. However, concern about the growing number of outlets, bearing in mind their over-provision during the 1930's, led to a government investigation under the auspices of the Ministry of Transport. A Committee was appointed in February 1947 to consider and report, as speedily as possible, with regard to the following :-

(a) the technical considerations which should govern the number, capacity and distribution of petrol stations in urban and rural areas ;

(b) the minimum standard of service which stations should be required to provide, e.g. times of opening, stock, etc. ;

(c) whether stations should be divided into classes corresponding with defined standards of service, and, if so, the approximate proportions in which each class should be divided in urban and rural areas.

The Waleran Report, as it was known, was published in 1949, and, whilst only briefly considered at this stage, will be further examined in the following chapter.[39] It was hoped that the Report would serve to guide local authorities when considering applications for new stations, and whilst this was indeed so, the main recommendations were not adopted. However, the Report reveals that there was an awareness regarding the danger of establishing too many stations, and equally, a growing desire that new outlets should be opened only in locations where there was a real need for extra facilities. It was realised that many unprofitable outlets had been abandoned during the 1920's and 1930's, and there was little alternative use for such sites, especially in rural areas.

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39. Ministry of Transport. Report of the Technical Committee on Petrol Stations. H.M.S.O. 1949.

The principal recommendations embodied in the Waleran Report concerned the need to define categories of stations, according to facilities and service offered, and to suggest that licensing and planning authorities should consider the type of road alongside which a proposed station was to be built. In this fashion, it was recommended that only Grade I stations, equipped with at least 4 pumps and having a large waiting-space and adequate visibility from the road should be allowed to be developed on Trunk and Class 1 roads. However, stations of Grades II and III could be allowed on such roads if traffic was exceptionally light. The Report was further concerned with the frequency of particular grades of stations along each type of road, recognising differences between urban and rural areas, but came to no firm conclusion except to suggest that, unless local authorities were satisfied that a real need existed, permission for development should not be granted.

To some extent, the Waleran Report was re-iterating some of the provisions of The Town & Country Planning Act of 1947, which was also concerned with the frequency of stations along the highway. Embodied in this Act was the ruling that, outside built-up areas, no more than one station should be allowed on each side of the road every 5 miles, or 8 kilometres, but it will be left to the following chapter to consider whether this became the practice of local authorities when granting permission for development.

The 1947 Act replaced the earlier Town & Country Planning Act of 1932 and The Restriction of Ribbon Development Act of 1935, and in fact simplified the procedure involved in trying to establish a new station by allowing one application to be made in respect of planning and building permission from the county or county borough highway authority and the local authority respectively. This made for greater uniformity of treatment throughout the country, and also allowed the higher authority to view the proposal in its overall setting within a specified area, also paying attention to existing stations in neighbouring authorities. The Act further restricted potential sites by prohibiting the siting of stations at or near road-junctions or where visibility was seriously impaired, although no power was granted to order the removal of existing stations contravening these requirements.

The only acceptable sites from this time onwards would be those situated well away from the roadside, having two access points, viz. entry and exit, an adequate waiting-space or forecourt, and not be located along roads where there were likely to be widening schemes in the foreseeable future. Again, a consideration of the results of these enactments will be delayed until the next chapter, but it is interesting to recall that the trade itself was advising dealers along these lines as long ago as the late 1920's.

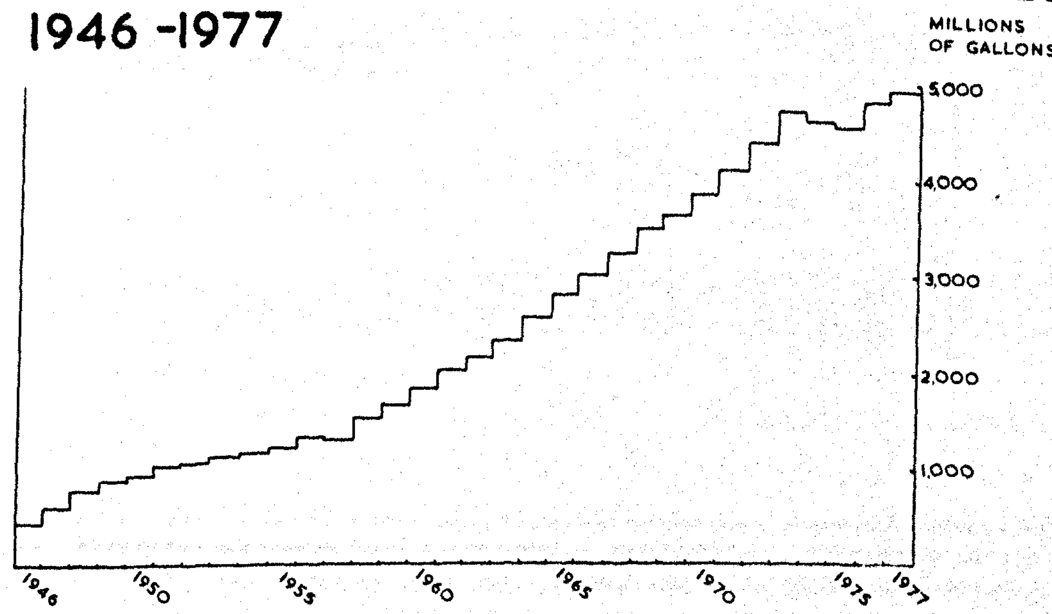
By the end of the 1940's, the scene was apparently set for the further expansion of petrol retailing in the U.K., all the indicators showing an upward trend. These included not only annual consumption of petrol, but also numbers of outlets and numbers of vehicles, and, within a few years, the return of branded products followed by an increasing number of new company entries into the market. Thus, it could have been surmised at that time, a period very similar to the 1920's was about to commence, but, whereas it did indeed prove a period of expansion, it was not to be another 'Golden Age' as the earlier era had been for the trade.

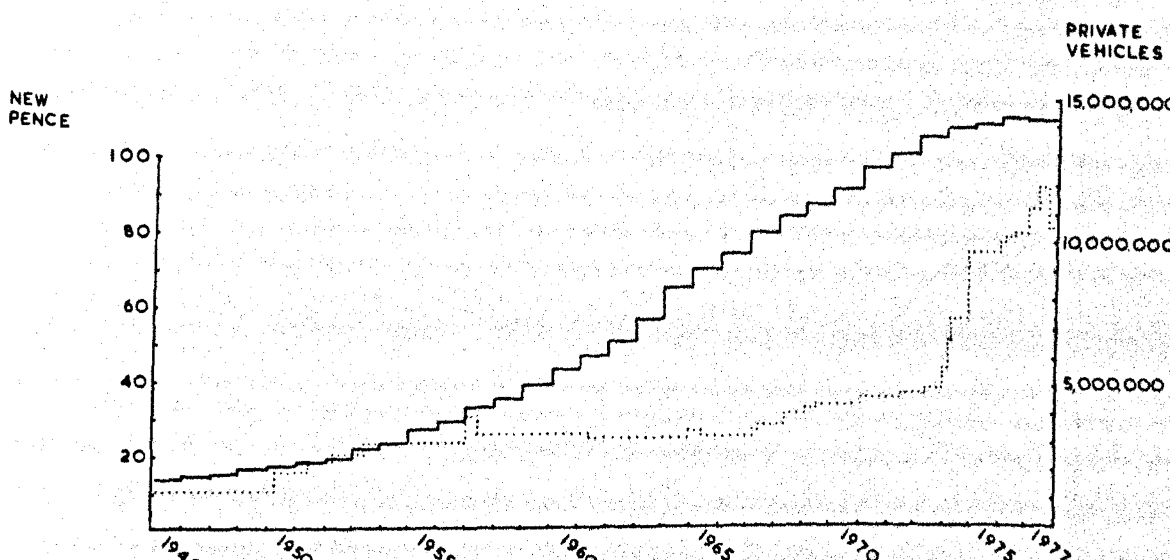
Phase IV : 1950-1965 : The Years of Expansion.

The numbers of private vehicles had been steadily increasing, and annual consumption, although somewhat more erratically as figure 2.4 reveals, had been on an upward trend since 1945. Also, an increase was again taking place in the number of outlets, as figure 2.5 indicates, this rising from 28,000 in 1945 to 34,000 in 1953, and continuing to reach 36,000 by 1960 and 38,500 in 1965. Although total numbers grew to about 40,000 in 1967, an important source of reduction had begun from 1965. In terms of annual averages, station throughputs had climbed from 31,000 gallons in 1950 to 39,000 gallons in 1955, 51,000 gallons in 1960 and 73,000 gallons in 1965. Since then, mean values have doubled in ten years, to a considerable extent due to the fall in the number of outlets whilst annual consumption continued to increase. Again, during this period, many large new marketing companies have entered the market, emphasising its claim to be regarded as a time when petrol retailing was expanding smoothly and profitably. Whereas, in 1953, when brands were re-introduced, there were only 9 companies that supplied more than 100 stations each, by 1965 there were 23 such companies. Since 1965, with one exception, entrants have been on a local or regional scale only. Thus, 1965 can be regarded as a suitable year to mark the end of an important era im petrol retailing, namely one of continuous expansion.

The first important development of this era was the introduction in 1950 by Anglo-American, which later effected a change of name to Esso in 1951, of the 'solus system', already pioneered in the U.S.A. Every other major company followed its lead during the next year, effectively establishing control over retail outlets without actually owning them. This was a natural development of the mid-1930's attempt to discourage the continuation of split-sites. Each company, following Esso's lead, tried to persuade dealers to stock their own products only, giving cash incentives in the form of gallonage rebates to those prepared to sign contracts undertaking to exclusively sell that particular brand for a minimum period of 5 years. Further incentives included low-interest and sometimes interest-free loans so that dealers could improve their premises. Such a contract appeared attractive to many dealers as it would mean not only a reduction in accounting and less-frequent deliveries, but also the availability of help and advice

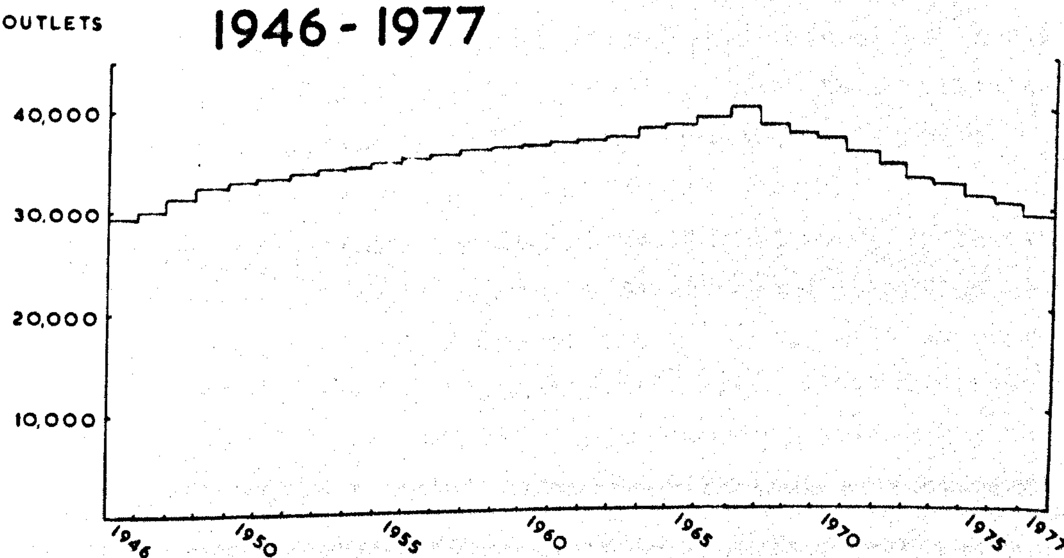
FIGURE 2.4 ANNUAL CONSUMPTION, PRIVATE VEHICLES & PETROL PRICES 1946-1977

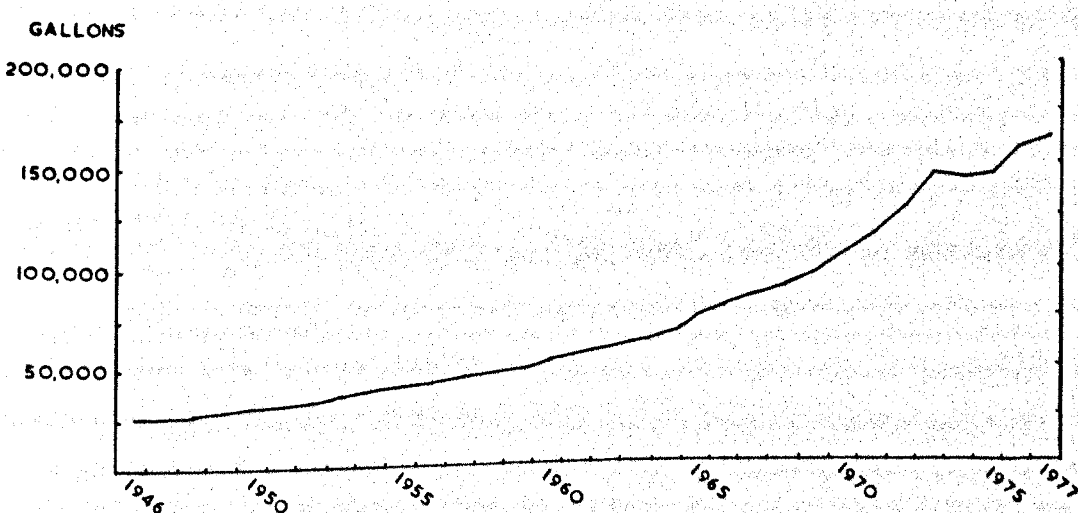




(Sources: annual consumption and prices obtained from records maintained by the Institute of Petroleum ; vehicle numbers from Basic Road Statistics)

FIGURE 2.5 NUMBERS OF OUTLETS & MEAN STATION THROUGHPUT 1946 - 1977





(Sources: compiled from statistical material held by the Institute of Petroleum) from specialists employed by the supplying company. From the viewpoint of the latter, apart from effecting a saving in delivery costs, such contracts assured them of an outlet for their petrol for a guaranteed length of time, many of them having invested heavily in refining capacity during the post-war period. By November 1951, such was the attraction of this new arrangement that 20,000 stations had voluntarily entered into solus contracts.[40]

It should be stressed that petrol companies had never sold directly to the public in the U.K., but had from the earliest years supplied private dealers, who, in turn, sold petrol to motorists. This had always been the case, the only exceptions having been a small number of Anglo-American stations serving commercial vehicles during the inter-war period. From the early 1950's, a considerable change in the structure of retailing was therefore taking place, with an ever-increasing number of dealers entering into solus ties with particular companies. Clearly, such a contract need have been for no more than the supply of that company's brand of petrol to the dealer, who, in turn, agreed not to handle products from other companies. In practice, however, solus agreements gave the companies considerable powers to direct the affairs of dealers, extending occasionally to the right to set times of opening and closing, as some solus contracts included clauses governing the amount of petrol to be sold in a given number of years.[41]

Notwithstanding the loss of their freedom in this manner, by 1954 more than 90% of all stations were either bound by solus contracts or sold one brand to the exclusion of all others.[42] Thus, a very great change had been effected during the early 1950's to give a situation in which the petrol companies had gained a very large measure of control over retail outlets, almost all of which sold one brand only. Also, during this era, companies had actively sought to recruit stations to their brand, and, as solus agreements were to run for a minimum period of 5 years, and usually for considerably longer, very few stations changed their brand before the late-1950's in spite of the entry of a number of new suppliers in search of outlets.

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40. The Times. 24.11.1951

41. Monopolies Commission Report : Petrol, and information supplied by Petroleum Retailers' Association (P.R.A.).

42. Service Station. January 1954.

A survey, conducted at that time, revealed that 81% of private motorists were in favour of split-sites, but certainly the companies preferred the more-economic delivery system and degree of control inherent in one-brand outlets.[43] Clearly, it was the companies that had their way in this matter, as within ten years there were virtually no split-sites left apart from the special case of motorway service areas.

The return of branded petrol in February 1953 strongly encouraged the trend to single-brand solus sites, as it marked the end of trading restrictions and a return to free competitive marketing. Each major company introduced a premium grade of petrol whose price was not controlled by the government, as was the price of the cheaper standard grade which replaced 'Pool', although being very similar to it in terms of quality. Sales of the premium grade increased rapidly, within two years accounting for more than a half of all petrol sold through stations.[44]

This was a difficult period in financial terms, with margins never exceeding 1.5p. per gallon. However, a solus station qualified for a rebate from the supplier of the order of 0.25-0.50p. per gallon. In addition, the larger companies offered a volume rebate for stations able to take sizeable deliveries, this adding another 0.25-0.50p. per gallon for those receiving 'drops' in excess of 1,500 gallons. At a later stage, many companies introduced a surcharge for deliveries below this amount. However, at this time, it was possible for a dealer to be making a gross profit per gallon of up to 2.5p., depending on station throughput, which, in 1953, averaged some 35,000 gallons.[45] Such an average outlet would have made a profit of some £875 on petrol sales alone, but after deducting necessary items such as labour and lighting which could between them account for about £300 at least, this did not leave a great amount for the dealer. As a result of this situation, and the active encouragement of the companies who saw a way to extend their control over retail outlets, many dealers sold their stations to the suppliers and then leased the premises, thus continuing as tenants of the petrol company. This system was becoming fairly common

43. Motor Agents and Manufacturers Association survey. The Times. 18.6.1956.
44. Service Station. December 1955.
45. Monopolies Commission Report : Petrol.

by 1955, and within 10 years, the number of company tenants had reached about 5,000 or 13% of the total number of outlets. By December 1977, 30% of all stations were in company-ownership, a total of some 8,845 in all, but, significantly, they were believed to be selling rather more than 50% of the total amount of petrol sold through retail outlets.[46] If this was so, and it seems probable, it suggests that the companies had bought wisely by concentrating their investment on the higher-gallonage sites.

Accompanying the growth of tenancies was a smaller-scale, but highly-significant, move towards company-managed stations. The first of these was opened by Shell in Reading in August 1955, at the time being described by the company as a 'model station' at which new techniques and methods could be appraised.[47] Although opposed by the Motor Agents Association, the leading trade body, in view of the fear of company-domination in a market that had traditionally been the preserve of private dealers, Shell claimed that new stations were indeed required as there had been significant changes in the distribution of population since stations were originally established. This was undeniable, the great expansion of suburban population having occurred during this period, and, to some extent, being due to the growth in car ownership. Whether or not it was apparent at that time, in the mid-1950's, company-managed stations were eventually to account for a much greater proportion of petrol sales than their numbers would imply. By 1975, although only some 3,000 stations, or 10% of the total, were directly operated by the companies, they accounted for some 55% of annual sales.[48] This again, like the solus system, was a development first introduced in the U.S.A., but although it gave further control of the market to the suppliers, over the next two decades many improvements were introduced into petrol retailing through the company-managed stations.

This period commenced with a fairly small number of companies sharing the British market. Dominating the scene were Shell, B.P., National Benzole, Power, Esso, Cleveland and Regent, who, in 1953, together accounted for 93% of annual sales, as is shown in figure 2.6.

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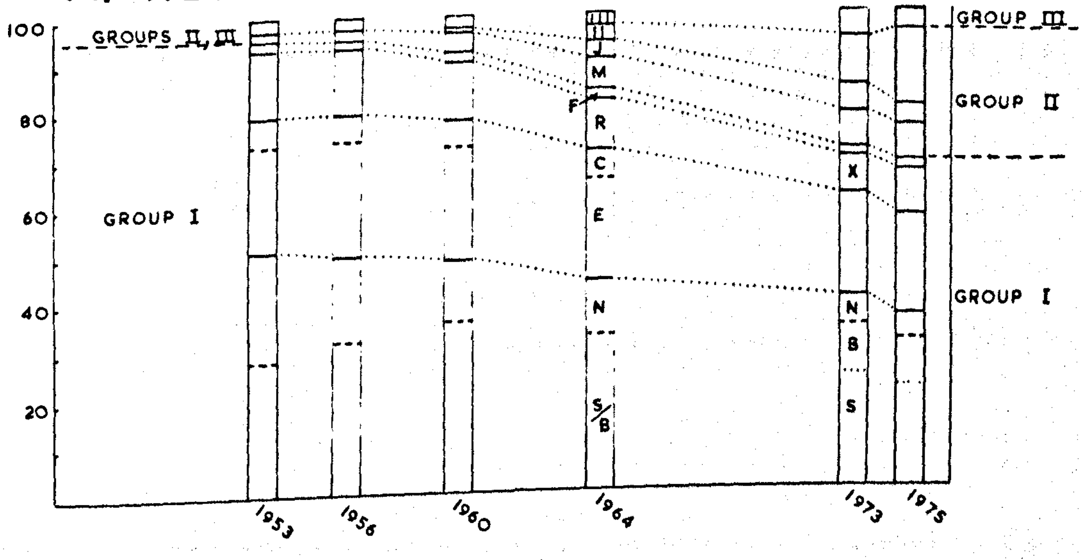
46. Petroleum Review. March 1978.
47. Service Station. December 1954 and September 1955.
48. Petroleum Review. March 1976.

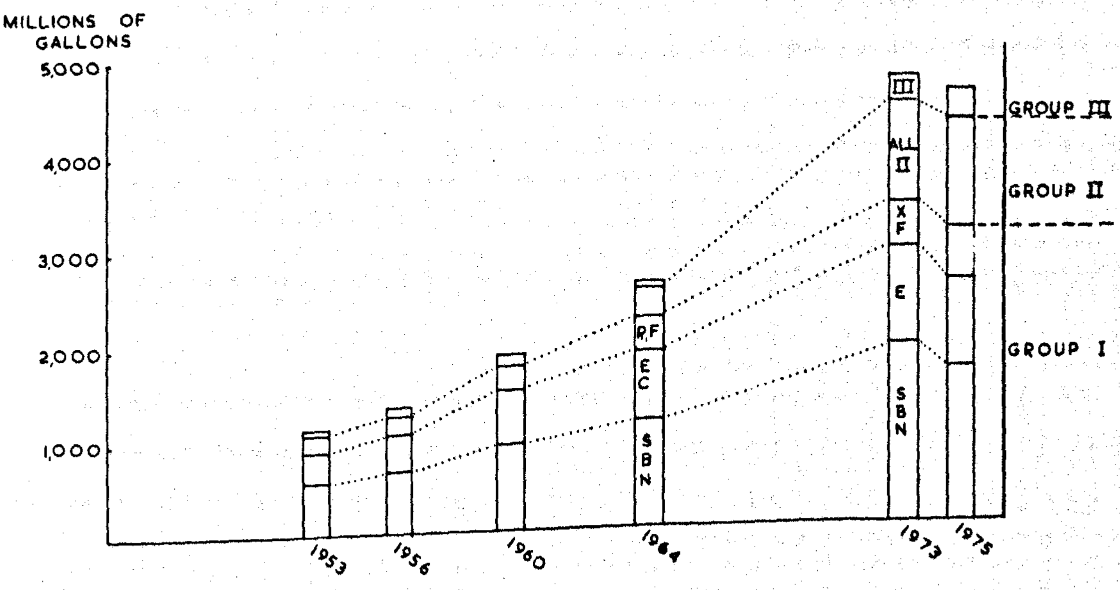
FIGURE 2.6 MARKET SHARES

A. RELATIVE



S. SHELL. B. B.P. N. NATIONAL. E. ESSO. C. CLEVELAND. R. REGENT. X. TEXACO.
F. FINA.
M. MOBIL. J. JET. II. OTHER GROUP II BRANDS. III GROUP III BRANDS.

B. ABSOLUTE



(Sources: this figure is based on a number of sources, including the Monopolies Commission Report of 1965, press reports and information supplied by actual companies)

This situation was to change greatly by 1965, the total share of these companies having fallen to 82%, although in relation to a larger annual consumption. Such a change was achieved by the arrival of a number of new entrants, some of whom were subsidiaries of large international groups, others being aggressive price-cutters. The full list of entrants during this period is as follows :-

(1) Mobil in January 1952, this company importing petrol from the U.S.A. until its refinery at Coryton came 'on stream' in July 1953. Mobil had been in this country since 1886, but had not retailed petrol before 1952, having concentrated on lubricating oils.

(2) Jet in February 1955, originally only in Yorkshire, but gradually moving into the Midlands as an aggressive price-cutter. Jet was purchased by the Continental Oil Company (Conoco) in May 1961, by which time it had achieved a total of 400 outlets.

(3) Nafta in 1959, like the pre-war R.O.P., a subsidiary company of the Russian government. This company, although a price-cutter, remained small, never exceeding 150 stations.

(4) Gainsborough in 1960, eventually reaching a total of 280 stations in 1969 when it was bought by the Atlantic Richfield Group.

(5) Total, a French company, in December 1960. This company expanded to 800 stations by September 1974 before buying the Atlantic Richfield Group's 450 outlets.

(6) Curfew in 1961, in South-east England only. The chain consisted of 135 stations when Curfew was bought by Burmah in February 1968.

(7) Octane in August 1961, a small localised price-cutter in the London area, eventually bought by VIP in May 1963.

(8) Murco in June 1962, which grew rapidly to reach 590 stations by 1970.

(9) Gulf in October 1962, this being its first entry into the retail petrol market, although it had been in this country since 1928 when it purchased Silvertown Lubricants Ltd.

(10) Agip, a subsidiary of the Italian E.N.I. state-owned company, in February 1963. Agip was bought by Esso in 1965 by which time it had grown to 82 outlets.

(11) European Petroleum (E.P.) in May 1963, a price-cutter confined to the London area. It was purchased by Murco in 1970 by which time it had expanded to supply 458 outlets, many in the Midlands.

(12) Conoco in November 1963, under its own separate livery, although having owned Jet since May 1961. In contrast to Jet, the Conoco stations were not price-cutters, but the brand was withdrawn in 1971 when only 23 stations were being supplied.

(13) Amoco in January 1964, having originally appeared in July 1962 on the acquisition of Vigzol, an oil distributor.

(14) Gem Petroleum, distributing the Apex brand, in December 1964. This company was a price-cutter, and was taken over in 1969 by Burmah who continued to distribute through Apex stations, all of which are company-owned and company-operated.

(15) Imperial Chemical Industries (ICI) in April 1965, on Teesside, but any dealer wishing to sell this brand, which could undercut the major companies by about 2p. per gallon, had to collect supplies from the refinery. By June of 1965, ICI was distributing to dealers within a 100-mile radius of Teesside, but since then has been delivering throughout the North and the Midlands. The brand name was Imperial from 1965 to 1970, since then being known as ICI.

(reference to figure 2.2 would help to clarify the sequence of entries, withdrawals and mergers mentioned above.)

In addition to the above entrants, a number of other changes concerning established companies occurred during this period, these including the assimilation of National Benzole into the Shell-B.P. Group in 1957, this marking the end of the Power brand which had been sold by National Benzole since the return of brands in 1953. However, the latter brand continued on offer, but, following the separation of Shell and B.P. in January 1976, as a subsidiary company wholly-owned by B.P. Burmah bought Lobitos, a company that had retailed petrol since 1908, in 1962, but continued with the Lobitos brand until its withdrawal in 1969. Isherwoods, which had been retailing petrol to dealers since 1920, changed its name to VIP in 1960, and was then bought by Signal Oil & Gas in 1964. The chain was later bought by Occidental in 1968, who, in turn, sold the 550 VIP stations to Elf in December 1974. In spite of all these changes of ownership, the VIP brand was retained from 1960 until its changeover to the Elf brand in April 1976.[49]

That this period was one of expansion is emphasised by the number of companies that entered the market, during the early 1960's especially, as is revealed in figure 2.2, but of equal significance is the fact that many of them were subsidiaries of world-ranking firms. Of the new entrants, both Mobil and Gulf were parts of the seven largest oil companies in the world, and many of the others, such as Murco and Total, also belonged to groups that controlled every aspect of petroleum from the production of crude to the marketing of products. Some of these entrants subsequently established refineries in the U.K. to add to those already operated by the older companies, with the result that, like these, they also followed a policy of acquiring company-owned sites.

49. The above information has been gleaned from a variety of sources, including The Times, Service Station and Petroleum Review.

As most of the entrants offered their products at prices similar to those of the major companies, their initial success in entering the market must have been due more to careful site-selection and advertising than to price-cutting. During the early 1960's, especially, there was a world surplus of crude oil and a Western European surplus of refining capacity, so that the U.K., at that time the third largest national market in the world after the U.S.A. and Canada, was an attractive venue for the retailing of petrol. Another factor that helped new entrants to gain a foothold in the market was that many solus contracts, originally signed for a period of 5 years or more between 1950 and 1957, were approaching their renewal dates. The average length of such contracts had been 7 years, so that it is not coincidental that the period of greatest activity in terms of new company arrivals was between 1960 and 1964. Many new companies were able to recruit dealers who had previously sold the longer-established brands, possibly by offering more attractive delivery and volume rebates.

Not all of the entrants fell into the above category, many of them being much smaller and also lacking their own refineries. It was the existence within Western Europe of the already-mentioned surplus refining capacity that gave these companies the opportunity to compete with major groups possessing the whole range of facilities. Such companies were able to purchase petrol in bulk in Rotterdam, particularly, but also in West Germany and Italy, and import it into the U.K. to supply relatively small numbers of stations, preferably fairly near to the point of entry. Amongst this group were Curfew, Octane, E.P. and Gem (Apex), not one of which ever supplied more than 150 stations each, and that in a localised part of the country. It is unlikely that the activities of these very small groups would have influenced the policies of the major companies to any appreciable extent, as each of these larger brands were being sold at upwards of 1,500 outlets each in 1960. However, the presence amongst the price-cutters of the Jet company caused more concern, as this, from its introduction in Yorkshire in 1955, had spread throughout Northern England and the Midlands by the time of its take-over by Conoco in 1961 to supply about 400 stations in all. Its purchase by Conoco considerably strengthened its competitive position, as the U.S.-based company possessed producing wells in Libya, so that Jet no longer had to rely on bulk purchases of petrol from West Germany. From a 1% share of the 1960 market, with 400 outlets, Jet increased its sales to 3.5% of the country's annual consumption in 1964, supplying a total of 650 stations.

With regard to market shares during this expansionary period in the development of petrol retailing in the U.K., as has been stated earlier, during the early 1950's the scene was dominated by the major companies. The changes from 1953 to 1965 are shown in figure 2.6, the most striking feature being the decline of the Shell-B.P.- National Benzole Group from 51% to 44% of annual sales during this period. The Esso-Cleveland Group seems to have maintained its share throughout this time, but Regent fell from 14% to 11%. Fina, again, held its place, actually recording an increase from 2% to 2.5%, but, most significantly, two new entrants, Mobil and Jet, made considerable inroads by gaining 6% and 3.5% respectively of the 1965 market total. A further consideration of market shares, numbers of stations and average throughputs will be made later in this chapter, and it will be seen then how much variation exists between the performances of different brands.

During the period 1950 to 1965, a very great increase occurred both in the numbers of private vehicles and in annual consumption of petrol, as figure 2.4 will indicate. This will serve as a reminder that this period was indeed one of expansion, although the increase in private cars and vans was a progressive one. From 2.25 millions in 1950, it took eight years to double numbers to 4.5 millions, but only another seven years to again double the numbers to 9 millions by 1965. In addition, numbers of 2-wheeled vehicles rose from 0.75 million to 1.7 million in the same period. Clearly, demand for petrol in this situation had to increase, the total sold through retail outlets in 1965, approximately 2,800 million gallons, being almost twice as great as the 1950 total of 1,500 million gallons. This was not as great an increase as could have been expected in view of the four-fold growth in private vehicles, and must be partly explained by an increase in general motoring costs and also partly by an increase in the numbers of 2-car families, this being a case where annual mileage could not be expected to double. In fact, average annual mileage rose from about 6,500 miles in 1950 to 8,000 miles in 1965, whilst average petrol consumption per vehicle decreased at some 2% to 2.5% per year.

Reference to figure 2.4 will reveal that the price of petrol almost doubled between 1950 and 1965, rising from 15p. to about 26p. per gallon, and, for the four months from December 1956 to April 1957, standing at 30p.[50] The duty increased from 50% of the 1950 price to 63% of the 1965 gallon. During the late 1960's, tax was to continue to increase, this naturally being a government decision and owing nothing to the wishes of the retailing companies. In fact, between 1950 and 1965, the actual cost of the petrol alone, less duty, only rose from 7.5p. to just under 10p. per gallon, and of this amount, 1p. was accounted for in extra dealers' margins. It is, thus, fair to regard this period as one in which the retailing companies did not seek to raise prices, but much of the credit for this situation should go to the continued existence of a world surplus of petrol, and also to the activity of the price-cutters in the British market. The latter group, by capturing about 7% of the annual consumption by 1965, more or less ensured that the majors had to keep prices as low as possible or suffer a greater loss of their market shares. One way in which the major companies responded to the activities of price-cutters was through the adoption of trading stamps, introduced on a small scale in early-1964, but used very widely in the late 1960's and 1970's.

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50. Higher prices were in operation during the Suez Crisis. Information regarding prices has been obtained largely from leaflets published by the Petroleum Information Bureau.

Phase V : 1965 onwards : The Period of Rationalisation.

The various companies engaged in petrol retailing, at present or recently active, can be subdivided into three groups according to their (a) dates of entry into the market, (b) sources of supply, and (c) apparent marketing policies. This subdivision is shown in table 2.1, which also reveals a number of characteristic features which further distinguish each group. The first group, the majors, includes the companies present in the British market before the withdrawal of brands in 1939, and which, by 1953, when brands re-appeared, had their own refineries in the U.K., thus having an assured supply of petrol. Originally, these companies had been prepared to supply any outlet in order to achieve and maintain maximum representation, but such a practice is no longer followed.

The second group consists of companies that have entered the British market since 1953 and who have subsequently established refineries either in the U.K. or elsewhere in Western Europe.[51] Without exception, these are subsidiary companies of large international oil groups, whose marketing policies were geared to concentrating on moderate numbers of high-gallonage stations rather than trying to obtain as many outlets as possible. This will be further considered in Chapters 3 and 5.

In marked contrast, the third group consists of independent companies without their own refining capacity. Each of these firms must buy petrol from the Rotterdam 'spot market'[52] or else from members of the first two groups. As such companies have no concern with the high-risk element of the oil industry, namely exploration and production, they exist entirely as retailers, but with the advantage of being able to buy their stocks at wholesale prices. As a result, they have often been able to undercut other brands in the retail petrol market, although they have for long performed a useful service to the refining companies.[53]

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51. The post-war economic revival of Western Europe had been accompanied by an increasing demand for fuel oil, this having been met by the establishment of oil refineries, which, in turn, led to a surplus of petrol.

52. This surplus of petrol, mainly in Rotterdam, the centre of refining capacity in Western Europe, is generally available for sale.

53. The refining of crude oil results in varying proportions of petrol, generally more than the amount required by that company itself. It is, therefore, useful to have other firms prepared to buy some of this product.

Table 2.1 : Some characteristic features of the retailing companies, 1977.

Brand.	(1) Number of outlets.	(2) Mean Throughput.	(3) Percentage of Total Outlets.	(4) Total Sales.	(5) Index.	(6) Percentage of Company-owned sites.	(7) Self-serve sites.
Shell	6450	161,165	21.9	21.1	0.96	25.7	12.8
Esso	6305	157,840	21.5	20.2	0.94	24.8	12.6
Texaco	2225	199,278	7.6	9.0	1.18	44.0	14.8
B.P.	3198	149,431	10.9	9.7	0.89	24.3	14.2
National	2102	126,563	7.2	5.4	0.75	22.0	11.0
Fina	1057	125.845	3.6	2.7	0.75	29.0	15.0
Group I	21337	157,239	72.7	68.1	0.94	26.9	13.1
Mobil	1336	258,130	4.5	7.0	1.56	49.1	35.9
Jet	813	224,212	2.8	3.7	1.32	40.2	16.8
Elf	554	248,998	1.9	2.8	1.47	24.4	26.2
Total	900	273,700	3.1	5.0	1.61	69.4	32.2
Amoco	326	256,908	1.1	1.7	1.55	82.2	29.1
Burmah /Apex	872	124,295	3.0	2.2	0.73	32.5	11.8
Chevron	205	168,225	0.7	0.7	1.00	69.3	27.3
Gulf	312	315,808	1.1	2.0	1.82	76.9	39.4
Murco	341	187,818	1.2	1.3	1.08	38.4	7.6
Group II	5659	229,833	19.4	26.4	1.36	49.5	25.7
ICI	450	218,960	1.5	2.0	1.33	-	6.7
Globe	177	139,169	0.6	0.5	0.83	11.3	5.7
Nafta	130	113,691	0.4	0.3	0.68	17.7	12.3
Ultramar	358	137,615	1.2	1.0	0.82	12.3	8.9
others	1262						
Group III	2377	113,994	7.9	5.5	0.69	-	-

One member of the third group, Nafta, has its own source of supply, but outside Western Europe, and is placed in this category due to its apparent marketing policy of being prepared to recruit and supply any type of outlet irrespective of annual throughput. Again, ICI is included in this third group as, although having its own refinery in the U.K., its actual brand representation has more in common with that of the independents rather than with those companies of the first two groups. In actual fact, its output of petrol from its Teesside refinery is incidental to its other products, but, as some is produced, it must be sold. The only company that cannot be placed in one of these three groups is Heron, as, although lacking its own source of supply, its marketing methods put it in the forefront in terms of site-selection. However, comparatively few Heron outlets sell brands other than Shell, Texaco, B.P., or Mobil, so that the majority will already have been included under those brands.

As was mentioned on p. 65, the total number of outlets had increased up to 1967 when there were about 40,000 in existence. However, since that year, as figure 2.5 shows, numbers have declined by about 25%, falling to some 29,000 by the end of 1977. In fact, although total numbers had continued to increase to 1967, decreases were already taking place in the numbers of outlets retailing brands of Group I companies from 1965. From supplying 8,200 stations in 1965, the Shell brand fell by 21% to 6,450 in 1977. For the whole of the Shell-B.P.-National Group the decline was even greater, falling by 35% from 18,000 to 11,750. Likewise, the Esso-Cleveland Group fell by a similar percentage, about 31%, from 9,756 to 6,720. The other two majors have also recorded decreases, the Regent brand which incorporated a change to Texaco and Chevron in late-1967, falling by 44%, while Fina lost 29%. The total decrease for Group I companies between 1965 and 1977 amounted to almost 12,000 outlets, or 37% of the 1965 representation.

In complete contrast to this pattern, the total number of outlets in the second group increased by 1,577, rising from 4,082 to 5,659.[54] The largest increase was achieved by Total which almost trebled its numbers from 321 to 900, partially by the acquisition of other brands, whilst Gulf increased its representation by 75% to reach 312 in 1977.

54. Most of this increase was achieved through the opening of new stations rather than by recruitment from amongst those shed by the majors.

Again, Amoco expanded from 120 to 326 outlets, not greatly below the Total rate of expansion, and Jet went up by 20% from 674 to 813. With regard to Group III, the independents, their total of outlets fluctuated considerably during this period, but, at 2,377 in 1977, their total number was virtually the same as it was in 1965. However, there were only 21 companies in this group in 1977 compared with 31 in 1965.

Despite the overall decrease in outlets, and also in the number of independent brands, this period saw the entry of a number of new companies. However, with few exceptions, as outlined below, the majority of the new entrants lacked their own refining capacity, so that they are allocated to Group III. It must be realised that entry into the market would have seemed worthwhile before the severe shortages of late-1973 and early-1974, which, in turn, led to the steep escalation of petrol prices, as up to that time annual consumption had been steadily rising. Also, the recommendations of the Monopolies Commission in 1965 had been designed to encourage new entrants. Certainly, a substantial number of companies had entered the market before 1973, in contrast to subsequent years when only two new arrivals appeared.

The Monopolies Commission Report of 1965 had found not only that a monopoly situation actually existed in the petrol retail market, but that the suppliers were increasingly acquiring their own sites and thus gaining, for the first time, complete control over certain outlets in a market that had been traditionally operated by private retailers. The principal recommendations were therefore designed not only to limit this latter development, but also to make it easier for new companies to enter the market so as, hopefully, to reduce the degree of control held by the leading brands. The two more significant recommendations, subsequently agreed with the petrol suppliers and retailing companies, referred to company-owned stations and to the length of solus contracts respectively. With regard to the former undertaking, it was stated

> "that no petrol supplier, or group of suppliers, whose deliveries of petrol in any year to company-owned stations exceed 15% of his total deliveries to petrol stations in that year should build or acquire any such interest in any further stations while such excess continues, provided that this prohibition should not apply in any year in which the total deliveries by the supplier or group to petrol stations are less than 10 million gallons." 55

55. Monopolies Commission Report. op cit.

In view of the fact that annual consumption in 1965 was of the order of 2,800 million gallons, companies whose market shares were as small as 0.35% could thus have been affected by this undertaking if more than 15% of their total deliveries were to company-owned sites. Although the larger companies seemed effectively to be prevented from increasing their control over the market as a result of this ruling, too many small companies were also subjected to the same restriction. This was not necessarily undesirable, as, had the limiting amount been set higher than 10 million gallons, a large number of small companies could have, in theory, extended their ownership of sites, and the sum total of such acquisitions could have been quite substantial.

It is perfectly clear that the major companies began to reduce their numbers of outlets from 1965, but rarely did they relinquish a company site. Such reductions were almost entirely achieved by terminating the contracts to supply the smaller, more-remotely-located and privately-operated stations, these dealers subsequently being recruited to the many independent brands who were actively trying to increase their representation in the market. A number of the more-successful independent companies who had managed to acquire outlets with large annual throughputs were themselves taken over by some of the Group II companies at this time, while those of their number who supplied low-volume stations were able to continue in business as separate concerns, at least until the more-difficult trading conditions of late-1973 caused the withdrawal of several such brands. The above undertaking was cancelled in 1968, having operated for less than 3 years, but, contrary to its intention, it had taught the major companies an important marketing lesson. This has become increasingly apparent since then, each of the major companies having pruned or rationalised their networks so as to concentrate where possible on their high-volume sites, and retaining smaller stations for the express purpose of maintaining brand-loyalty in areas of low population density. This aspect will be examined in relation to the study-area in the following chapter.

The second recommendation, which again became part of the undertakings agreed to by the companies, referred to the length of solus contracts, where it was stipulated that they should not exceed 5 years unless the company had made a loan that the operator could not possibly repay in that period of time. In such cases, the agreement could extend beyond 5 years, but on an annual basis only or until such time as the operator wished to repay the outstanding amount. At the other end of the scale, it was decided that a minimum solus contract should be for not less than 3 years unless the dealer was prepared to agree to reach a specified gallonage within a lesser period, and, if failing to do this, the agreement lapsed. It will be realised that neither dealer nor tenant had very much security in terms of continued supplies of petrol over a long period of time, although up to 1973 the general system was that companies persuaded operators to sell their brand. After 1973, conditions changed to the extent that it was not the length of solus contracts that mattered primarily, but merely having a solus agreement at all. This was a period when petrol prices increased so greatly that annual consumption actually declined, and, coupled with the trend to reduce the total numbers of outlets, it is evident that companies would not have to indulge in very much persuasion in order to obtain the agreement of operators to virtually any length and type of solus contract, as the main need would have been to obtain some kind of guaranteed supply.

However, there can be little doubt that this second recommendation helped the Group II companies in particular to recruit outlets to their brand, as a reduction in the lengths of solus contracts gave dealers more frequent opportunities to change their allegiance. It is clear that only actual or potential high-volume stations were acceptable to Group II companies, as is suggested by their greater mean throughputs, as shown in figure 2.7 ; this is further considered below.

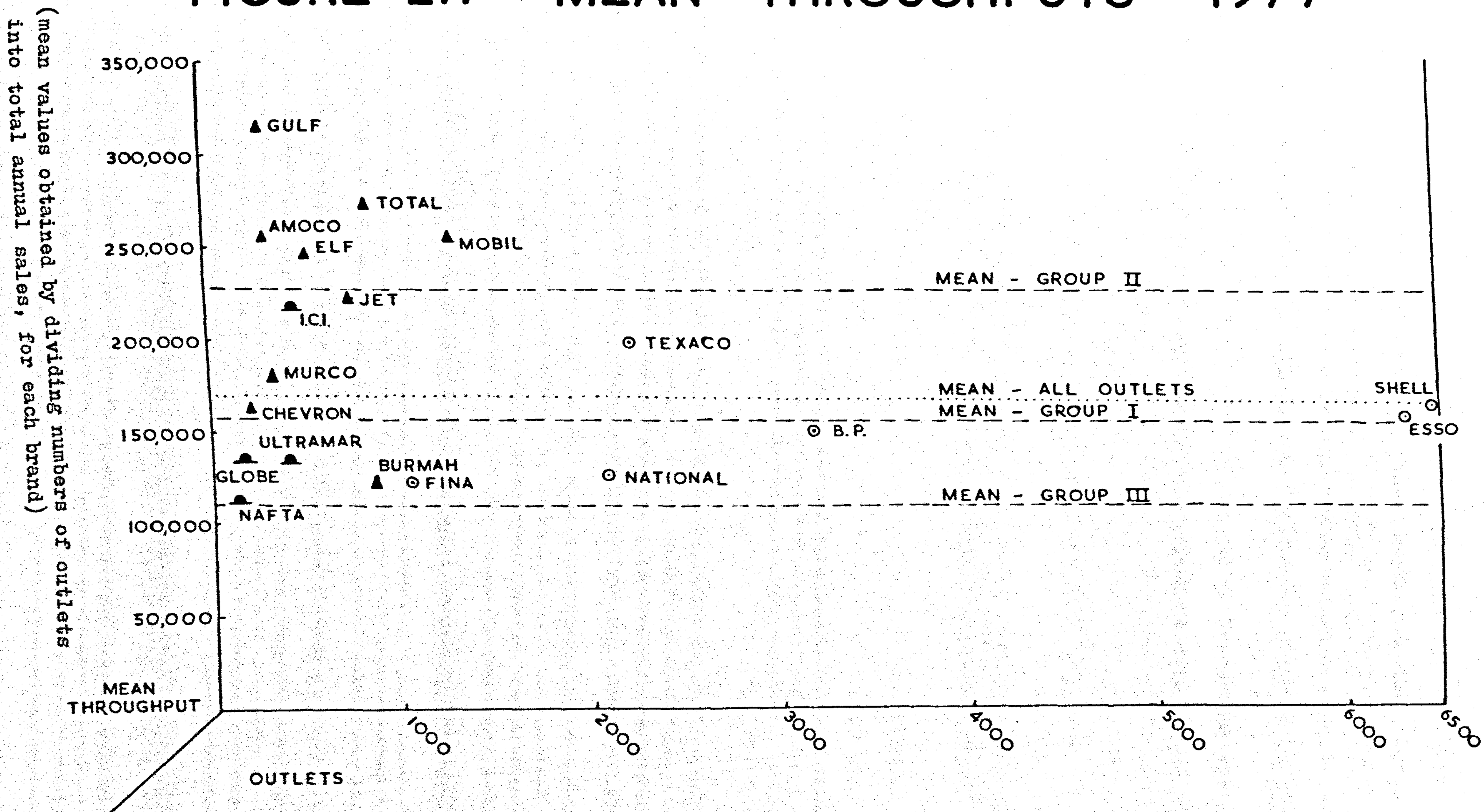
Although, as already stated, a substantial number of new companies entered the market after 1965, the majority were independent brands that lacked their own sources of supply. Those companies not in this category were as follows :-

(1) Atlantic Richfield (Arco) in 1967 by its purchase of the Gainsborough and Abco brands, this being followed in November 1968 by the purchase of Atlantic. Arco was itself bought by Total in September 1974.

(2) Occidental in 1968 through its purchase of Signal Oil's VIP chain, although the brand remained unchanged.

(3) Elf in December 1974 through its purchase of VIP from Occidental, the brand being converted to the Elf insignia in April 1976.

FIGURE 2.7 MEAN THROUGHPUTS - 1977



The independent brands that appeared during the post-1965 period included M.P., Ultramar, Thrust, Pace, Thames, Panther, Freedom, Rix, Bell, Draco, Paragon, Sheaf, Zip, Sky, Highway, Redwing, Butler, Sadler and Gaelic, several of these being taken over or ceasing to trade during the early 1970's. Arguably the most important entrant, Heron, commenced in 1966 in the London area, from where it spread to the larger urban areas of the country, setting new standards in petrol retailing for the leading brands to follow. Apart from offering such brands at discounted prices, largely through the use of self-serve which allowed a saving on labour charges, Heron stations generally had spacious fore-courts with either 4 or 6 blender pumps on separate stands, thus providing good means of entry and exit and also minimising waiting time. It will be subsequently shown in Chapter 5, when outlets are classified, that these stations are of very high quality in all respects. A car-wash was usually installed, serving both to attract customers and to provide an extra source of income, as was the display of 'impulse purchases' flanking the cash-desk. This type of station was soon developed by many of the leading brands, but, as such a substantial amount of capital was required either to convert an existing station or to develop a new site, such outlets were normally company-owned. In fact, the success of Heron was so great that Texaco bought or leased 70 of its stations in 1971, the attraction being primarily that these outlets were averaging annual throughputs of at least five times the national average amount.[56]

Most of the post-1965 entrants were independent companies operating in particular regions of the country, examples being M.P. in South Lancashire and Cheshire, Thrust Petroleum in the West Riding and East Midlands, and Pace and Thames in South-east England. Although the VIP brand was represented throughout most of England, its network predated this period, none of the other entrants attempted any semblance of a national system of outlets. Several brands disappeared during these years, normally being acquired by other companies. As is shown in figure 2.2, a number of companies of Groups I and II were instrumental in purchasing some of these brands.

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56. Heron stations in 1971 were claimed to be achieving sales of the order of seven times as great as the national average.
Service Station. October 1971.
Self-serve stations were aggregating three or four times the volumes of attended sites. (personal communications from Shell, Esso, Texaco and Mobil)

In summary, the general decrease that occurred in total numbers of outlets was paralleled by the decline in brands, the latter falling from 50 in 1965 to 36 in 1977. Also, it is apparent that most of the Group III brands are located in Eastern and South-east England, these being the parts of the country most coveniently placed to import supplies from Rotterdam.

The late-1960's saw a number of significant changes in petrol retailing, including the following :-

(1) The development of self-serve, which, from its introduction by Shell in 1963, by 1977 was in use at 15% of all outlets. The average annual throughput at such sites is generally accepted as being three or four times the national average. Most such systems are of the post-payment type, the customer then having to face shelves of 'impulse purchases' om the way to the cash-desk. Some stations, especially those in remote areas and those offering an unattended night service have installed pre-payment pumps, but these are not common as yet.

(2) The introduction in 1966 of credit cards for petrol purchases led to stations rapidly advertising their readiness to accept, in particular, either Barclaycard or Access or both. The number of stations still prepared to accept cards has declined very greatly owing to recent price-wars, largely due to the insistence of the card companies on the same reduction being allowed in a card purchase as in a cash sale. In turn, the petrol stations claim that such a reduction should be less owing to the cost of clearing such transactions, although card purchases are significantly greater than those involving cash. 57

(3) The introduction of the blender pump in 1966 by B.P., which proved its worth particularly from 1968 when all 4 grades of petrol could be dispensed through the one unit.

In terms of annual consumption, a continuous increase occurred until 1973, at a mean rate of 6.5% per annum from 1965. Following the shortages of petrol from late-1973 and the great price increases from early-1974, annual consumption fell by almost 2% during the latter year. This continued, with a further decrease of 1.6% in 1975, these being the first ever instances of decreasing annual consumption apart from the years of war and rationing. However, from 1976 onwards, increases were again taking place.[58]

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57. Both Barclaycard and Access were threatening to terminate agreements with outlets refusing to give full discounts on card purchases. Service Station. April 1976. At this time, Barclaycard was accepted at 9,500 outlets and Access at 7,400, petrol being the biggest single item bought with credit cards.

58. Energy Trends. monthly issue.

Whereas total consumption for 1975 was 3.5% below that of 1973, had the trend continued the upward growth of earlier years, the 1975 total would have been about 13% above that of 1973. In other words, the actual 1975 total was 16.5% below the level that could have been projected for that year during the early-1970's, the difference being of the order of about 600 million gallons. The 1976 total was only slightly greater than that of 1973 while the 1977 amount was about 3% larger than this, so that once more demand could be seen to be rising.

However, during this period, average station throughput more than doubled, rising from 73,000 gallons in 1965 to 168,000 gallons in 1977. This increase resulted from the actions of several contributory factors, as follows :-

(a) a 60% overall growth in annual petrol consumption, in spite of the setbacks of 1973-1975 ;

(b) a 26% decrease in the total number of outlets, from about 40,000 in 1967 to 29,373 in 1977 ; 59

(c) an increase of 57% in the total car population, from almost 9 millions in 1965 to about 14 millions in 1977 ;

(d) an increase in average annual car mileage, from 7,900 in 1965 to 8,700 in 1977. (12,640 to 13,920 kilometres) 60

The average annual consumption per vehicle rose from 316 to 345 gallons between 1965 and 1977, and, furthermore, the number of cars per station increased from 235 to 477. However, such figures must be treated with caution, as it is doubtful if the 'average motorist' or the 'average station' exists.[61]

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59. The numbers of outlets per brand are published annually by the Institute of Petroleum in the March issue of Petroleum Review. However, their accuracy cannot be guaranteed as returns are made on a voluntary basis by individual retailing companies. There is no other source for this information, as the respective categories are not included in the Census of Distribution.

60. Statistical material relating to mileages and numbers of vehicles derives from Highway Statistics.

61. Market research undertaken on behalf of B.P. in 1969 showed that business car-users, who accounted for some 40% of all cars, were averaging 20,000 miles annually, more than twice the mean amount for that time. Such vehicles were therefore consuming some 700 gallons of petrol per year.

For specified stations, a study of catchment areas in terms of car population and socio-economic structure, together with a knowledge of the relationship of casual to regular sales, would provide an approximation of the numbers of cars required to support a particular throughput. However, the break-even point for commercial viability is more important, and, whilst this varies according to type of outlet, for a specialised filling station the required amount is probably in excess of 250,000 gallons per year.[62] It is, therefore, hardly surprising that estimates made in 1968, 1970 and 1974 claimed that 40% of all forecourts were operating at a loss.[63] The whole of this aspect will be further considered in relation to actual stations within the study-area in Chapter 6.

Whereas the market share held by Group I companies fell from 84.1% to 68.1% between 1965 and 1975, that of Group II increased from 12.2% to 26.4%, whilst the share of Group III rose from 3.7% to 5.5%.[64] The performance of the second group, particularly, is emphasised when shares of total sales are compared with those of total outlets, as shown in table 2.1. An index greater than unity in column 5 indicates a share of sales exceeding that of stations, so that those brands with a value greater than 1 are selling amounts larger than could be expected from a knowledge of their numbers of outlets. It is clear that Group II out-performed Group I in this respect, not one member of the former category apart from Burmah having an index below unity, whereas only Texaco of the older companies enjoyed this distinction. This contrast is further emphasised when annual sales are divided by the respective numbers of outlets to give a mean throughput by brand. Taking the overall mean in 1977 as 168,000 gallons, again only Texaco of Group I exceeded this amount. As is shown in figure 2.7, the mean Group I value, at 157,239 gallons, was less than the overall mean and greatly below that of Group II's 229,833 gallons.

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62. The break-even point for a station without other sources of income was estimated to be 180,000 gallons per year in 1967. The Times. 13.3.67 This will be further considered in Chapter 6.

63. Service Station. May 1968. Petrol Forecourt Survey, N.E.D.O. 1970. Personal communication from Petroleum Retailers Association. July 1974.

64. Market shares are not often published, and are generally estimates. Sources include Monopolies Commission Report 1965, The Times 12.4.1977, and personal communications from several companies.

Some members of the second group have gained further representation by the purchase of other companies in the same group, subsequently converting such outlets to their own brand, but normally only when satisfied with their potential. It is suggested that the majority of Group II outlets are located in or near urban centres and either on heavily-used routes or within large suburban housing estates. Obviously, many outlets retailing the older brands are similarly located, but an important point of difference is that the great majority of rural stations, having relatively few cars in their immediate vicinities, tend to sell these brands, thus resulting in lower scores for Group I companies. Such contrasting patterns are largely the result of the indiscriminate spread of stations during the inter-war period, long before the appearance of the post-1953 entrants, when the norm was the split-site, few of which failed to offer at least one of the brands of the Shell-B.P. or Esso-Cleveland Groups. This aspect will be examined in detail, with reference to the study-area, in the following chapter.

Apart from having to supply smaller numbers of outlets, which, by implication, suggests a policy of concentration on better-located stations, each of the second group has a greater proportion of company-owned sites than the older brands, as is shown in column 6 of table 2.1. Whereas the latter tend to own some 22-29% of their outlets, members of Group II own between 38% and 82% of their stations, with the notable exception of Elf's 24%. As stated earlier, Elf bought an existing chain of stations from VIP, so that its background was rather different from those of the other Group II companies. However, it is significant that the only member of Group I to have a mean station throughput comparable to those of the newer entrants, namely Texaco, owned 44% of its outlets. In one sense, Texaco is itself a new company and it certainly is a new brand as it only appeared in the U.K. in 1967 along with Chevron when the former Regent company was subdivided into these two separate firms. Since then, in company with the older brands, Texaco has substantially reduced its numbers of outlets.

Another contrast, although less marked than that pertaining to company-ownership of sites, is to be found in the relative proportions of self-serve stations offering particular brands. Whereas none of the older brands, including Texaco, had more than 15% of their total outlets operating on this system, most of the newer entrants had between 26% and 39% in 1977. It is generally claimed that annual throughputs are greater both for company-owned and self-serve sites than for privately-owned and attended stations respectively, and, if this is so, this would help to explain the higher mean throughputs associated with the newer brands of Group II. Clearly, such stations would have involved greater capital investment, thus, out of necessity to maximise returns, they would normally be located at carefully-chosen sites and be equipped with modern spacious facilities. It will be considered in a following chapter whether these claims can be substantiated, when, in Chapter 5, by allocating points for various features, a comparison of the different types of outlets will be attempted.

Returning briefly to the third group, it is accepted that these companies perform a useful service by their purchase of surplus petrol from the integrated oil groups, but clearly they can have little control over such sources of supply. In the retail market they compete against these same firms by retailing petrol under their own brand insignia. During conditions of over-production of petrol, such as the 1960's, many such firms appeared in the U.K. market, and were generally able to adopt price-cutting policies. Their sole requirements, apart from transportation of product, sometimes from Rotterdam, were a number of outlets preferably in a particular region of the country so as to reduce distribution costs. Many of these companies were able to secure solus contracts with private dealers who formerly retailed the older brands, as not only were the major companies shedding their smaller outlets, but the independents could offer petrol at lower rates as few of them charged any extra for small deliveries as was the practice amongst the majors from 1968 onwards.[65]

Clearly, trading conditions for these companies has worsened, especially since the petrol shortages of late-1973, which, in turn, set off the steep increase in prices, leading eventually to the very severe price-wars of the last few years. As a result of the more-powerful

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65. The major companies, led by Esso and Shell, imposed a surcharge on small deliveries in April 1968. These were at the rate of 0.8p. per gallon on 'drops' of up to 399 gallons, 0.6p. for amounts between 400 and 699 gallons, and 0.4p. for greater totals. Service Station. April 1968.

companies in the first and second groups becoming actively involved in price-cutting, the major advantage of the independents disappeared. Thus, several have ceased to operate, whilst some of the more-successful members of the third group have been taken over by larger brands. Included amongst the latter were brands such as Sky, which, at the time of its purchase by Elf operated through company-owned sites only, and Thames whose 22 outlets were selling at a rate of 7 million gallons annually before their conversion to the Esso brand.[66] Such companies were obviously very different to the majority of the independents, who, commonly, were prepared to supply any outlet however small the throughput.[67] Thus, a few of the Group III companies could be seen to be following marketing policies very similar to those of the second group, but without the security of supply enjoyed by the latter. It was not, therefore, surprising that such companies should be taken over, as their stations matched the requirements looked for by Group II companies in their outlets. This type of take-over was engendered by a desire for good outlets rather than out of fear of competition, as the independent firms combined have never held more than 5.5% of the market.

Clearly, no consideration of the development and present structure of the retail petrol market would be complete without reference to the very great increase in purchase price that has occurred during the last few years. From 1965 to 1973, prices rose quite substantially as is shown in figure 2.4, moving from 27p. to 38p. per gallon largely due to taxation increases. That this rise of 40% had little apparent effect is shown by the continuing increases in annual consumption that took place during these years, but from late-1973 onwards the situation changed greatly as the price almost doubled during the 12 months up to December 1974 when it reached 72.5p. for a gallon of 97 octane 4-star grade petrol.[68] This period, not surprisingly, experienced a substantial fall in consumption, as already mentioned, but in spite of a further rise, in stages, to reach 90p. in April 1977, such a decrease in sales was

66. Thames company advertisement feature. <u>Service Station</u>. August 1976.

67. Personal communications from a number of companies including M.P. and Sotro indicated that they were prepared to supply any outlet. In contrast, both Amoco and Chevron required minimum throughputs of 350,000 gallons per year for a station to be recruited.

68. Retail prices are regularly published by the Institute of Petroleum, these being supplemented by newspaper reports and the observation of posted pump prices, the latter having been kept since May 1973.

revealed as little more than a temporary, although very serious, setback, as monthly deliveries during the early months of 1977 were once more above corresponding levels for 1976. The withdrawal of the extra duty imposed by the Budget and a reduction of 3p. per gallon by the marketing companies brought the purchase price of 4-star grade down to about 82p. in early August 1977, but this must be regarded as little more than a notional price as there is now neither a recommended retail price nor a stated maximum price, apart from that set by the Price Commission.

In fact, this price has been substantially exceeded, in particular at motorway service stations where 90p. was commonly being charged in October 1977. Within the study-area, where posted prices have been observed and recorded for the last few years for a large number of stations, the variation in the price of 4-star petrol during this month ranged from 73.9p. to 84p. , and to 90p. for the motorway sites. This is a very great change from past conditions, when stations, at least those retailing the same brand and unless taking part in a special promotion, offered particular grades at much the same prices. At least, then, customers were aware of the current price of petrol, in complete contrast to the situation that developed from late-1974, since which time the purchaser has had little knowledge of the true market price. The reason for this lies in the great numbers of outlets that have indulged in price-cutting activities over the last three years, the result being that such stations commonly stressed in their advertisements, not the base-price, but their own reduction or offer. Thus, a customer tended to be aware of outlets that offered a stated number of pence off each gallon, without knowing the price from which the reduction was being made. Clearly, stations could and did try to outwit each other, examples being recorded of adjacent outlets offering in one case 15p. off the posted pump price, and in the other only 7p., in neither case displaying the base-price. In actual fact, in this example, the former had a posted pump price of 90p. while the latter was reducing from 84p., thus although the former offered the best bargain, the differential was only 2p. and not 8p. as suggested by their respective posters. Following a long period of consultation and negotiation with trade bodies and marketing companies, the Office of Fair Trading eventually managed to legislate against this type of misleading advertising. From August 1977, price displays at stations offering discounts must show very clearly the prices of two grades, one of which has to be that of 4-star petrol.

The decrease in petrol consumption from late-1973 was not the sole cause of the extensive and almost continuous price-wars which have characterised the market from mid-1974 onwards. To explain this activity, a number of contributory factors can be identified, including :-

(a) the existence of surplus petrol within Western Europe,

(b) the rapid rise in the selling price of petrol which raised dealers' margins and thus made it more possible to offer reductions,

(c) the desire to maintain particular market shares in a period of declining sales,

(d) the removal of the maximum retail price structure in late-1974.

The imminence of extensive price-cutting had been forecast from early in 1974,[69] but when it did begin later that year it was partially due to chance factors. From what was known of price-wars, recorded and analysed in the U.S.A., their origins invariably lay in the aggressive action of a large company attempting to increase its share of the market at the expense of its competitors, as explained on page 19. This did not happen in this instance in the U.K., the actual start being attributable to the production of petrol as a by-product by ICI. This had been sold for some years, within a radius of some 100 miles of the Teesside refinery, at a price generally 4p. per gallon below those of other brands. When, in December 1974, a price increase of 10p. per gallon was introduced, ICI was not allowed to raise its price through an anomaly in the Price Code. This, clearly, gave a great advantage, the result being that many private dealers, at the end of their solus contracts with other suppliers, converted their outlets to this brand. During the period 1967-1977, the actual numbers of stations retailing ICI petrol increased from 100 to 450, but more importantly, such sites were no longer confined to the North-east of England, appearing elsewhere in the North and also spreading into the North Midlands. This would have put an increasing number of neighbouring outlets under pressure, but as ICI only accounted for about 2% of the market, of itself it would not have led to the widespread discounting that has characterised recent years.

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69. The retail manager of the Total company, basing his view on the fact that, at 5p. per gallon, gross margins in the U.K. were the highest in the world, forecast an imminent start to a severe price-war. Petroleum Review. March 1974.

With the creation in December 1974 of such a large discrepancy in prices, the Asda group of hypermarkets realised that wholesale purchase of petrol from ICI would allow their stores to retail at very low prices, and thus become a significant aid to attract car-borne customers to their premises, basically to make other purchases. Although possessing only 22 such outlets, it is clear that their presence in any locality would have greatly affected a substantial number of existing petrol stations, as total sales at Asda sites in 1975 reached 30 million gallons, by this time being supplied by Mobil.[70] Thus, although this amount was less than 1% of the entire market, the sudden appearance within particular localities of stations averaging annual sales of over one million gallons would have been very considerable. However, other hypermarkets and superstores followed the lead set by Asda, thus extending the overall effect to a larger number of stations.[71]

It is probable that neither the increase in ICI outlets nor that of hypermarkets selling petrol would have had any further influence on the market had it not been for the continued existence of a surplus of petrol within Western Europe, together with the fact that the 10p. rise of December 1974 was an unrealistic increase in terms of actual production costs. Thus, the smaller companies that lacked their own refining process could buy cheaply in Rotterdam and subsequently undercut other brands in the U.K. This practice did not begin before the end of 1974 as a system of maximum retail prices had previously been in operation, and there had also until then been some uncertainty about the security of crude oil supplies from the Middle East. However, once these obstacles had been removed, price-cutting was adopted by many companies, including Jet, a brand with a national network and a considerable record of aggressive price-cutting. This put such pressure on the major brands that they responded by providing support for those of their own retailers located in the vicinities of price-cutting outlets, but on a more-generous scale for their tenants than for their dealers. The first of the major companies to subsidise some of their outlets was Esso in June 1975, but as this brand retailed through some 6,850 stations, the effect of such support was to spread the practice of discounting, with the result that most brands followed so as to protect their own representatives.

70. The Times. 4.11.1975 and 21.1.1976.
71. Within the study-area, hypermarkets in Newcastle and Stoke-on-Trent started selling cut-price petrol during the first half of 1975.

Although only a minority of stations were originally granted this type of support, such was the effect of the loss in sales at other outlets that the system spread rapidly. Apart from stations who decided, voluntarily, to cut their prices in order to protect their own sales, it is believed that the oil companies forced others to offer discounts so as to maintain market shares.[72] Whereas the larger companies had agreed to end discounting by means of price support for their retailers in October 1975, a further price rise led to a continuation of the activity. The companies had themselves requested, and been granted, an increase of 4.5p. per gallon in December 1975, whereupon in January 1976 they immediately renewed price-support at selected stations, as their sales remained depressed in the face of continued competition from the independent price-cutters. This type of support was meant to last on this occasion only until the end of May, supposedly then being discontinued as the cost of crude oil was increasing owing to the falling value of the pound sterling. However, the fact that sales failed to increase where prices were not substantially lowered led to the continuation of selective subsidies, the overall effect being to spread the practice of discounting. During the autumn of 1977, it was apparent that price-cutting was taking place at a majority of outlets, at least in those where petrol sales were an important source of income, and this was during a period of increasing sales. This practice was beginning to appear as the normal situation, as, within the study-area for example, price-cutting had been almost continuous since mid-1974. It was clear that no major brand, nor those of Group II, had taken the initiative as an aggressive competitor, although the actions of Esso in mid-1975 had placed it fairly close to being so described. Most brands had been forced to follow this lead so as to protect their own share of the market, although it is probably more correct to visualise competition as an inter-station, rather than an inter-brand, activity.

Although it has been stated that the majority of stations have been price-cutting during the last few years, not every such outlet actually reduced the selling price by means of a cash reduction. An alternative method was to offer trading stamps in lieu of a cash discount,

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72. This claim was made by the P.R.A. who stated that only 7% of stations were offering discounts voluntarily. Service Station. September 1975. In January 1976, Esso, almost immediately followed by most companies of Groups I and II, began to sell at 7p. per gallon below the normal price. This reduction was achieved by the operator and the company each 'providing' 2.8p., the remaining 1.4p. being saved on a lower VAT payment.

this probably proving a more attractive inducement to business motorists. However, the situation had developed by late-1976 where many stations were offering up to 40-fold stamps per gallon.[73] It seemed clear at the end of 1977 that any outlet whose petrol sales formed a significant part of total income had little alternative but to offer some form of discount if it was to remain in business.

Whereas the late 1960's saw a number of nation-wide promotions to foster brand-loyalty, some of which were outstandingly successful in increasing sales at least in the short-term,[74] recent years have been characterised by a lack of company advertising. The place of such promotions has in a sense been taken by discounting and stamp-trading, effectively shifting the emphasis from inter-brand to inter-station competition. This has been accompanied and, to some extent, caused by an increasing public awareness of the general similarity between the various brands of petrol,[75] and also a decline in the level of avoidance of minor brands. This must mean that brand is now of less significance than price, possibly for the first time ever. According to a recent Report, minor brands were avoided by 20% of motorists in 1973, but by only 10% in 1975.[76] This would seem to suggest strongly that price has become the most important consideration when buying petrol, although it seems probable that location must also be of some significance. This aspect will be further referred to in Chapter 6.

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73. As trading stamps are given on the price of petrol less duty and VAT, a single issue means 5 stamps per gallon. The cost to the station operator during 1975 was as follows :- single 0.3p. per gallon, quad (quadruple) 1.2p., 40-fold 12p. (personal communication from Green Shield and Sperry & Hutchinson).
At the end of 1976, Green Shield stamps were being dispensed at 9,800 stations, this being 84% of all outlets giving stamps. The Times. 1.2.1977.

74. The most successful was Shell's Make-Money Game which involved trying to match halves of 'banknotes', given at the rate of half-a-note per 2 gallons. It is claimed by the company to have increased sales by 60 million gallons over a 10-week period, this being about 10% of Shell's total sales during 1966.

75. Which. January 1964.

76. E.I.U. Special Report No. 39. op. cit.

Finally, the following trends may be regarded as significant in the structure of the petrol retail market as it is at present :-

(a) decreasing numbers of outlets,

(b) increasing numbers of petrol-using vehicles,

(c) increasing annual mileages per vehicle,

(d) increasing annual consumption of petrol,

(e) increasing average throughputs per station, especially marked in the case of company-owned outlets,

(f) increasing percentage share of company-owned outlets in the total number of active stations,

(g) increasing percentage share of self-serve sites in the total number of active stations,

(h) price competition, particularly severe in certain localities.

There is, currently, no immediate likelihood of changes in the above trends, so that the next few years are likely to experience a further decrease in numbers of outlets. Theoretically, total numbers could continue to fall quite substantially without great inconvenience to motorists. If the total number of stations fell to 25,000, this would imply that the average station would supply some 560 vehicles on a regular basis. Further, if annual consumption per vehicle was taken as 345 gallons, in view of the average purchase being 4 gallons per visit, the average vehicle would make some 86 annual visits to a station. This would give a daily customer rate of about 140 vehicles, hardly too many for a station to manage.

Throughout this chapter, as stated at the outset, the main concern has been to explain developments and changes within petrol retailing from 1885 onwards, and to recognise trends which are of current significance. The spatial aspects of petrol retailing will now be considered in the following chapter, with particular attention being paid to situations within the study-area.

Chapter 3 - The Evolution of Outlets within the study-area.

The central theme of this chapter is the spatial distribution of outlets at different stages of time, together with a consideration of changes in such patterns arising from causes and influences that have already been explained in the preceding chapter. However, it is first necessary to introduce the actual study-area in which a detailed field investigation has been conducted since mid-1973, and to justify the extent to which it may be regarded as typical of the whole nation.

The study-area includes almost the whole of Staffordshire, the exception being that part lying immediately to the west of Wolverhampton, together with South Cheshire and North-east Shropshire. In terms of administrative areas created in April 1974, the following are included :-

(a) Staffordshire - The Districts of Staffordshire Moorlands, Stoke-on-Trent, Newcastle-under-Lyme, Stafford, East Staffordshire, Lichfield, Cannock Chase and Tamworth, together with that part of South Staffordshire lying to the north of Codsall ;

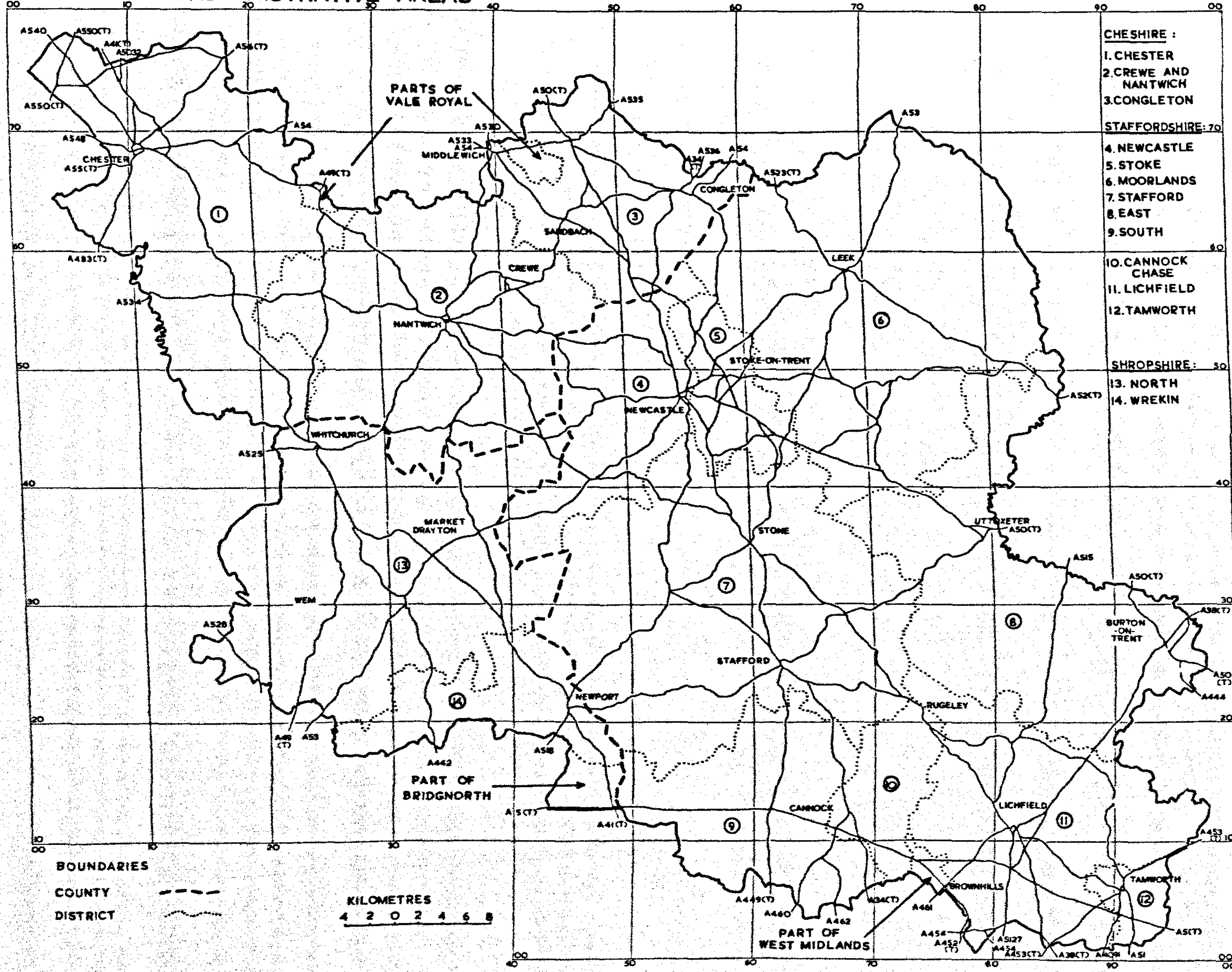
(b) Cheshire - the 3 southern Districts, namely Chester, Crewe & Nantwich, and Congleton ;

(c) Shropshire - most of the District of North Shropshire together with part of Wrekin District ;

In addition, a number of small areas lying in neighbouring administrative districts have been included as their exclusion would have been illogical, as is explained below. These include a 2.5 kilometre section along the A51 at Tarporley, a 2.5 kilometre section of the A54 between Middlewich and Holmes Chapel, and the urban area of Brownhills through which pass a number of important roads including the A5.

These areas are shown in figure 3.1, which also reveals where deviations have been made from administrative boundaries. The study-area follows such boundaries mainly due to the fact that the establishment and operation of petrol retailing outlets are regulated by local authorities, thus simplifying to some extent the compilation of material derived from those departments particularly concerned with planning, trading standards and fire prevention. Thus, parts of neighbouring districts are included only where their exclusion would have resulted in the interruption of the network of major roads. The selection of administrative areas as the

FIGURE 3.1 ADMINISTRATIVE AREAS



basis of the study-area also allowed its outer limits to follow reasonably natural breaks between urban areas, so that the outer suburbs of Walsall, Wolverhampton and Sutton Coldfield were excluded. Finally, the study-area was designed as a fairly compact area lying around an approximately central point, Madeley in North Staffordshire, this being the base for the actual research.

The resultant area covers approximately 4,413 square kilometres, this being some 1.8% of the U.K. and 3.4% of England alone. Lying between the conurbations of West Midlands and South Lancashire and extending from the Pennine Moorlands to the Welsh border, it includes a total population of some 1,364,400 people, this being 2.5% of the U.K. total and almost 3% of the total for England. Within its boundaries are a conurbation of about one quarter of a million people, namely Stoke-on-Trent, together with several urban centres of over 50,000 each, these areas providing the bulk of the local market for petrol. In addition, there are a number of towns of lesser size, in particular clustered fairly closely around 20,000 and 10,000 in terms of population, together with a large number of villages and hamlets.

The whole area has a population density of 309 per square kilometre, thus lying between such values for the U.K. and England, these being 228 and 353 respectively. For the Staffordshire part of the study-area the mean density is 365 per square kilometre, this being very similar to that of England alone. In contrast, that part of the area within Shropshire is quite sparsely-populated, having a value of only 81, while the Cheshire tract averages 270. By comparison with the proportion of urban dwellers in England alone, viz. 78.2%, the study- area has only 70% of its population in this category. However, the proportion for Staffordshire alone is fairly close to that value, being 76%, while those parts within Cheshire and Shropshire have, respectively, 61% and 49%. Thus, overall, the area may be claimed as being reasonably representative of England at least in terms of population distributions and densities, while the major part, that within Staffordshire, is considerably closer. Thus, not only is there a clearly-defined urban sector, notably in the belt extending in an approximately North-west to South-east direction from Crewe and Congleton to Tamworth, but also a variety of rural areas that range from the hills and moors of North-east Staffordshire to the lowlands of West Cheshire and North Shropshire.

However, with regard to petrol retailing, it is the car rather than the human population that has the greater significance. In 1977, the study-area had 2% of the U.K. car population, the national rate of 258 cars per 1000 persons being very closely paralleled in Staffordshire where the rate was 256. Within South Cheshire and North-east Shropshire corresponding rates were 258 and 287 respectively. Whereas 46% of all British households had one car, and another 10% had 2 or more, rates for the study-area were 47% and 12%.[1] Such rates varied considerably between urban and rural areas, ranging from Stoke-on-Trent's 38% and 5% to those of 52% and 12% in Staffordshire Moorlands. To some extent, the greater availability of public transport in the larger urban areas can explain such differentials, particularly that relating to single-car households, but the variation in percentages of households owning 2 or more cars is due more to income differences.[2] However, in general, absolute numbers of cars will be greater within centres of population concentration, namely the major towns. The latter point is substantiated in figure 3.2 where the distribution of cars is shown, and if this is compared with figure 3.3 it will be seen that the great majority of petrol outlets are located in those areas having the greatest concentration of cars. However, such a simple relationship may be deceptive, as there is the added factor that most outlets are located on major roads, such roads invariably linking together those areas having the greatest absolute numbers of cars, viz. the major towns. With regard to public roads, the study-area included 8,320 kilometres, this being some 2.5% of the national aggregate.

With regard to figure 3.3, a total of 847 outlets are shown to have been active in July 1973, this being 2.56% of the number for the whole of the U.K., viz. 33,000 at that time. In terms of population, the study-area contained 2.46% of the national total, but only 2% of its total number of cars. The latter can be explained by the existence of an extensive rural tract, of sparse population density, which gave to the area a lower urban population percentage when compared with that of the U.K. as a whole. Thus, the area had less than its expected share

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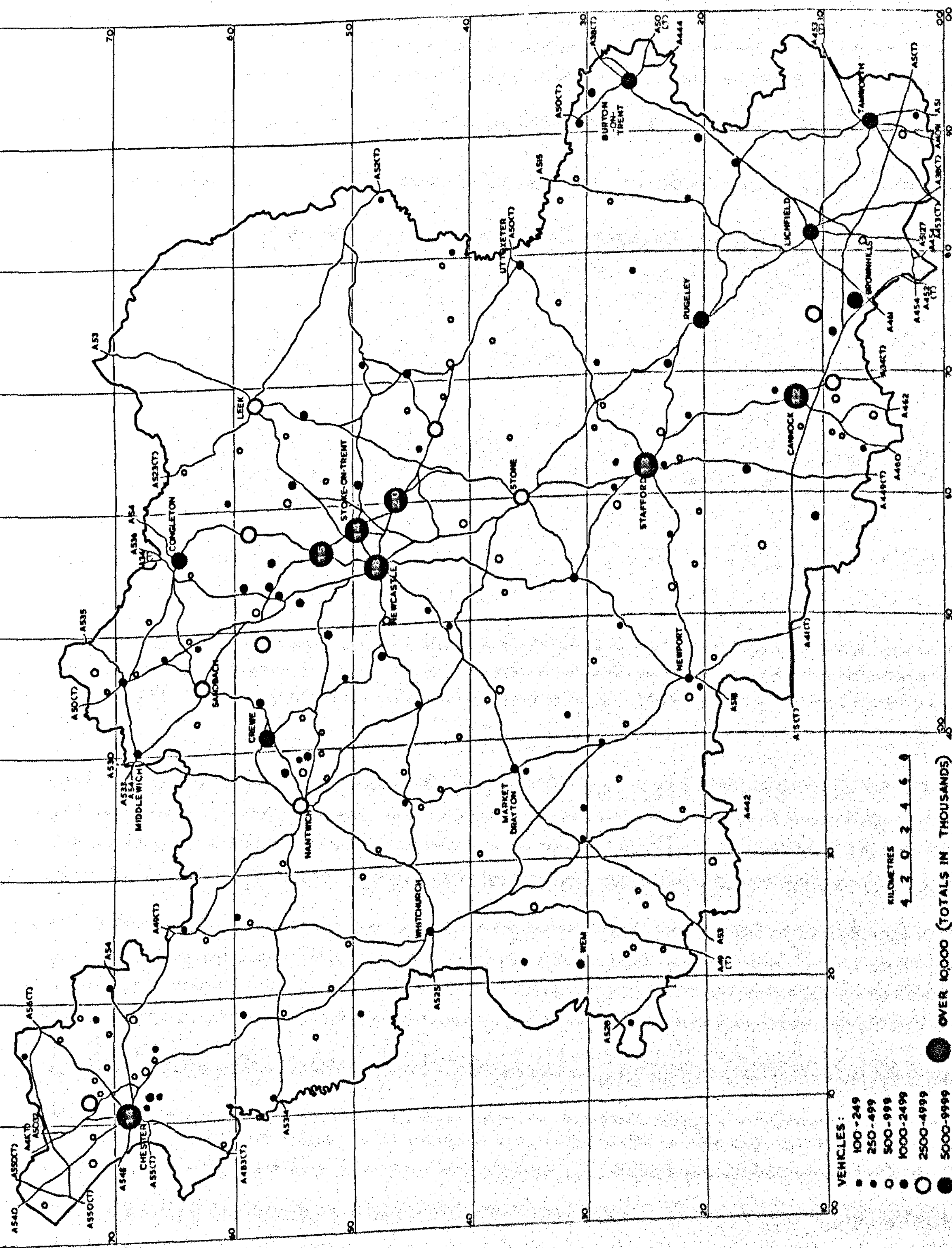
1. These have been compiled from statistical material supplied by the County Planning Departments, and also from the Staffordshire Abstract of Statistics and the Cheshire Bulletin of Statistics.

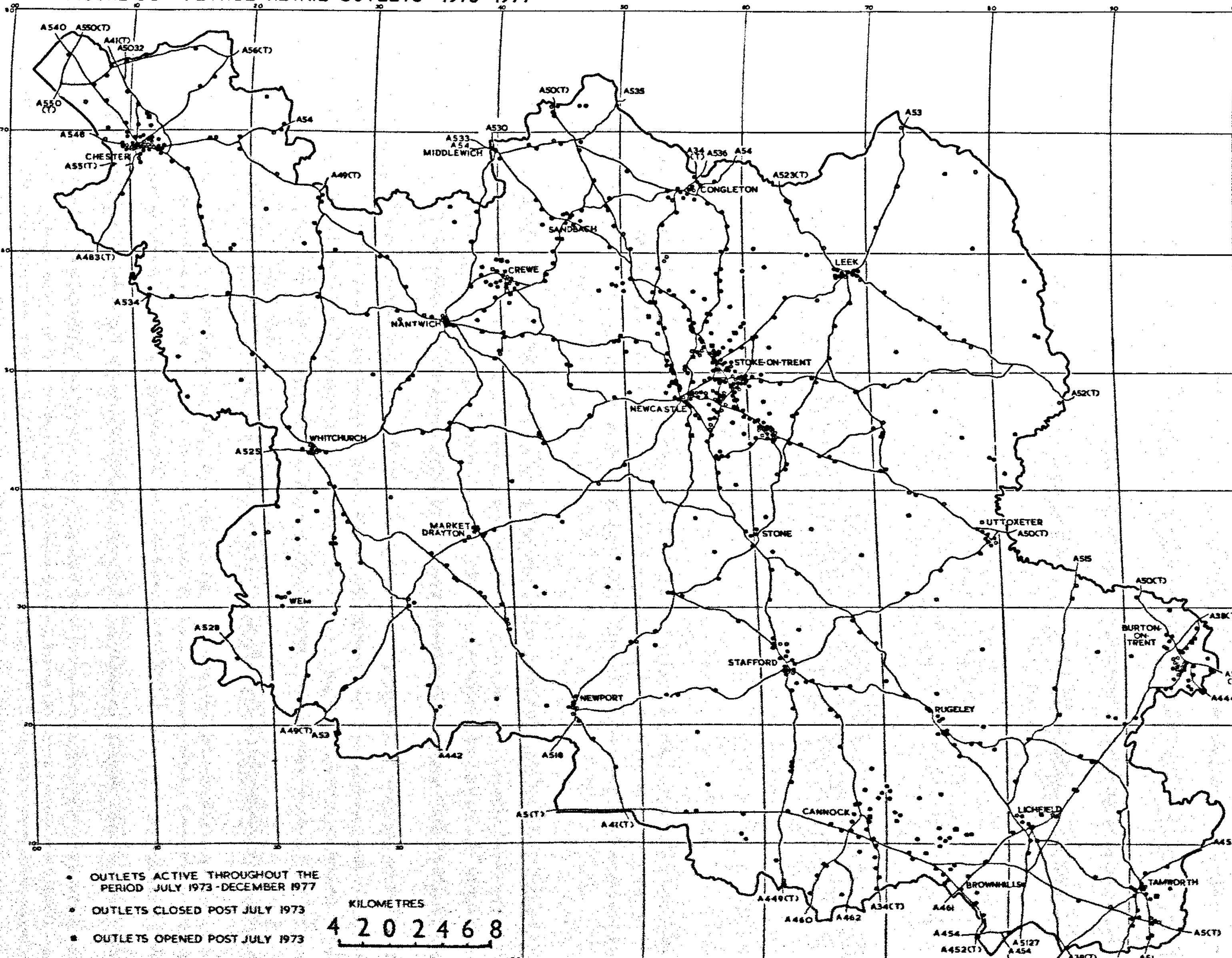
2. Households with more than one car are concentrated in the districts where mean incomes are high.

FIGURE 3.2 DISTRIBUTION OF PRIVATE VEHICLES



(Based on 1971 Census material)

FIGURE 3.3 PETROL RETAIL OUTLETS 1973 - 1977



(Based on personal fieldwork)

of the national car population, so that it is hardly surprising to find that by December 1977 net closures within the area had exceeded the national rate, and that such closures had been mainly in the rural districts. At the end of 1977 there were 724 active outlets within the study-area, this accounting for 2.46% of the national total. As table 3.1 indicates, 147 outlets closed during the period of study, this being 17.4% of the 1973 total. However, as 24 new outlets were opened, the net closure rate was 14.5%, although still well above the national rate of 11%.

Having considered the way in which the study-area compares with the whole nation in terms of population characteristics, levels of car ownership, petrol outlets and lengths of paved roads, attention will now be directed to the evolution of the network of petrol stations within the area. In this chapter, it will be the actual network and location of outlets that will be considered, delaying until Chapter 5 an analysis based on function.

In order to examine the growth of the network of stations in detail, the central part of the study-area has been selected, namely that between Eastings 20 and 80 and Northings 20 and 60. As will be seen by reference to figure 3.3, considerably more than a half of the entire study-area is thus included. For this sector, the period of origin of all retail outlets is presented in a series of 4 maps that relate to the temporal phases identified in the preceding chapter in the following manner :-

	Phases identified in Chapter 2.	Phases adopted in Chapter 3.
I.	1885-1919	1. pre-1928
II.	1920-1939	2. 1929-1939
III.	1939-1950	3. 1945-1964
IV.	1950-1965	
V.	1965-	4. 1965-

Table 3.1 : Establishments, terminations and survivals in the central sector.

Categories.		Pre-1928	1929-1939	1945-1964	1965-1973	post-1973	Totals Gross	Totals Net
Establishments		142	203	159	35	17	556	
Terminations		47	57	37	-	-	141	
Survivals		95	146	122	35	17	415	
Survival Percentage		66.2	72.	77.4	100.	100.	74.6	
Urban, Major road	I.	15(7)	7(0)	-	1	2	25(7)	18
	2.	43(10)	38(7)	43(9)	20	7	151(26)	125
	3.	9(2)	3(2)	1	-	-	13(4)	9
	4.	6(1)	17(3)	15(3)	4	1	43(7)	36
Urban, Minor road	1.	-	-	-	-	-	-	-
	2.	13(3)	21(7)	30(4)	5	6	75(14)	61
	3.	1(1)	2	-	-	-	3(1)	2
	4.	24(18)	21(8)	15(7)	1	1	62(33)	29
Village, Major road	1.	-	1(1)	-	-	-	1(1)	-
	2.	9(4)	16(2)	10(3)	-	-	35(9)	26
	3.	-	-	1(1)	-	-	1(1)	-
	4.	-	10(5)	7 -	1	-	18(5)	13
Village, Minor road	1.	-	-	-	-	-	-	-
	2.	2	2	4(1)	1	-	9(1)	8
	3.	-	-	-	-	-	-	-
	4.	1	20(7)	9(2)	1	-	31(9)	22
Rural, Major road	1.	6(1)	4(2)	-	-	-	10(3)	7
	2.	12(0)	28(7)	16(4)	1	-	57(11)	46
	3.	-	-	-	-	-	-	-
	4.	-	3(1)	2(0)	-	-	5(1)	4
Rural, Minor road	1.	-	-	-	-	-	-	-
	2.	-	3(1)	4(1)	-	-	7(2)	5
	3.	-	-	-	-	-	-	-
	4.	1(1)	7(4)	2(1)	-	-	10(6)	4

Key : 1. Adequate visibility (100 metres +), hazard to traffic.
2. Adequate visibility (100 metres +), not a hazard.
3. Poor visibility (less than 100 metres), hazard to traffic.
4. Poor visibility (less than 100 metres), not a hazard.

The reasons for not following the temporal divisions made in Chapter 2 are that, although these are still claimed as the most logical forms of differentiation for the whole era from 1885 onwards in terms of trends particularly, they are not quite so suitable for cartographic representation. Thus, if the pre-1939 period were to be mapped according to the divisions of Chapter 2, the important 'watershed' represented by the various planning requirements introduced during the late 1920's would have been missed. The only other differentiation is due to the war years and the period of rationing and austerity that followed, although the post-1965 era is further subdivided to take account of the changes that commenced from 1973 onwards.

In addition to the 4 maps mentioned above, figure 3.10 both summarises the whole situation and also shows the locations of outlets that closed during the post-war years. It is perfectly clear even from a cursory glance that many more stations have closed during the post-1973 period, thus underlining the marketing difficulties of this era. In fact, within this sector, there have been exactly twice as many closures since 1973 as during the whole of the preceding 28-year period from 1945.

1. <u>Pre-1928 establishments.</u>

A number of characteristics regarding early sites were explained in the previous chapter, these being in summary for pre-1928 stations :-

(a) their very rapid proliferation from about 10,000 nationally in 1919 to 28,000 in 1930 ;

(b) their establishment in centres of population, thus attempting to ensure a local catchment area ;

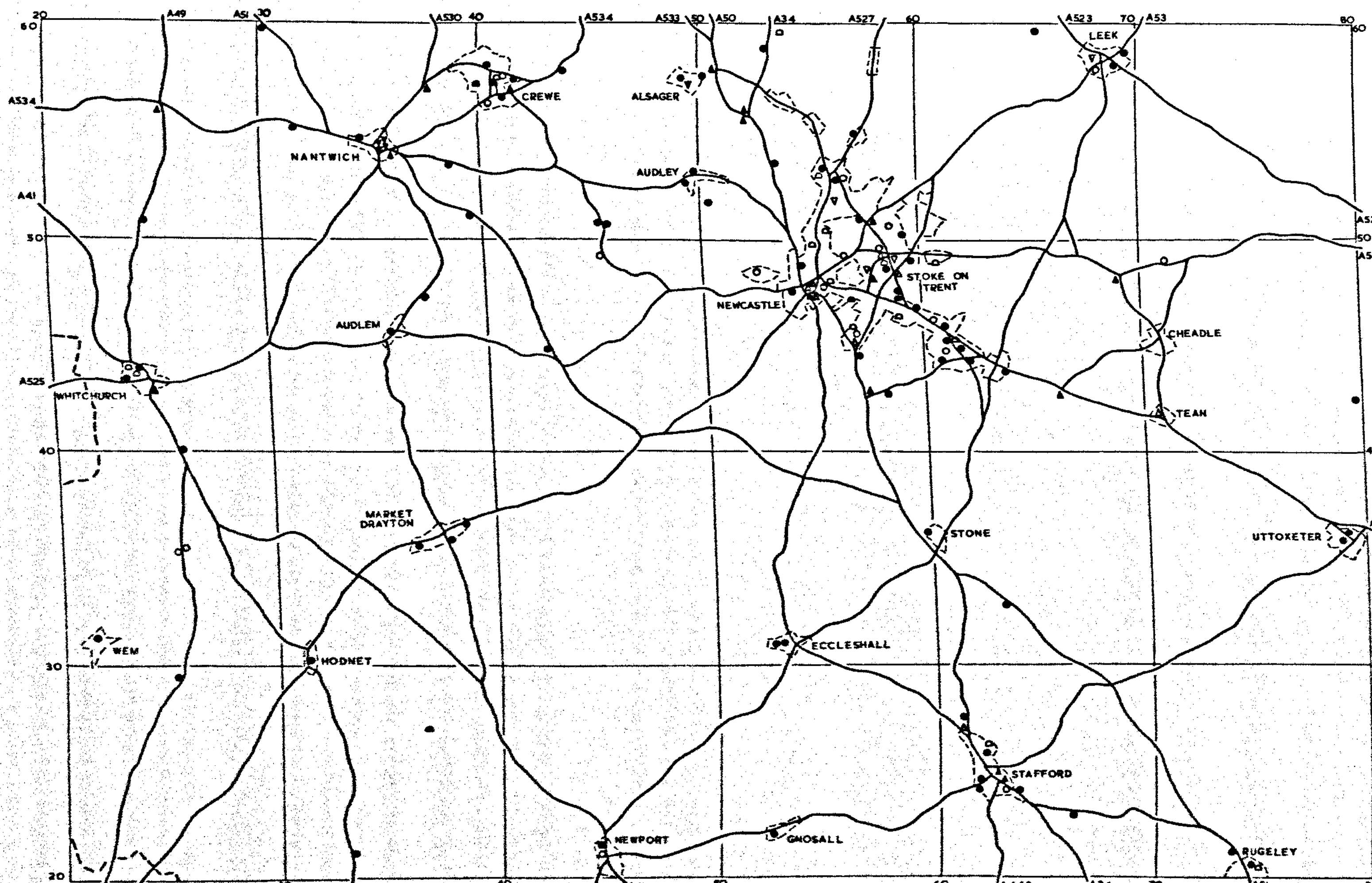
(c) their siting in positions where they could be seen in adequate time for motorists to stop, generally on major roads ;

(d) their occasional location on sites that would possibly not have been allowed following the introduction of planning controls, viz. at cross-roads, road-junctions or sharp bends.

It will be seen in figure 3.4 that 142 outlets had been established by 1928, the great majority being in or near settlements. In fact, 111 outlets were within urban areas and 12 were in villages, with another 7 only just outside the urban fringe. Thus, only 12 outlets

(Based on personal fieldwork)

FIGURE 3.4 PETROL RETAIL OUTLETS ESTABLISHED PRE-1928



KILOMETRES
4 2 0 2 4 6

END 1977

	ACTIVE	TERMINATED
1.	▲	▲
2.	●	○
3.	▼	▼
4.	●	○

URBAN AREA

BOUNDARY OF STUDY AREA

could be regarded as occupying essentially rural sites, suggesting that most were established in the knowledge that the possession of a local catchment area would be vital for commercial viability. However, the reality could well have been very different, as many of these early outlets merely added petrol sales to already-existing activities such as cycle dealerships, at least in towns and villages.

Again, as many as 102 outlets were located on major roads, and, of the remaining 40 on minor roads, 37 were on side-streets in towns and the other 3 in village centres. Clearly, therefore, not a single outlet was located on a minor road outside built-up areas, so that, even in an era of comparatively low traffic volume, stations were related either to an immediate catchment area or to major routes.

It can be further claimed, as is shown in figure 3.4, that 111 outlets occupied sites commanding reasonably good visibility, that is to say where they could be seen from at least 100 metres by an approaching motorist.[3] However, 24 of these sites could be termed 'impediments to traffic flow', being located at cross-roads or road-junctions. Of the 31 outlets having less than 100 metres visibility, only 9 could be regarded as traffic-hazards.

In terms of the above categorisation, it appears that the typical pre-1928 establishment was located on a major road in an urban setting, and possessed an adequate visibility factor while not forming an impediment to passing traffic.

With regard to closures, the majority have occurred in urban locations, in fact 38% of the urban establishments have now closed. In other words, 41 of the 47 terminated outlets occupied town sites and another 4 were in villages, thus suggesting that it is the rural stations that have achieved the best survival rate. Only 2 of the latter outlets have in fact closed, this being 10.5% of the actual total of 19 that were originally opened before 1928. Two factors would have certainly helped to achieve such a rate, namely the comparative lack of nearby competing outlets and the subsequent increase in traffic volumes.

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3. Outlets have been sub-divided into 4 categories in each of figures 3.4, 3.5, 3.6 and 3.9, on the basis of their visibility factors and their possible hazard to traffic-flow. This division forms the substance of table 3.1, details being supplied at the foot of p. 95.

With regard to the terminated urban stations, apart from 3 major road sites which were forcibly closed by the local authority due to road alterations, there was a fairly even division between major and minor road outlets. On the other hand, as many as 33 of the closures were stations occupying sites that could have been described as offering no impediment to traffic flow, thus perhaps implying that such sites were not as successful as those that were located at points where vehicles had either to stop or to reduce speed. This aspect will be considered in Chapter 5 in relation to the whole of the study-area. Finally, 29 closed outlets occupied sites having adequate visibility, again suggesting that such an apparently desirable attribute was not of critical importance in determining viability. One possible explanation is that few stations, apart from those on rural trunk roads, have ever relied greatly on casual custom, and if this is indeed the case, it means that sales were mainly to regular callers who would thus be familiar with station locations.

Of the 142 outlets opened before 1928, 95 are still in existence, thus achieving a survival rate of 66% over a period of more than 50 years. Clearly, whether or not early outlets were deliberately sited in terms of estimated future sales, this is an impressive result. However, it must be realised that many of these existing outlets have survived, at least partially if not largely, on the basis of income from other activities such as car repairs, and not necessarily as a result of successful petrol sales. A classification of outlets in terms of function and viability will be attempted in Chapters 5 and 6 respectively.

2. <u>1929-1939</u>.

The following features were suggested in the previous chapter to be characteristic of stations developed during this era :-

(a) their continued increase from 28,000 in 1930 to 35,000 in 1939 ;

(b) their choice of sites having adequate visibility without creating hazards to the free flow of traffic ;

(c) their continued proliferation in towns, but also particularly in smaller centres and villages not previously possessing petrol outlets ;

(d) their establishment along major roads, often in rural areas, but seldom very far from some type of local settlement ;

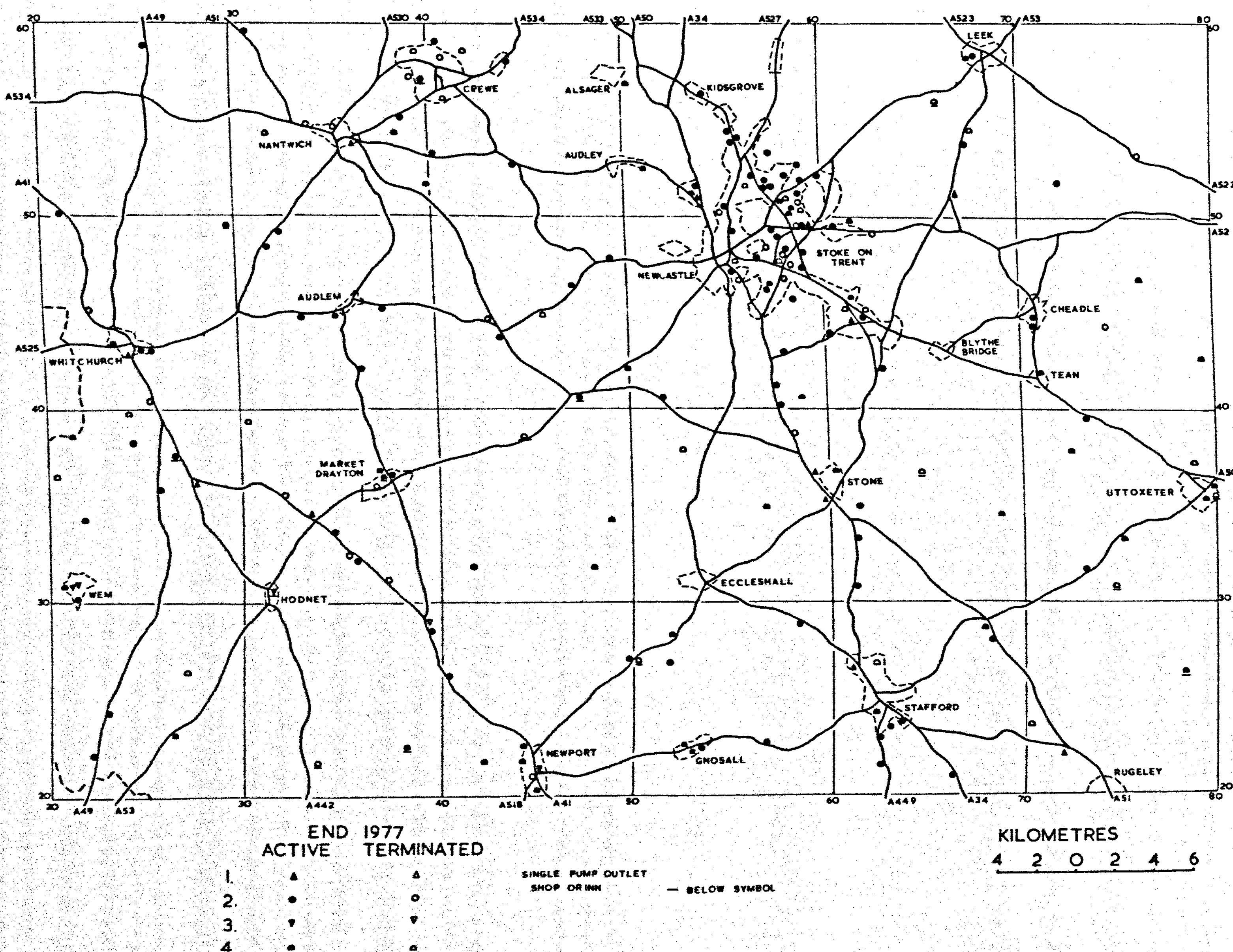
(e) a tendency for single pumps to be sited outside public houses or small shops such as sub post offices in rural districts, thus forming part of business activities having no obvious connection with the motor trade.

Within the sector under consideration, 203 outlets were established during this period. Of the 120 sites that possessed an adequate visibility factor, only 12 could be regarded as forming impediments to traffic flow. Another 5 sites of inadequate visibility could also be placed in the latter category, thus such outlets in total accounting for 8.4% of all establishments, as compared with 22% for pre-1928 locations. However, it is somewhat surprising to find that such sites were developed at all in view of the introduction of planning procedures during 1929, but clearly, and especially with another 6 post-war openings of this type, such measures did not necessarily prevent development from taking place at major road junctions. Apparently, the only category of road junction for which planning permission has never been authorised has been the roundabout, but even so, a number of outlets at present occupy such sites. In each case, such outlets pre-date the respective roundabouts, but it is noteworthy that the only stations that have had to be terminated have been those whose sites have been compulsorily purchased in order to allow for the widening or straightening of approach roads.

Of the 203 outlets established during this period, a little over a half, viz. 54%, were sited in urban areas with another 24% in villages, this being shown in figure 3.5. Thus, the majority were placed within areas of population where concentrations of cars would have existed. An interesting pattern was the establishment of 43 outlets in villages not previously possessing such facilities, some villages, in fact, receiving more than one outlet. The result was that 39 villages were served for the first time, thus the period 1929-1939 must be regarded as the one when the national network of outlets essentially extended into smaller settlements. This claim can be reinforced in view of the fact that, within this sector, only 10 villages had been served before 1928, with another 13 being represented for the first time between 1945 and 1964, and 2 more between 1965 and 1973. In addition, some of the urban areas received their first outlets during this era, in particular Cheadle, Kidsgrove and Knypersley.

FIGURE 3.5 PETROL RETAIL OUTLETS ESTABLISHED BETWEEN 1929 AND 1939

(Based on personal fieldwork)



With regard to village sites developed during this era, only one occupied a site that could be regarded as hazardous to traffic, being located on a road junction. However, the majority, 30 out of 49, did not possess adequate visibility, but this could hardly have affected their patronage to any great extent as they would undoubtedly have relied virtually entirely on local custom. However, the rural outlets in contrast would have relied, probably to a considerable extent, on casual custom, thus an adequate visibility factor would have been desirable. The fact that 35 out of 45 rural sites did possess this attribute would seem to emphasise this point. Again, 35 rural outlets were located on major roads, giving further credence to this claim. The majority of such stations were sited on comparatively heavily-travelled routes such as the A34 and A41, but, although seldom being far from some measure of local settlement, such settlements were usually quite small, so that the bulk of their customers could not possibly have resided in close proximity.

The fifth characteristic of this era, as stated earlier, was a tendency for business activities not previously associated with the motor trade to diversify by establishing single pumps on the roadside fronting village shops or public houses. Within this sector there were 17 such openings, compared with 7 before 1928 and 5 during the 1950's. Thus, as a feature of station development, this aspect characterised the 1929-1939 period more than any other. Of the 17 single-pump sites, 12 were shops and 5 were public houses, but, by 1977, 5 of the former and 4 of the latter had discontinued their petrol sales. As a group, these sites had possessed neither adequate visibility nor substantial catchment areas, so that their high failure rate was hardly surprising.

Out of the 203 stations established durimg this period, 57 have now closed, thus achieving a survival rate of 72%, a little better than the 66% recorded by the pre-1928 group. In terms of location, 27 terminations occurred in urban areas out of a total of 109 establishments, 15 out of 49 were village sites and 15 out of 45 were in rural areas. This gives closure rates of 25%, 31% and 33% respectively, thus increasimg progressively as local population decreased. These rates are in direct contrast to corresponding rates for the pre-1928 sites, which were, 38%, 33% and 10.5%. This can be at least partially explained in view of the relatively small numbers of non-urbam sites that were developed during the earlier period, whereas 46% of the 1929- 1939 group were in this category.

3. 1945-1964.

The features characteristic of this period would appear to be :-

(a) an increase in the total number of outlets from 28,000, to which point they had fallen by 1945, to reach 38,500 by 1965 ;

(b) a new awareness of the need to control the further establishment of new stations, as incorporated in the Town & Country Planning Act of 1947, by the terms of which the following requirements had to be met by such proposed developments :-

(i) not to be situated at or near road junctions or where visibility might be seriously impaired (although no powers of removal were established for existing stations contravening these conditions) ;

(ii) to be situated well away from the roadside, and with 2 access points for entry and exit ;

(iii) not to allow more than one station on each side of the road every 5 miles, outside built-up areas ;

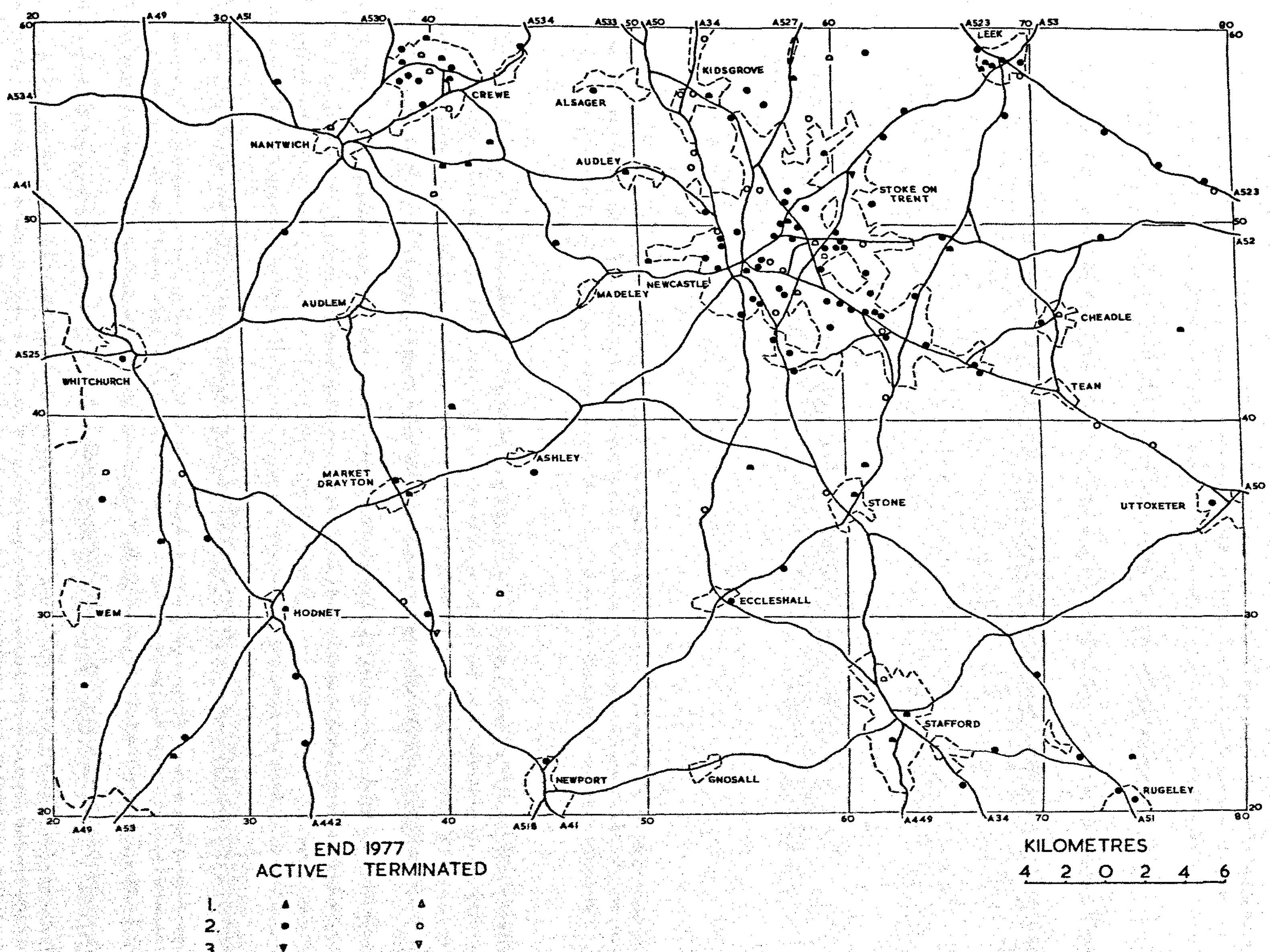
(c) the further reiteration of these points, with many others regarding numbers and functions of outlets, by the Waleran Report of 1949. Although its recommendations were not implemented, this Report will be considered below as it supplies much information regarding petrol retailing during the immediate post-war years. Interestingly, it stressed that new outlets should only be allowed in areas of deficiency, thus its acceptance by the government, and subsequent enactment, could have prevented the large scale closures of recent years.

Within this sector of the study-area, a further 159 stations were established during this period, taking the total number of openings to 504 by 1964. Of these new establishments, shown in figure 3.6, 104 were in urban areas and another 31 were located in villages, so that, in total, 83% of all outlets up to 1964 had been placed in areas of potential local custom, and, as 51 out of the 52 post-1965 openings were similarly located, this trend was to continue in a marked fashion.

With regard to the characteristic features mentioned above, specifically item (b)(i), it appears that only 2 sites could possibly be regarded as having formed possible impediments to traffic flow, both being some 50 metres from road junctions, but, as these stations were established during 1947, they managed to avoid the more-rigorous requirements set by the 1947 Act. Clearly, therefore, one major improvement was apparently achieved, namely to prevent development at or near road junctions. However, the same degree of success could not be claimed for the requirement regarding visibility, as 52 stations, or 33%

FIGURE. 3.6 PETROL RETAIL OUTLETS ESTABLISHED BETWEEN 1945 AND 1964

(Based on personal fieldwork)



of total openings, possessed less than 100 metres visibility for an approaching vehicle on the nearside of the road. Still, as the Act did not stipulate a required minimum visibility, merely stating that

"stations were not to be situated......where visibility might be seriously impaired",

it is possible to construe this as a minimum of 50 rather than 100 metres. If this is assumed, the number of outlets with less than 50 metres visibility was 12, or 7.5% of the total established during this period, although it could have been expected that no such outlet should have been allowed to open. However, only 2 of these sites could reasonably be termed to have created serious impediments to moving vehicles as the rest were on roads that carried small amounts of traffic, being mainly on urban side-streets. The 2 stations that did occupy seemingly undesirable sites were both on urban major roads and both were located on the nearside immediately following railway bridges. Both outlets are still in operation at the present day, so that such reduced visibility does not seem to have seriously affected their viability, although it must surely have detracted from their ability to attract casual custom.[4]

Regarding item (b)(ii), a situation

"well away from the roadside and with 2 access points for entry and exit"

would normally have been met by the provision of a forecourt having a frontage and depth of at least 15 and 10 metres respectively, thus allowing adequate space for pump stands and waiting vehicles. The Act, again, did not actually stipulate these dimensions, although the Waleran Report regarded a frontage of 150' or about 40 metres as being essential for the busiest type of outlet. Disregarding this recommendation, which was not in any case accepted, it could be claimed that the former dimensions might be indicative of the meaning contained within the 1947 Act. Further, it could be reasonably assumed that such a requirement was meant to apply only to outlets on major routes, thus excluding those on less-busy minor roads and side-streets. Of the 95 stations actually sited on major roads, 66 met this requirement by having a forecourt of at least 15 metres frontage and 10 metres depth, with 2 access points. However, if the stated dimensions were taken to be a frontage of 10 metres and a depth of only 7 metres, which, it could be argued, would have

4. Reference to Appendix C will reveal that neither of these stations, numbers 553 and 668, achieved viability in their sales of petrol, so that their survival must be due to income from car repairs.

allowed vehicles to move clear of the roadway and thus prove adequate for all but the busiest outlets, 87 of the total of 95 would have qualified for inclusion. Amongst the 8 stations remaining were the 4 already discussed as either occupying hazardous sites or having a visibility of less than 50 metres, and, of the other 4, 3 were rural sites on relatively quiet major roads and one was essentially an oil-distributor with 2 pumps largely for the use of the business itself. Thus, the requirement in the 1947 Act regarding the desirability of situating petrol facilities away from the roadside, with suitable access points, seemed to have been largely met, although, as usual, there were some exceptions.

The requirement regarding the spacing of stations referred to rural roads only, the latter being interpreted by the 1947 Act as being outside built-up areas and without statutory speed limits. In effect, the requirement stipulated that there should be no more than one station on each side of the road per 5 mile (or 8 kilometre) length, or in total a maximum of one station on either side every 2.5 miles (or 4 kilometres). Although the provisions of the Act gave no further detail, the Waleran Report of 1949 may well have spelt out its exact meaning. Whilst reiterating the spacing outlined above, it recommended the desirability of having stations of an acceptable standard, so that although a road might appear to be adequately served in its actual number of outlets, this might not be the case if such outlets failed to provide the facilities and type of service set out in the Report.

Table 3.2 has been constructed in order to show station numbers for each road within the sector under consideration. Every major road has been separated into sections running from town centre to town centre in each case, distances being given in kilometres for these full lengths and also for the rural portions of each section. The second table, table 3.3, indicates station frequencies for both rural and total lengths of road in aggregate form for 1945 and 1964. For the former date, an indicated frequency of more than 4.0 for the rural aggregate would have implied scope for the establishment of a new outlet regardless of the standards of existing stations, at least in terms of obtaining the necessary planning authorisation. This would only have applied to rural sections of roads, as those within built-up areas were exempt from such provisions in relation to station frequencies.[5]

5. The A34 to the north of Newcastle, the A50 north of Hanley and from Hanley to Blythe Bridge are excluded owing to a lack of rural sections.

Table 3.2 : Road lengths and numbers of stations, 1945 and 1964.

(1) Road.	(2) Section.	(3) Rural length	(4) Total length	(5) Numbers of stations 1945 Rural	(6) 1945 Total	(7) 1964 Rural	(8) 1964 Total
A34	South of Stafford	4.0	7.0	1	5	2	6
	Stafford - Stone	8.0	12.0	2	5	2	5
	Stone - Newcastle	8.0	15.0	4	9	5	12
A41	North of Whitchurch	9.0	10.0	2	3	2	3
	South of Whitchurch	31.0	32.0	12	16	15	19
A49	North of Whitchurch	20.0	21.0	3	4	3	4
	South of Whitchurch	24.0	25.0	8	10	9	11
A50	Blythe Bridge - Uttoxeter	10.0	19.0	1	6	3	11
A51	Rugeley - Stone	22.0	23.0	5	6	7	9
	Stone - Nantwich	35.0	37.0	5	10	6	11
	North of Nantwich	7.0	8.0	3	6	4	8
A52	East of Stoke	19.0	28.0	2	8	4	13
	Newcastle - Nantwich	16.0	24.0	3	11	5	18
A53	South of Hodnet	13.0	14.0	1	2	3	4
	Hodnet - Market Drayton	8.0	10.0	1	4	1	4
	M. Drayton-Newcastle	20.0	22.0	3	4	3	5
	Stoke - Leek	8.0	20.0	1	8	3	15
A442	Hodnet - Whitchurch	17.0	18.0	4	9	6	9
	South of Hodnet	9.5	10.0	1	2	3	4
A513	Stafford - Rugeley	8.0	13.0	3	7	4	9
A518	Newport - Stafford	15.0	21.0	1	8	1	8
	Stafford - Uttoxeter	18.0	22.0	2	4	3	5
A519	Newport - Eccleshall	12.0	14.0	3	6	3	7
	Eccleshall - Newcastle	16.0	19.0	0	1	1	3
A520	Leek - Blythe Bridge	12.0	16.0	3	3	5	6
	Blythe Bridge - Stone	6.0	10.0	0	1	1	3
	Stone - Eccleshall	7.0	8.0	0	1	1	2
A522	Tean - Cheadle	2.0	4.0	0	3	0	3
	North of Cheadle	8.5	9.0	2	2	2	3
A523	East of Leek	13.0	14.0	1	2	5	7
A525	Whitchurch - Audlem	11.0	12.0	1	5	1	5
	Audlem - Newcastle	20.0	22.0	5	6	5	7
A525/A531/A5020	Newcastle - Crewe	20.0	22.0	5	10	6	12
A529	Newport - M.Drayton	17.0	19.0	3	6	5	8
	M.Drayton - Audlem	10.0	11.0	1	4	1	5
	Audlem - Nantwich	9.0	11.0	1	3	1	3
A530	North of Nantwich	6.0	7.0	1	2	1	2
	South of Nantwich	15.0	17.0	3	5	4	6
A534	West of Nantwich	17.0	18.0	2	4	2	5
A5013	Stafford-Eccleshall	8.0	12.0	1	3	1	4

Table 3.3 : Traffic volumes, station frequencies and indices of adequacy and deficiency.

(1) Road	(2) Section	(3) Daily traffic volume - 1949	(4) Station frequencies 1945 Rural	(5) 1945 Total	(6) 1964 Rural	(7) 1964 Total	(8) Index
A34	South of Stafford	2059	4.0	1.4	2.0	1.2	1
	Stafford - Stone	4330	4.0	2.4	4.0	2.4	2
	Stone - Newcastle	6975	2.0	1.6	1.6	1.2	1
A41	North of Whitchurch	4339	4.5	3.4	4.5	3.4	5
	South of Whitchurch	4456	2.6	2.0	2.0	1.6	1
A49	North of Whitchurch	2713	6.7	5.3	6.7	5.3	5
	South of Whitchurch	2491	3.0	2.5	2.7	2.2	1
A50	Blythe Bridge - Uttoxeter	2733	10.0	3.2	3.4	1.8	4
A51	Rugeley - Stone	2377	4.4	3.8	3.2	2.6	4
	Stone - Nantwich	673	7.0	3.6	5.8	3.4	1
	North of Nantwich	2808	2.4	1.4	1.8	1.0	1
A52	East of Stoke	1508	9.5	3.5	4.8	2.2	4
	Newcastle-Nantwich	1698	5.4	2.2	3.2	1.4	4
A53	South of Hodnet	1743	13.0	7.0	4.4	3.5	4
	Hodnet-M.Drayton	1627	8.0	2.5	8.0	2.5	5
	M.Drayton-Newcastle	1073	6.7	5.5	6.7	4.4	5
	Stoke - Leek	1756	8.0	2.5	2.6	1.3	4
A442	Hodnet-Whitchurch	877	4.3	2.0	2.8	2.0	1
	South of Hodnet	788	9.5	5.0	3.2	2.5	4
A513	Stafford - Rugeley	1261	2.6	1.8	2.0	1.4	1
A518	Newport - Stafford	1041	15.0	2.5	15.0	2.5	5
	Stafford-Uttoxeter	566	9.0	5.5	6.0	4.4	4
A519	Newport-Eccleshall	477	4.0	2.4	4.0	2.0	2
	Eccleshall-Newcastle	382	-	19.0	16.0	6.4	3
A520	Leek-Blythe Bridge	1544	4.0	5.4	2.4	2.7	1
	Blythe Bridge-Stone	968	-	10.0	6.0	3.4	4
	Stone-Eccleshall	456	-	8.0	7.0	4.0	4
A522	Tean - Cheadle	1279	-	1.4	-	1.4	5
	North of Cheadle	1406	4.2	4.5	4.2	3.0	2
A523	East of Leek	1656	13.0	7.0	2.6	2.0	4
A525	Whitchurch-Audlem	643	11.0	2.4	11.0	2.4	5
	Audlem-Newcastle	748	4.0	3.6	4.0	3.2	2
A525/A531/A5020	Newcastle - Crewe	1422	4.0	2.3	3.4	1.8	1
A529	Newport-M.Drayton	1151	5.6	3.2	3.4	2.4	4
	M.Drayton-Audlem	485	10.0	2.8	10.0	2.2	5
	Audlem-Nantwich	972	9.0	3.6	9.0	3.6	5
A530	North of Nantwich	5415	6.0	3.5	6.0	3.5	5
	South of Nantwich	1867	5.0	3.4	3.8	2.8	4
A534	West of Nantwich	509	8.5	4.5	8.5	3.6	5
A5013	Stafford-Eccleshall	1204	8.0	4.0	8.0	3.0	5

The following is a summary of the situation relating to rural sections of roads in 1945 and 1964 :-

	1945		1964	
	Rural portions.	Total lengths.	Rural portions.	Total lengths.
Roads without stations	4	0	1	0
Roads with an aggregate of 4.0 or more	31	13	22	5
Roads with an aggregate of below 4.0	5	27	17	35

Whereas most rural roads in 1945 had aggregate frequencies of more than 4.0, a substantial change had occurred by 1964, although the majority were still apparently deficient in terms of actual numbers of stations. However, if frequencies for total road lengths are considered, it will be realised that such deficiencies related essentially to rural sections of road. This factor, together with a relatively low volume of traffic on the majority of such roads, as figure 3.7 indicates, would probably have discouraged the opening of more stations in rural areas.

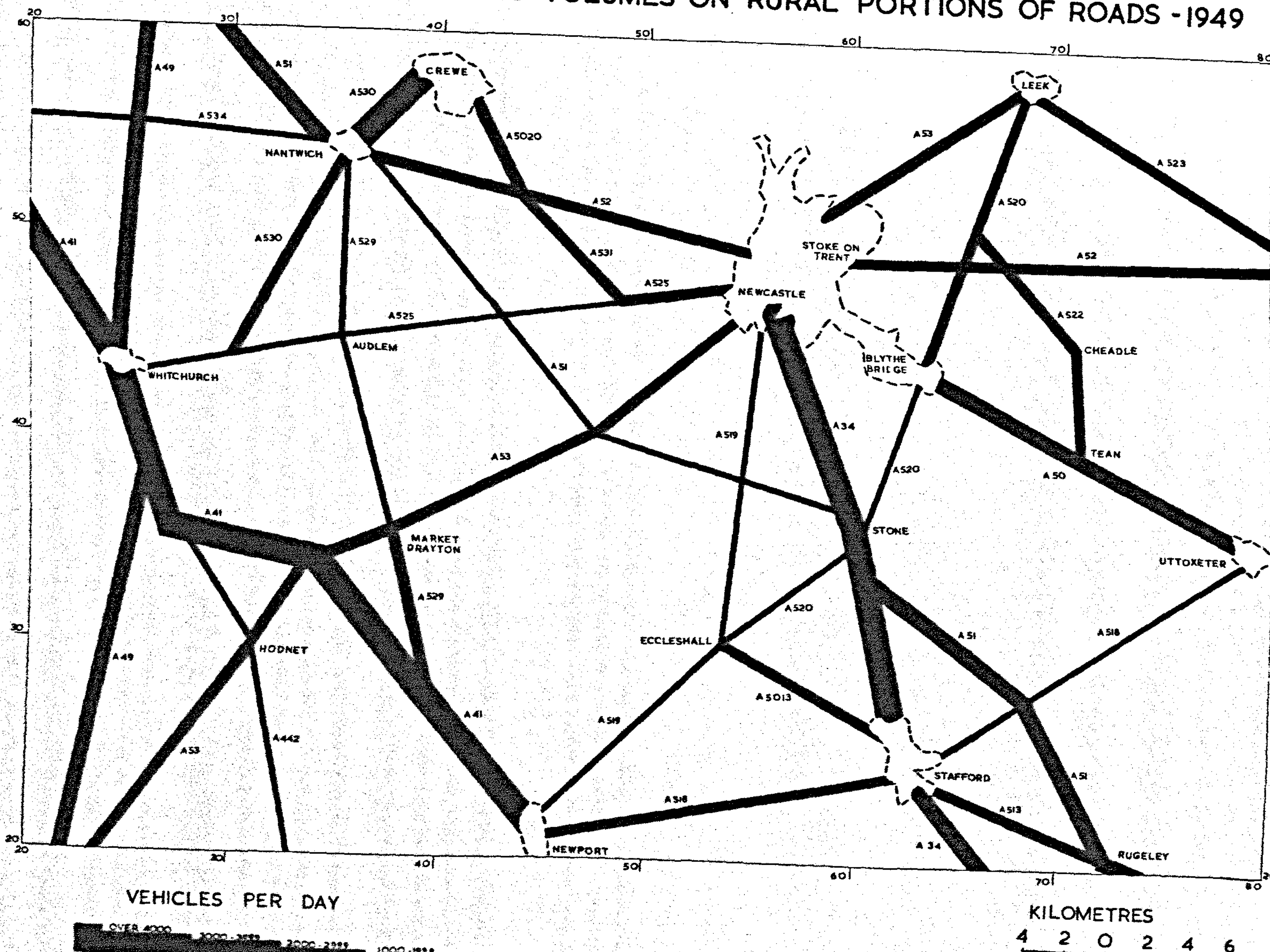
In view of the requirement in the Town & Country Planning Act of 1947 that local authorities should not allow more than one station every 4 kilometres of road, it could have been expected

(a) that new outlets would have been placed on roads of apparent deficiency, and

(b) that no further stations would have been established on those roads with an aggregate frequency of less than 4.0 in 1945, unless existing outlets were of an inferior standard.

With regard to the former expectation, 12 rural road lengths experienced reductions in their frequencies to less than 4.0, and another 4 sections fell but remained above this level. As to the second point, it is perhaps surprising to learn that 5 rural roads, already below 4.0 in 1945, had by 1964 been further reduced. Only 2 of these sections had existing outlets of an inferior standard, but even by discounting such stations, their 1945 frequencies were still below 4.0. These particular roads, the A41 and the A49, both to the south of Whitchurch, certainly carried comparatively heavy volumes of traffic during this period, so that, quite clearly, the spacing requirement was not applied inflexibly as long as demand for petrol was apparent.

FIGURE 3.7 MEAN DAILY TRAFFIC VOLUMES ON RURAL PORTIONS OF ROADS - 1949



(Based on traffic statistics supplied by the County Surveyors Departments of Cheshire, Shropshire and Staffordshire)

As only apparent deficiency has so far been considered, the question of actual deficiency, which was of greater significance, will now be discussed. According to the Waleran Report, the following was an indication of the need for petrol facilities along roads outside built-up areas :-

Traffic volume.	Station frequency.
less than 1,000 vehicles daily	8.0
between 1,000 and 2,000	4.8
over 2,000	4.0

By applying these criteria, roads of actual deficiency or adequacy in terms of station provision may be recognised. Referring to table 3.3, which includes traffic statistics for the early part of this period, the indices in column (8) represent the following :-

		Roads.
1.	Adequate in 1945, station frequency further improved by 1964	10
2.	Adequate in 1945, no resultant reduction	4
3.	Deficient in 1945, some reduction by 1964, but remaining deficient even by the standards of the late 1940's	1
4.	Deficient in 1945, station frequencies reduced to reach adequate levels	13
5.	Deficient in 1945, no resultant reduction	12

The totals of roads in each category are shown on the right, above, so that 24 out of 40 rural roads experienced a reduction in station frequencies. Although the 13 roads in category 4 apparently reached adequate levels by 1964, it must be remembered that this was in terms of late 1940's traffic volumes. However, it remains to be stressed that these results show that the establishment of new stations was not confined to roads of inadequate provision.

In summary, it can be stated that roads in category 1 carried substantial volumes of traffic, having a mean flow of 2,457 vehicles daily. Thus, it is not altogether surprising that they experienced further establishments of stations. However, in category 2, the section of the A34 between Stafford and Stone could have been expected to have received further openings as this was one of the busiest lengths of road in 1949, although its total aggregate was probably adequate. The only road in category 3 was the A519 between Eccleshall and Newcastle, this road receiving its first rural station during this period. In view of its very light traffic flow it is somewhat surprising that this road gained even one outlet, although it must be said that the facility consisted only of a single pump placed outside an isolated house. With regard to category 4, these were mainly roads that carried intermediate amounts of traffic, and the addition of only one or two stations in almost every case allowed them to be rated as adequate by 1964. If 2 roads are discounted in category 5, viz. the A49 to the north of Whitchurch and the A530 to the north of Nantwich, the mean traffic volume of the other 10 roads was only 1,155 vehicles daily, thus not being particularly attractive for new station establishments and therefore remaining deficient. The latter road can certainly be disregarded as the bulk of its traffic would have been moving between Nantwich and Crewe, both towns having a considerable number of urban stations. Also, as Crewe experienced a number of new establishments during this period, no actual deficiency could possibly have existed in connection with this road. Again, the relevant section of the A49 experienced several openings just to the north of the area under consideration, so that this road did not remain in a deficient category.

The claim can probably be substantiated that the spacing requirements of the 1947 Act in conjunction with criteria set out by Waleran largely governed post-1949 station establishments. Nevertheless, in view of the fact that most stations established both before and after this date were in towns, it remains to be stressed that the most important consideration for potential operators was the total aggregate frequency of a road and not just its rural frequency.

One further trend characteristic of this era was that urban outlets were generally located further from town centres than had been the case in earlier times. Such an impression can be gained from a comparison of the series of maps showing periods of establishment, figures 3.4, 3.5,3.6 and 3.9, and it can be substantiated by means of a calculation of mean distances of all urban stations from their respective town centres. The following values are the means of such distances measured in straight lines :-

pre-1928	-	0.325 kilometres
1929-1939	-	0.522 kilometres
1945-1964	-	0.626 kilometres
1965-1973	-	0.696 kilometres
1973-1977	-	0.982 kilometres.

This trend can be partially explained by the outward growth of towns, so that new establishments were being made in the urban fringe and particularly along major through-roads such as the A50 and the A34 through Stoke-on-Trent and Newcastle respectively. Again, many of the possible town centre sites would already have been developed, so that an operator wishing to establish in this type of location would probably have been faced with the extra costs of demolishing existing property in order to build a new station, quite apart from the higher rental or rateable charges characteristic of central areas in general. Clearly, the more attractive sites for new stations would have been in the area of the urban fringe rather than in town centres as not only would they have been less costly to develop but it would have been here that car-using commuters would have lived. Further, for the station needing space for such activities as car sales in addition to petrol retailing, it is probable that town centre sites would have been too expensive.

With regard to urban stations, in contrast to rural requirements, the Waleran Report failed to give guidance as to the number required by towns of known vehicle populations. This was a curious ommission, especially as the chief concern of the Report was to try to prevent the establishment of too many stations without due regard being paid to demand for petrol and quality of outlet. In spite of this failing, the Report provided estimates for station vaibility, claiming that, for those outlets entirely reliant on sales of petrol, thresholds of 70,000 gallons for Grade I and 40,000 gallons for Grade II stations could be regarded as necessary at this time. Having made such a claim, it would seem possible to have related numbers of cars in a town with average annual consumption, thus indicating, if only approximately, the required number of outlets. The one real difficulty in establishing such a relationship would have been the fact that only a minority of stations would have been entirely reliant on petrol sales.

One of the urban areas examined in detail in the Report was the City of Stoke-on-Trent where 115 petrol outlets were selling an annual total of 3,220,000 gallons, the city itself having a total vehicle population of 11,535. It is probable that only a minority of these outlets existed solely for the retailing of petrol, although the Report indicated that 62 stations were of Grade I standard and would almost certainly have been largely reliant on their income from petrol.

Another 31 outlets were of Grade II standard and 22 were Grade III, the latter being comparatively unimportant in terms of petrol sales as they were single-pump sites. The overall average throughput for all stations was 28,000 gallons per year, with Grade I outlets averaging some 41,000 gallons, thus it was probable that the majority were not viable as a result of petrol sales alone. However, given the vehicle population of 11,535 and in the knowledge that average annual consumption per vehicle was soon to reach about 280 gallons, this would suggest the following :-

either (a) that 46 Grade I stations could satisfactorily have met the needs of Stoke's vehicle population and have been viable entities,

or (b) that 80 Grade II stations could have performed similarly.

Still, being more realistic, and assuming that many stations would have possessed other sources of income such as repairs or car sales, it could be postulated that stations could have survived, and in fact did survive, with lower thresholds.

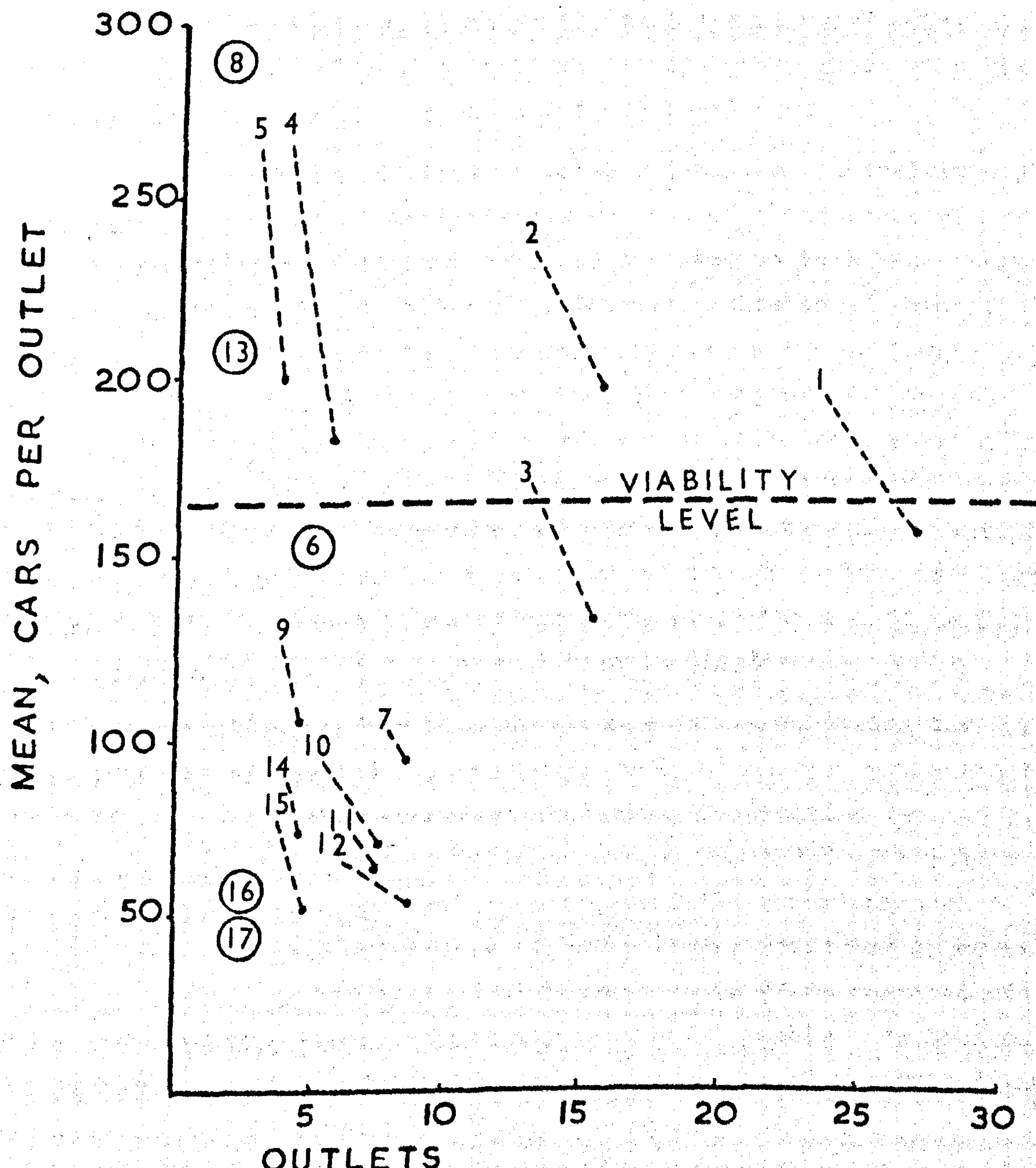
Given that there were twice as many Grade I stations as there were of Grade II standard, and taking their thresholds as 50,000 and 25,000 gallons respectively, the needs of Stoke could have been met by 50 Grade I and 28 Grade II outlets instead of 62 and 31 of each type. In addition, a number of Grade III single-pump outlets could have survived as points of convenience, selling only to customers calling primarily for other purposes. Thus, on this basis, and excluding Grade III sites, an approximate relationship could have been established between numbers of vehicles and numbers of petrol outlets in an urban area, viz. for every 1,000 vehicles, 6 stations could have been viable entities, as long as no more than 4 of these were of Grade I standard. Therefore, the critical level of cars per outlet would have been 167. By this token, Stoke at this time was clearly overpopulated in terms of petrol stations, but it was by no means alone as figure 3.8 illustrates.

Figure 3.8 is a visual representation of the following table, table 3.4, which shows mean numbers of cars in terms of both Grades I and II outlets, and in terms of all outlets, in each of 17 towns within this sector of the study-area.

Table 3.4 : Cars and Petrol Outlets, numbers and relationships, 1949.

Reference number in figure 3.8.	Town.	Number of cars.	Number of outlets.	Cars/ outlet.	Number of Grade I and II outlets.	Cars/ Grade I and II outlet.
1.	Newcastle	4382	27	162	23	191
2.	Stafford	3076	16	192	13	237
3.	Crewe	2209	16	138	13	170
4.	Leek	1070	6	178	4	268
5.	Alsager	800	4	200	3	267
6.	Stone	751	5	150	5	150
7.	Nantwich	727	8	91	7	104
8.	Cheadle	575	2	288	2	288
9.	Uttoxeter	519	5	104	4	130
10.	Newport	482	7	69	5	96
11.	Market Drayton	458	7	65	6	76
12.	Whitchurch	452	9	50	6	75
13.	Eccleshall	411	2	206	2	206
14.	Gnosall	280	4	70	3	93
15.	Wem	250	5	50	3	83
16.	Hodnet	115	2	58	2	58
17.	Audlem	80	2	40	2	40

FIGURE 3.8 CARS & PETROL OUTLETS, 1949



8 Mean numbers of cars, Grades I and II outlets.

Mean numbers of cars, all outlets.

6 All outlets of Grade I or II standard.

Numbers on graph refer to towns in table 3.4

It is perfectly clear in figure 3.8 that 10 of these towns had too many petrol outlets for their own vehicle populations, thus being in the same category as Stoke-on-Trent. With the exception of Eccleshall which occupied a viable position, these towns also had the smallest numbers of cars, although to their totals might be added those cars within their immediate rural areas as each one was an agricultural market centre. Conversely, those with larger car populations tended not to have too many stations, although the best 'performers' - Cheadle, Leek and Alsager - belonged to an intermediate group where very few stations served between some 500 and 1,000 local cars.

Clearly, in addition to local sales, through traffic would have required petrol, so that outlets in some of those towns of apparent over-representation could have possibly survived on this basis. In this category could be placed Whitchurch, Newport, Nantwich and Stone, each of these having been situated on relatively busy roads as figure 3.7 indicates. However, it is equally clear that many of the poorest performers did not even have this advantage to help them, viz. Audlem, Hodnet, Gnosall, Market Drayton, Uttoxeter and Wem, the latter not even being on a major road. In view of such adverse factors it is surprising that only 4 closures have taken place out of the 25 outlets in these 6 towns. This important theme of viability of stations will be further considered for the present period of time in Chapter 6.

Finally, to return to stations established during the 1945-1964 period, 36 out of the 159 stations concerned had closed by the end of 1977, the following being the percentages according to location :-
22% of urban stations, 23% of village stations and 25% of rural stations. Such proportions are very similar to those of the preceding period, but in each case the later values are slightly lower, producing an overall survival rate for the 1945-1964 establishments of 77.4% compared with 72% for the earlier period. Such a result could really have been expected in view of the more careful selection of sites that characterised the post-war years.

4. <u>1965-1977</u>.

This period has been characterised nationally by :-

(a) Factors that have formed part of a new development , namely the desire to maximise sales at fewer outlets so as to increase overall income by eliminating low-volume sites and concentrating on high-gallonage stations. Although already in evidence, they were not considered during the preceding section as their full impact was not felt until after the mid-1960's :-

  (i) the application of the solus system to cover every petrol outlet apart from motorway sites ;

  (ii) the growth of company-owned sites to a point where they now account for 30% of all outlets ;

  (iii) the adoption of self-serve facilities by 15% of all stations ;

  (iv) the entry of new supplying companies ;

(b) a reduction in the total number of outlets from about 40,000 in 1967 to 29,373 by the end of 1977, thus giving a very large closure rate of about 26%, this being particularly noticeable from 1973 onwards ;

(c) a relatively small number of new establishments, almost entirely in the form of specialised filling stations that relied on income from petrol sales, and generally being located on urban and suburban major roads, together with a smaller number of hypermarket forecourts ;

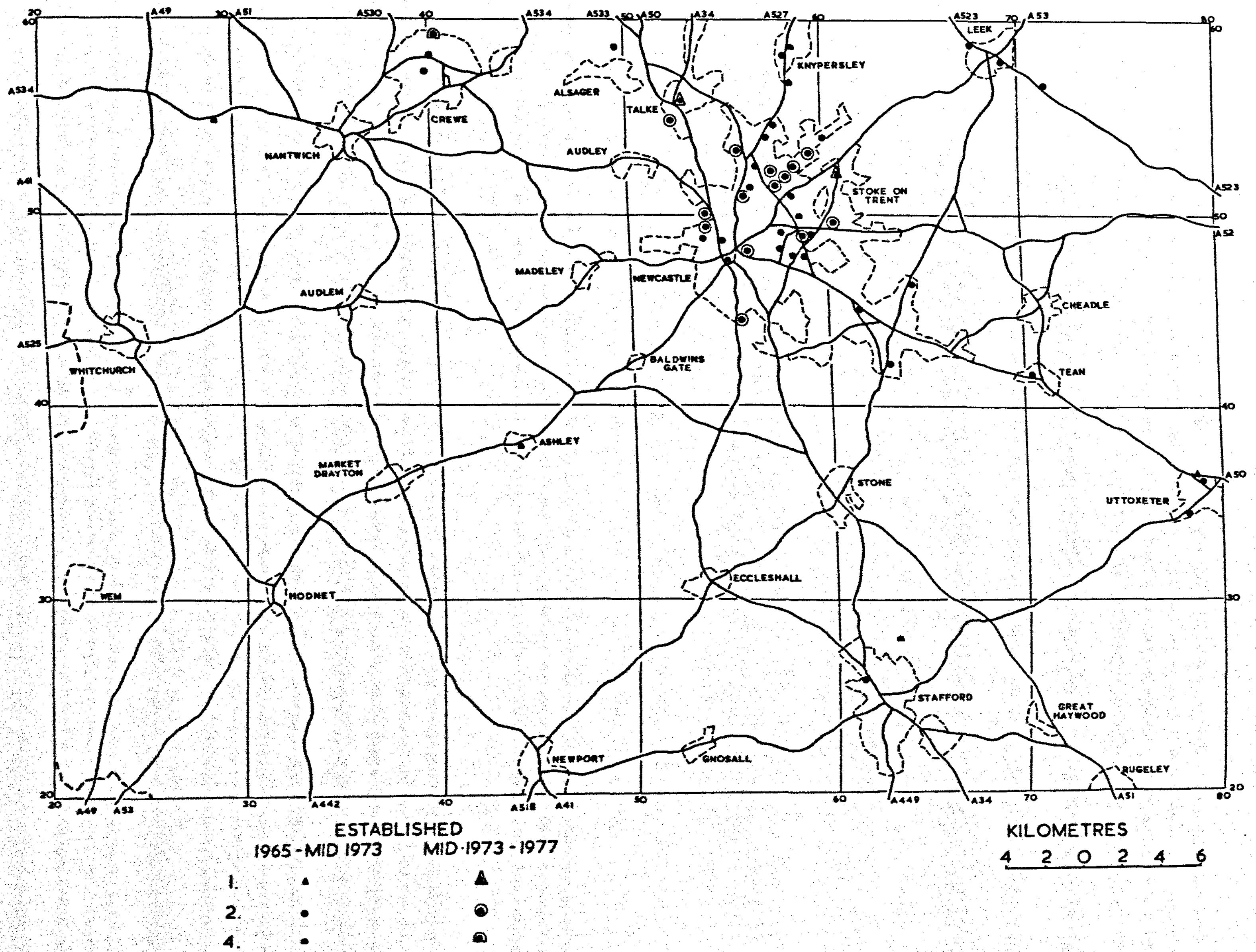
(d) a particular concentration of Group II brands in the type of location referred to in (c) above ;

(e) the withdrawal of Group I brands from many low-volume sites, generally in non-urban locations, necessitating either closure or change of brand to an independent Group III supplier.

Of the 52 post-1965 establishments within this sector, as figure 3.9 shows, 48 were in urban or suburban locations, this category including each of the 17 stations that opened during 1973-1977. Another 2 were located within recently-expanded villages, namely Hopton near Stafford and Lawton Heath near Alsager, and one formed part of a car-dealership in the small village of Faddiley to the west of Nantwich. Thus, only one station occupied a rural site, on the A523 some 2 kilometres east of Leek. Of the 35 that opened between 1965 and 1973, the majority, 21, were in Stoke and Newcastle, these forming the largest concentration of cars within this sector. This trend became more apparent after the middle of 1973 when 16 of the 17 new establishments were located in the conurbation.

(Based on personal fieldwork)

FIGURE 3.9 PETROL RETAIL OUTLETS ESTABLISHED POST-1965



Most of the stations occupied sites on major roads, this being a characteristic of 35 of the total of 48 urban outlets. Of the 13 stations established on minor roads, 10 were on relatively busy routes while the other 3 were associated with hypermarkets or superstores. Again, the majority possessed adequate visibility, although 3 stations occupied sites at or near busy road junctions and thus created possible hazards to the free movement of traffic. However, these 3 stations each had more than 200 metres visibility from all directions, and, furthermore, possessed very spacious forecourts with excellent entry and exit facilities, thus minimising any possible impediment to passing traffic.

By 1973, when the first survey was conducted within the study-area, with the exception of 3 motorway service areas, there was not one station selling more than one brand of petrol. Such a situation must have evolved since the introduction of the solus system by Esso in 1951, but it has not proved feasible to trace this development as no record is kept of changes of brand by any local authority department. Clearly, therefore, as the only source of such information is personal memory within the trade, this often being of a contradictory nature, it was decided not to pursue this aspect any further.

With regard to post-1965 establishments, all but 6 were developed by the supplying companies, in operational terms being almost evenly split between tenancies and direct management. The former accounted for 24 and the latter for 22 stations, but it is clear that the most recent trend has been towards company-managed sites as 13 of the post-1973 openings have been of this type. The 4 non-urban stations mentioned above were all privately-owned as perhaps could have been expected, and all 6 were opened before 1969. Thus, not surprisingly, not one privately-operated station has been established since the onset of the more difficult retailing situation in 1973.

Most of these 52 stations were equipped with self-serve facilities from their inception, but again, this trend has increased during recent years. Whereas only 14 of the 35 pre-1973 sites were of this type, 16 of the 17 later establishments were in this category. Further, with 35 of these 52 outlets being described as specialised filling stations, and not offering car repairs or vehicle sales, this trend has also become more apparent as 16 of the 17 post-1973 openings have been of this type.

Figure 3.10 is a summary of the series of 4 maps that show station establishments during the above periods, and also indicates both pre- and post-1973 closures. The overwhelming significance of the major urban centres as concentrations of petrol outlets is very clear, as also is the attraction of the main roads as places to develop sites. With regard to terminations, it is apparent that very many have occurred in the urban areas, and especially in the conurbation, and also in particular away from the major roads.

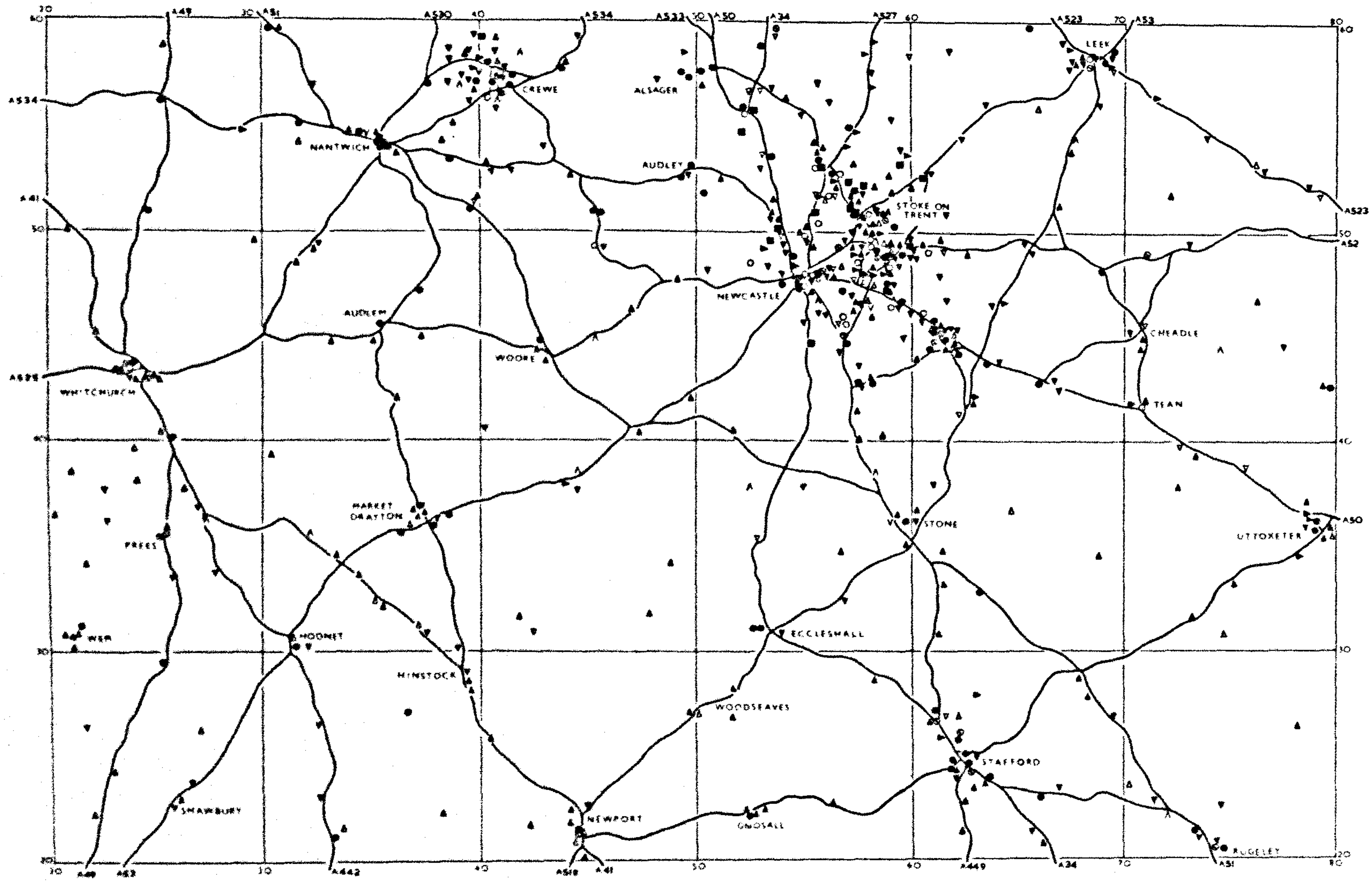
Table 3.5 summarises the period of establishment of all stations in the central sector according to their brand-allegiance at the end of 1977, while figures 3.11 and 3.12 represent the spatial distributions of the three categories of retailing companies, viz. Groups I, II and III. It will be seen that the major brands, Group I, accounted for 71.1% of all outlets in the sector concerned in 1977, this comparing with their national proportion which was 72.6%, thus being very similar. However, values for the two remaining groups were not as close, there being a higher number of Group II brands and a lower number of Group III brands within this sector.

Clearly, as the newer brands of Group II were not on the market when most of these stations opened, their representation here has been achieved by those outlets changing their allegiance. It is apparent that slightly more than a half of Group II outlets were established after 1945, the period characterised by more-careful site selection, 55% being in this category. This contrasts strongly with Group I outlets, only 39% of their total number of surviving stations having been established during the same period. As for Group III, not one post-war establishment retails such brands, recalling the fact that these companies are prepared to supply any outlet irrespective of location or throughput. Their recruitment has, therefore, been largely drawn from those outlets shed by the larger companies, being generally located as figure 3.12 indicates on minor roads or in areas having relatively small numbers of cars.

Again, with regard to Group II, their lowest percentage of stations originated during the years 1929-1939, this having been the major period for the opening of village outlets, and thus, apparently, providing less attraction for these brands. It is perfectly clear in figure 3.12 that

(Based on personal fieldwork)

FIGURE 3.10 ALL ESTABLISHMENTS ACTIVE AND TERMINATED AT END-1977



OUTLETS ESTABLISHED

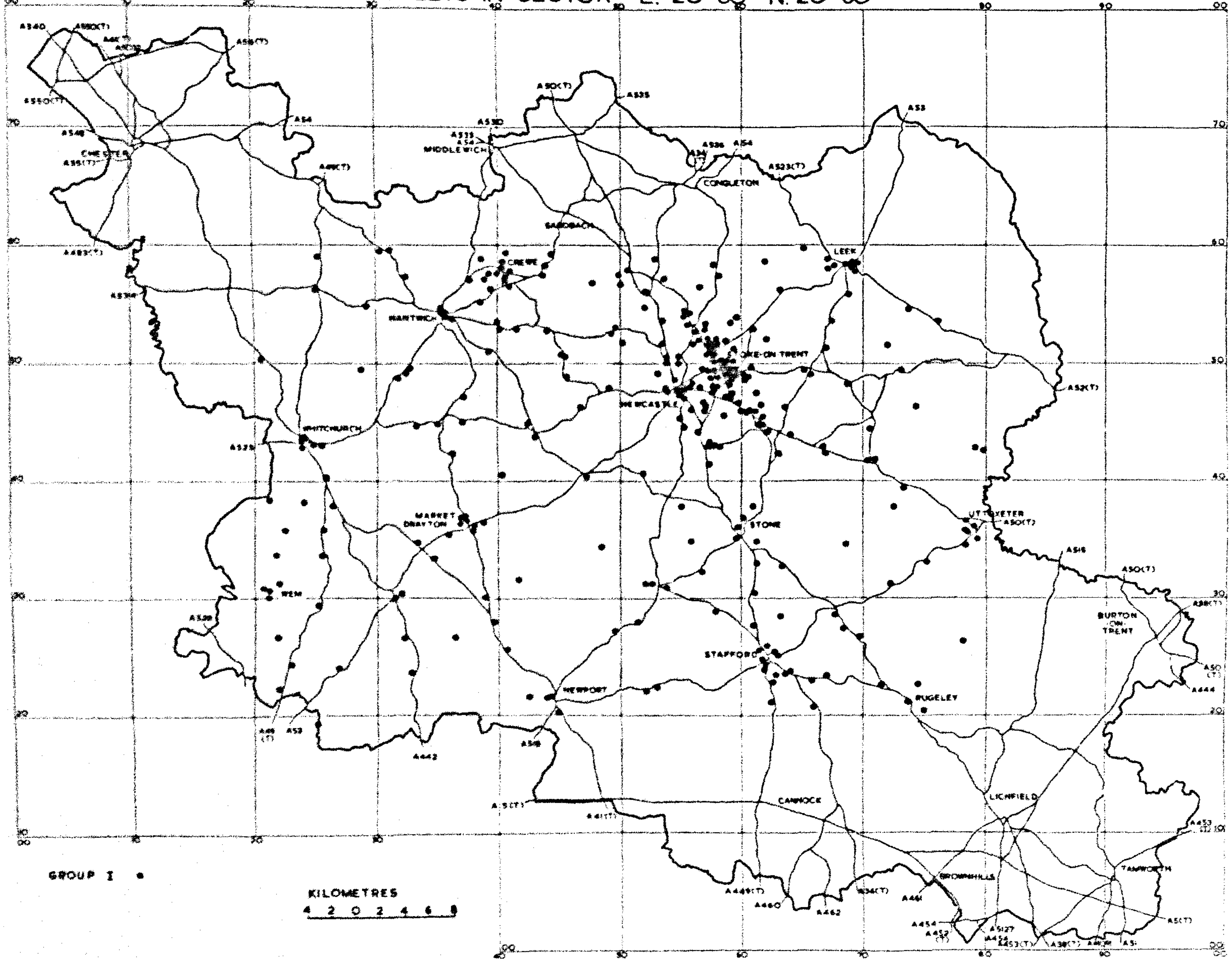
	PRE-1928	1929-1939	1945-1964	1965-MID 1973	POST-MID 1973
ACTIVE, END 1977	●	▲	▼	►	■
CLOSED POST-1973	●	▲	▼		
CLOSED PRE-1973	○	△	▽		

KILOMETRES
4 2 0 2 4 6 8

Table 3.5 : Periods of establishment of stations according to brand in 1977.

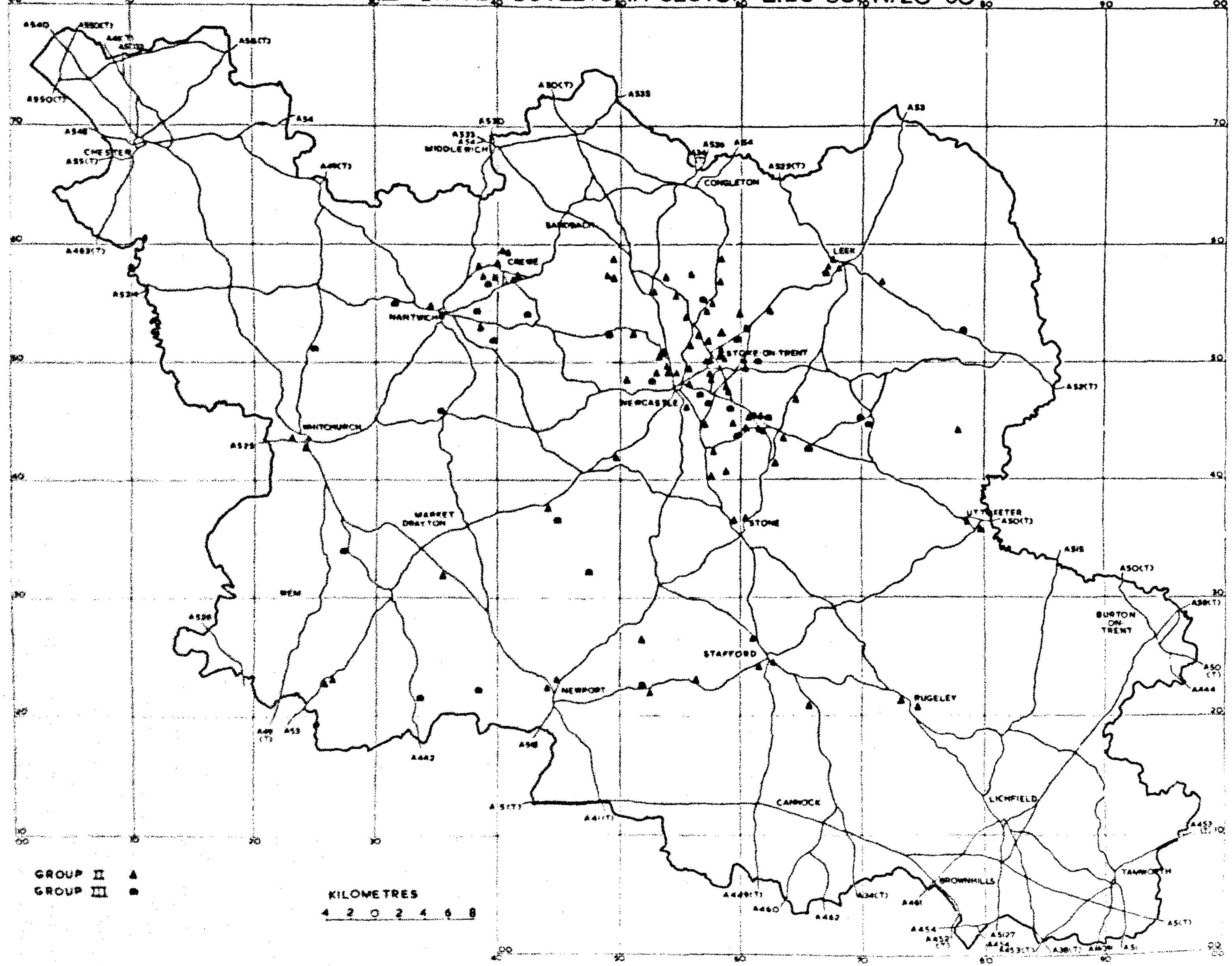
Brand.	Numbers of establishments by period Pre-1928	1929-1939	1945-1964	1965-1973	1973-1977	Total No.	Percentage.
Shell	26	38	17	4	2	87	21.0
Esso	21	40	29	4	2	96	23.0
Texaco	6	7	11	3	3	30	7.2
B.P.	8	12	9	2	1	32	7.7
National	5	10	16	1	2	34	8.2
Fina	3	4	7	2	-	16	3.9
Group I	69	111	89	16	10	295	71.0
(Percentage by period	72.6	76.0	73.0	45.7	58.8		
Mobil	5	3	9	6	2	25	6.0
Jet	2	10	2	4	-	18	4.3
Elf	2	1	2	-	1	6	1.4
Total	3	3	6	4	2	18	4.3
Amoco	2	1	2	1	1	7	1.7
Burmah	2	2	1	-	-	5	1.2
Apex	2	-	1	2	1	6	1.4
Chevron	-	-	1	-	-	1	0.2
Gulf	-	1	1	1	-	3	0.7
Murco	-	2	-	1	-	3	0.7
Group II	18	23	25	19	7	92	22.0
(Percentage by period	19.0	15.8	20.5	54.3	41.2		
ICI	2	3	2	-	-	7	1.7
Globe	1	4	4	-	-	9	2.2
Sotro	2	4	2	-	-	8	1.9
M.P.	2	-	-	-	-	2	0.5
Enerco	-	1	-	-	-	1	0.25
Thames	1	-	-	-	-	1	0.25
Group III	8	12	8	-	-	28	6.8
(Percentage by period	8.4	8.2	6.5	-	-		
TOTALS	95	146	122	35	17	415	

FIGURE 3.11 GROUP I BRAND OUTLETS IN SECTOR E. 20-80 N. 20-60



(Based on personal fieldwork)

FIGURE 3.12 GROUPS II AND III BRAND OUTLETS IN SECTOR E.20-80, N.20-60



(Based on personal fieldwork)

most Group II outlets are in populated areas, and furthermore, on major roads. In fact, 85% of the 92 stations are within urban areas while 77% are on major roads, such values being higher than corresponding results for Group I outlets. The distribution of the latter, as shown in figure 3.11, tends to resemble that of the whole population of petrol stations as presented in figure 3.3. However, this aspect of the spatial distribution of outlets in brand-categories will be further explored in the following chapter on pages 144-149. One striking contrast between Groups I and II is that the latter can claim exactly 50% of post-1965 openings although possessing only 22.1% of all the outlets in the sector. This serves to emphasise the claim that Group II companies are more interested in quality of site than in quantity of outlets, this also being the view that Group I companies have belatedly adopted.

Finally, with reference to brand changes, this sector experienced 52 cases between mid-1973 and the end of 1977. These are shown in table 3.6 which also indicates the type of change that took place and also the location characteristic of each outlet :-

Table 3.6 : Changes of brand in the central sector, 1973-1977.

Type of change, by Group.	Urban		Village		Rural		Total
	Major road	Minor road	Major road	Minor road	Major road	Minor road	
I to I	7	4	-	-	3	-	14
I to II	5	1	1	-	-	-	7
I to III	2	5	-	1	1	1	10
II to I	2	-	-	-	-	-	2
II to II	2	1	-	-	-	1	4
II to III	1	1	-	1	1	1	5
III to I	-	3	1	-	1	-	5
III to II	1	1	-	-	-	-	2
III to III	2	1	-	-	-	-	3
Totals	22	17	2	2	6	3	52

By disregarding 21 of these, as they consisted of changes to other brands within the same group, almost a half of the others, 15 out of 31, were 'down-gradings'. In other words, they involved changes to the independent Group III brands, 10 of these stations having been situated on minor roads. With regard to the total number of surviving Group III outlets, it is noticeable that their spatial distribution is very different to those of Group II, as only 57% of their stations are in urban areas and 50% on major roads.

With regard to terminations occurring between 1973 and 1977, this being the only period for which a full record of station brands exist, the 94 cases involved have been categorised by group and type of location. Also shown to the right of table 3.7, following, is the expected numbers of closures according to each group's representation in mid-1973 :-

<u>Table 3.7</u> : <u>Actual and expected numbers of terminations, 1973-1977</u>.

Location.	Total number of closures.	Actual closures.			Expected closures.		
		I	II	III	I	II	III
Urban, major road	31	19	6	6	19	10	2
Urban, minor road	26	11	6	9	18	4	4
Village, major road	6	4	-	2	5	1	-
Village, minor road	8	7	1	-	6	1	1
Rural, major road	13	11	1	1	11	1	1
Rural, minor road	10	7	1	2	6	2	2
Totals	94	59	15	20	65	20	9

Clearly, in terms of the total number of closures, both Groups I and II have experienced fewer than might have been expected, whilst Group III has performed badly especially within urban areas. It can be claimed that such results reflect the type of locations characteristic of Groups II and III at least, while Group I, by having the bulk of its representation in locations that were not particularly badly affected, has survived reasonably well.

It is clear also that sites on major roads have had a better rate of survival than those situated on minor roads, particularly if located within settlements. Only 50 of the former were closed, whereas the expected figure was 61, while those on minor roads, with an expected loss of 33 actually lost 44. However, the overall percentage of closure, 18.5%, must be regarded as very severe, especially by comparison with preceding years.

In summary, taking an overall view of the growth of the petrol retail network within this central sector of the study-area, it can be justifiably claimed that its actual development has reflected the national situation as explained in the preceding chapter very closely, so that the establishment and termination of stations has largely complied with expectations.

Thus, the pre-war period may be viewed as having experienced an almost indiscriminate spread of outlets, which, although being largely situated in areas of settlement, resulted in an over-provision of facilities. The post-war years have been characterised by fewer establishments, but in general being better-equipped and also more carefully sited in terms of potential sales, this trend being particularly apparent since the mid-1960's. Finally, the large numbers of terminated outlets, especially from 1973 onwards, bear witness to the fact that too many stations existed. Particularly since the appearance of high-volume specialised filling stations, generally able to support price-reductions because of financial backing from the supplier companies, the overall pressures on privately operated stations has increased, with the result that closures have been almost entirely within the latter group as will be demonstrated below on pages 190, 197, 274 and 279.

Chapter 4 : Spatial Distribution and Analysis.

Having considered the evolution of outlets in the previous chapter, attention will now be directed to their resultant distributional patterns. Although such an analysis will mainly concern the current stage, some element of comparison will be attempted with the situation that existed at the start of the period of survey in mid-1973. The latter may be regarded as the end of the era in which marketing costs were for the most part fairly stable, although being subjected to occasional small increases, whereas since then there has been a steep escalation in product prices, accompanied by severe discounting, but without a corresponding rise in total sales or profit margins. Thus, the situation reached by the end of 1977, in all probability, will be typical of the next several years in the field of petrol retailing. It can, therefore, be claimed that any comparison between these two stages will be meaningful and relevant, and that, furthermore, significant trends should become readily identifiable.

In view of the net decline in numbers of active outlets from 847 in 1973 to 724 in 1977, it is not surprising to discover that there has been a decrease in the crude density from 1 per 5 to 1 per 6 square kilometres. The whole study-area contains 4,312 square kilometres, but reference to figure 3.3 will clearly illustrate that the crude density has little meaning as there are distinct clusters of outlets particularly within urban areas. A more realistic approach would be to consider the relationship between location of outlets and distribution of vehicles, as this could be expected to yield more meaningful results. Such an analysis should allow the identification of areas having either too many or too few outlets in terms of their vehicle populations, but it must be realised that some stations will rely to a considerable extent on 'through traffic', although their total number will not be great. In other words, care must be taken to assess not only the local vehicle population but also the volume of traffic along the roads on which outlets are situated. This would imply that it is possible to estimate a station's potential market for petrol according to two basic factors, one being the number of vehicles normally resident within an area for which a particular outlet is the closest or the most accessible, the other being the number of petrol-driven vehicles that use the road running past the site. Admittedly, this excludes any consideration of either the brand or the price of petrol, but the assumption can be defended on the grounds that it is essentially concerned to establish measures of adequacy of provision throughout the study-area.

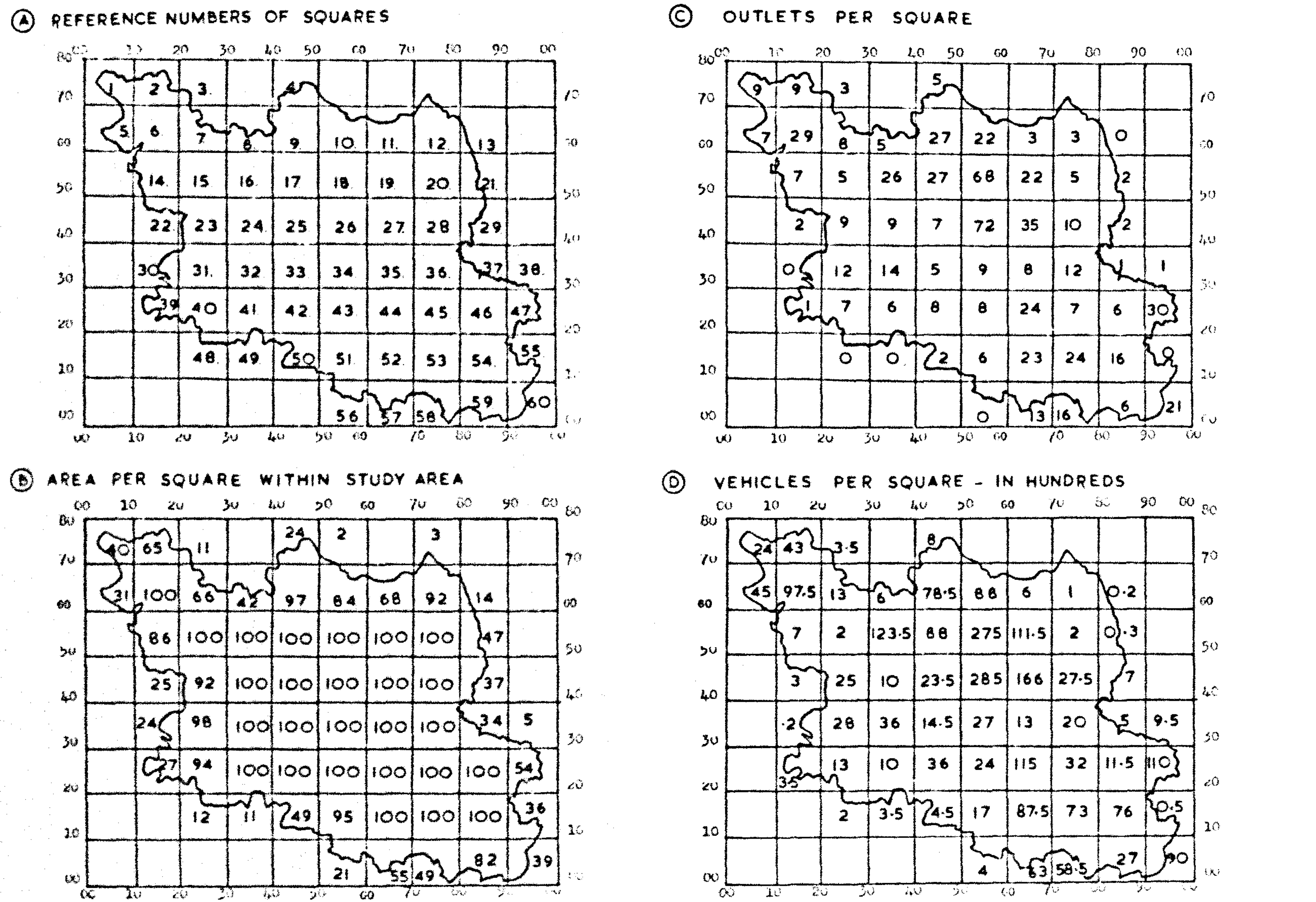
However, before attempting to analyse the study-area in this amount of detail, attention will be directed to the general distributional pattern of outlets, and also to their relationship with that of vehicles. The nature of this relationship is undoubtedly complex, as, apart from the provisioning of vehicles with their essential supplies of fuel, some of the outlets, in addition, engaged in the sale and maintenance of cars. This almost certainly implied that a strong correlation could have been expected, and also that it would not entirely have been due to the activity of petrol retailing.

If reference is made to figure 4.1, an impression may be gained of the broad distributional pattern of both outlets and of vehicles. The basis of construction is a 10-kilometre grid that includes the whole of the study-area, whose outer boundary is marked. Clearly, this form of presentation is inadequate to examine detailed aspects of the relationship, but will serve to present an overview. A calculation of the degree of relationship between outlets and vehicles in units of 100-square kilometres using the Pearson Product Moment Test confirmed a very high correlation between these distributions at the end of 1977. The coefficient was found to be 0.9695, this possibly being slightly greater than the result would have been had smaller units of area been used. However, the resultant coefficient made it clear that a high degree of correlation existed between the distribution of vehicles and the general location of outlets, although it did not signify which of these two, if any, was the independent variable.[1]

A high positive correlation could have been expected in this instance as the items concerned were clearly mutually interdependent, although a coefficient of 0.9695 would seem to have been indicative of an almost perfect relationship, notwithstanding the probable reliance

1. For 53 items, a coefficient of 0.9695 is significant at a 99% confidence level. Thus, in not more than one case in 100 could this correlation have occurred by chance.

FIGURE 4.1



(A) REFERENCE NUMBERS OF SQUARES
(C) OUTLETS PER SQUARE
(B) AREA PER SQUARE WITHIN STUDY AREA
(D) VEHICLES PER SQUARE - IN HUNDREDS

of some outlets on vehicles from more-distant areas. One possible explanation, apart from the use of such large units of area, is that in reality very few outlets relied to any substantial extent on this latter type of custom, with the great majority being situated in close proximity to their customers. That this was the general situation was probably undeniable, but it did not necessarily imply that vehicles existed in sufficient numbers to provide outlets with commercial viability. However, a consideration of this aspect will be delayed until a later stage in this chapter, and, more fully, in Chapter 6.

An examination of figure 4.1 will reveal that relationships between numbers of outlets and vehicle population were far from being as exact as the high coefficient of correlation indicated. For instance, in squares 1 and 2, both of which had 9 outlets, numbers of vehicles were, respectively, 2,400 and 4,300. Again, two further squares in which were located 9 outlets, viz. numbers 23 and 24, contained 2,500 and 1,000 vehicles respectively. Several such instances could be quoted where varaiation was quite considerable, but in spite of this, a general relationship appeared to exist, at least in the sense that those squares containing either the largest or the smallest numbers of vehicles tended also to contain the largest or smallest numbers of outlets.

This has been summarised in a frequency diagram, figure 4.2, in which it is apparent that a relationship existed, and that although broadly linear in style, a considerable variation existed in terms of expected numbers of outlets. It would seem logical to regard the latter as the dependent variable in this instance, although in actual fact both vehicles and outlets would have been initially dependent on population distribution in a general sense.

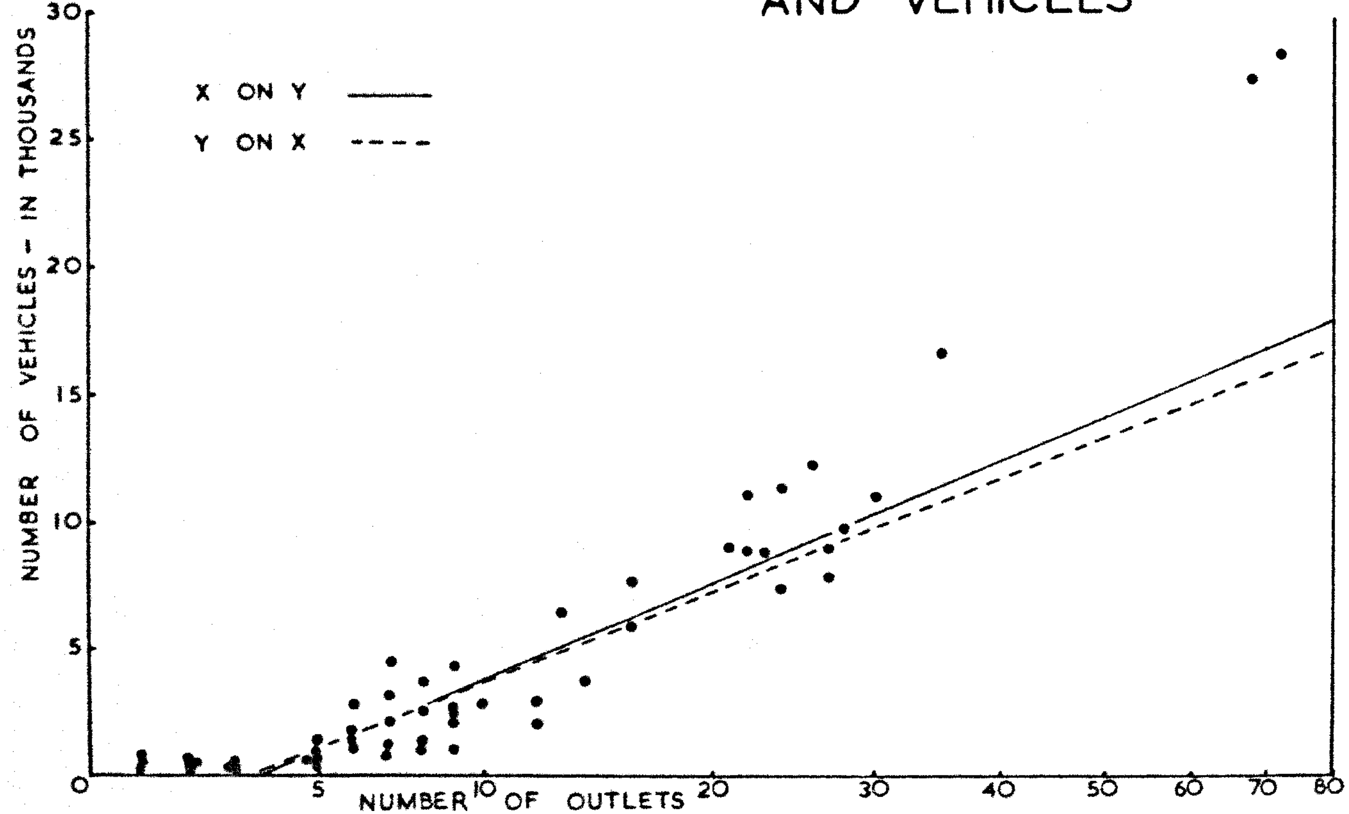
The nature of the relationship can be further elucidated by regression analysis, this being shown in figure 4.3 where the regressions of each variable on the other have been plotted. Again, as in figure 4.2, the same type of relationship is repeated, a linear belt pattern being seen to have existed. Clearly, therefore, the very high degree of correlation suggested by the Pearson Product Moment Test must be somewhat modified by such evidence.

FIGURE 4.2 FREQUENCY DIAGRAM OF OUTLETS AND VEHICLES

OUTLETS

VEHICLES	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-75
0 – 2000	••••• ••••• •••••	••••• ••••• •••													
– 4000		••••• •••	••••												
– 6000		••		•											
– 8000			•	•	•	•									
– 10000					•••	••									
– 12000					••		•								
– 14000						•									
– 16000															
– 18000								•							
– 20000															
– 22000															
– 24000															
– 26000															
– 28000														•	
– 30000															•

FIGURE 4.3 REGRESSION LINES FOR OUTLETS AND VEHICLES



However, figure 4.3 provides an opportunity to identify those areas having either more or fewer outlets than could have been expected from a knowledge of their vehicle populations, although it must be realised that this would not have implied the existence of commercial viability in the former group. Those points falling below the regression lines possess too many outlets for their numbers of resident vehicles and must be regarded as negative residuals, while those above the lines, the positive residuals, are in a healthier situation. The distribution shown in figure 4.3 can be categorised on the basis of the 100 square kilometre grid squares in the following manner :-

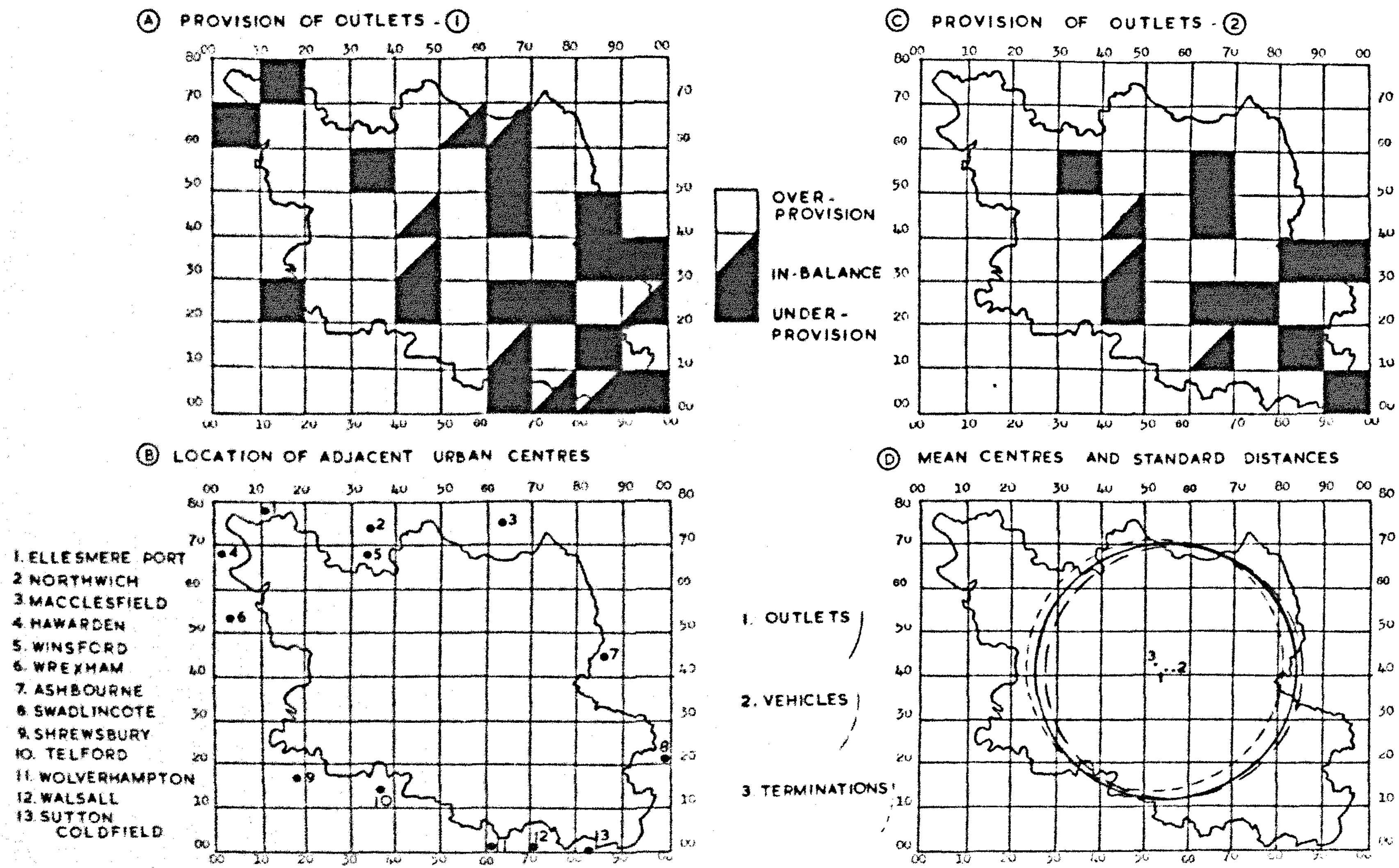
(a) squares with an over-provision of outlets ;
(b) squares with the expected numbers of outlets ;
(c) squares with an under-provision of outlets.

This threefold division has been plotted in figure 4.4 and it will be seen that most of the study-area suffered from an over-provision of outlets, as could have been expected.

The total numbers of squares in each of these categories were :- (a) 30, (b) 8, and (c) 15, giving 53 squares in all, the rest lacking either vehicles or outlets or both. In fact, the situation was worse than this, as a number of squares in the latter categories were peripheral to the study-area, so that by including their aggregate numbers of outlets and vehicles as many as 10 squares would have to be transferred to the first group, viz. (a). Thus, numbers in the stated categories would in reality have been :-
(a) 40, (b) 3, (c) 10. This is represented in figure 4.4C, the initial subdivision being shown in part A and the location of neighbouring urban areas in part B. None of the squares originally placed in category (a) above subsequently qualified for transfer on the basis of this further consideration, which meant that the number of squares with an over-provision of outlets was three times as great as the remainder.

With regard to those squares that were either in balance or had an under-provision of outlets, their resultant pattern was biased to the south-east of the study-area. Although the pattern had the appearance of clustering in this part, there seemed little purpose in

FIGURE 4.4


(A) PROVISION OF OUTLETS - (1)
(C) PROVISION OF OUTLETS - (2)
OVER-PROVISION
IN-BALANCE
UNDER-PROVISION
(B) LOCATION OF ADJACENT URBAN CENTRES
1. ELLESMERE PORT
2. NORTHWICH
3. MACCLESFIELD
4. HAWARDEN
5. WINSFORD
6. WREXHAM
7. ASHBOURNE
8. SWADLINCOTE
9. SHREWSBURY
10. TELFORD
11. WOLVERHAMPTON
12. WALSALL
13. SUTTON COLDFIELD
(D) MEAN CENTRES AND STANDARD DISTANCES
1. OUTLETS
2. VEHICLES
3. TERMINATIONS

applying the technique of spatial autocorrelation in an attempt to quantify the amount. Instead, it was deemed of greater significance to attempt a subjective explanation of their locations. A number of these areas, adjacent to squares containing some of the larger urban centres, included parts of their outer suburbs and commuter belts, thus recording substantial vehicle populations. In these cases, outlets were not as numerous as within the actual urban areas, the result being that such squares appeared to have an under-provision of outlets, these being numbers 16, 19, 25, 27 and 45. In contrast to this group, four squares of rural character had comparatively small amounts of vehicles and outlets, and thus were of relative insignificance, having only 15 outlets in total. In effect, another outlet in any of these squares, viz. numbers 33, 37, 38 and 42, would have meant their transfer to category (a), so that evidently their allocation to the under-provision category was somewhat tenuous.

Each of the remaining four squares contained substantial numbers of both outlets and vehicles, having, in fact, a total of 84 stations. These squares, numbers 44, 52, 54 and 60, covered the major urban centres of Stafford, Cannock, Lichfield and Tamworth, this sector having experienced the most rapid rate of population growth within the whole of the study-area in recent years. The key to their inclusion in this category probably lay in the related growth in their numbers of vehicles, which was accomplished without a corresponding increase in outlets. In spite of the development of 3 new stations since 1973, the rate of population increase, and, by implication, that of vehicles, has been very rapid, the former being estimated at 92%, 69% and 37% for Tamworth, Lichfield and Cannock respectively between 1961 and 1974.[2] Whereas Staffordshire as a whole increased its population by 16% during this period, the south and south-east of the county grew much more rapidly owing to the designation of Tamworth and Lichfield as expansion centres for the housing of overspill population from the West Midland conurbation. The impression conveyed by figure 4.4 that squares not experiencing over-provision tended to be located towards the south-east of the area can thus be supported by such evidence.

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2. Staffordshire Abstract of Statistics, 1975. County Planning Dept.

To further consider the extent of the relationship between outlets and vehicles, a calculation of mean centres has been attempted for the 1977 situation. The results are shown in figure 4.4D and are as follows :-

Mean centre of outlets	544411	(Grid Reference)
Mean centre of vehicle distribution	564407	

There was clearly a great similarity in the location of these points, with only 2 kilometres separating them. Both lay just to the south of the North Staffordshire conurbation which was positioned fairly centrally within the study-area. Such results might possibly have been expected as this was the major urbanised sector. Furthermore, to the north-west and south-east were areas of high vehicle populations and outlets, whereas to the north-east and south-west lay the more sparsely-populated rural tracts, so that the aspect of centrality was compounded in favour of Stoke-on-Trent and Newcastle. However, although the degree of correspondence between mean centres was surprisingly close and provided further evidence of the strength of the relationship, it must be recognised that two very dissimilar distributions could have common centres. To demonstrate that these distributions were, in fact, very similar, a calculation of standard distance has been made, as follows :-

Standard distance of outlets	29.13 kilometres,
Standard distance of vehicle distribution	28.72 kilometres.

These circles have been plotted in figure 4.4D and as they were almost co-extensive, it must be accepted that the two distributions were closely related. Although approximately two-thirds of both outlets and vehicles were included within one standard distance of the mean centres, this being indicative of a normal spatial distribution, the actual patterns appeared to be more elliptical than circular. Reference to figure 4.1 would confirm this claim, so that neither could really be termed a normal distribution. However, as both distributional patterns were obviously elliptical, with their main linear axes trending in a north-west to south-east direction, there seemed little purpose in constructing standard deviational ellipses, especially in view of the close relationship already established between these variables.

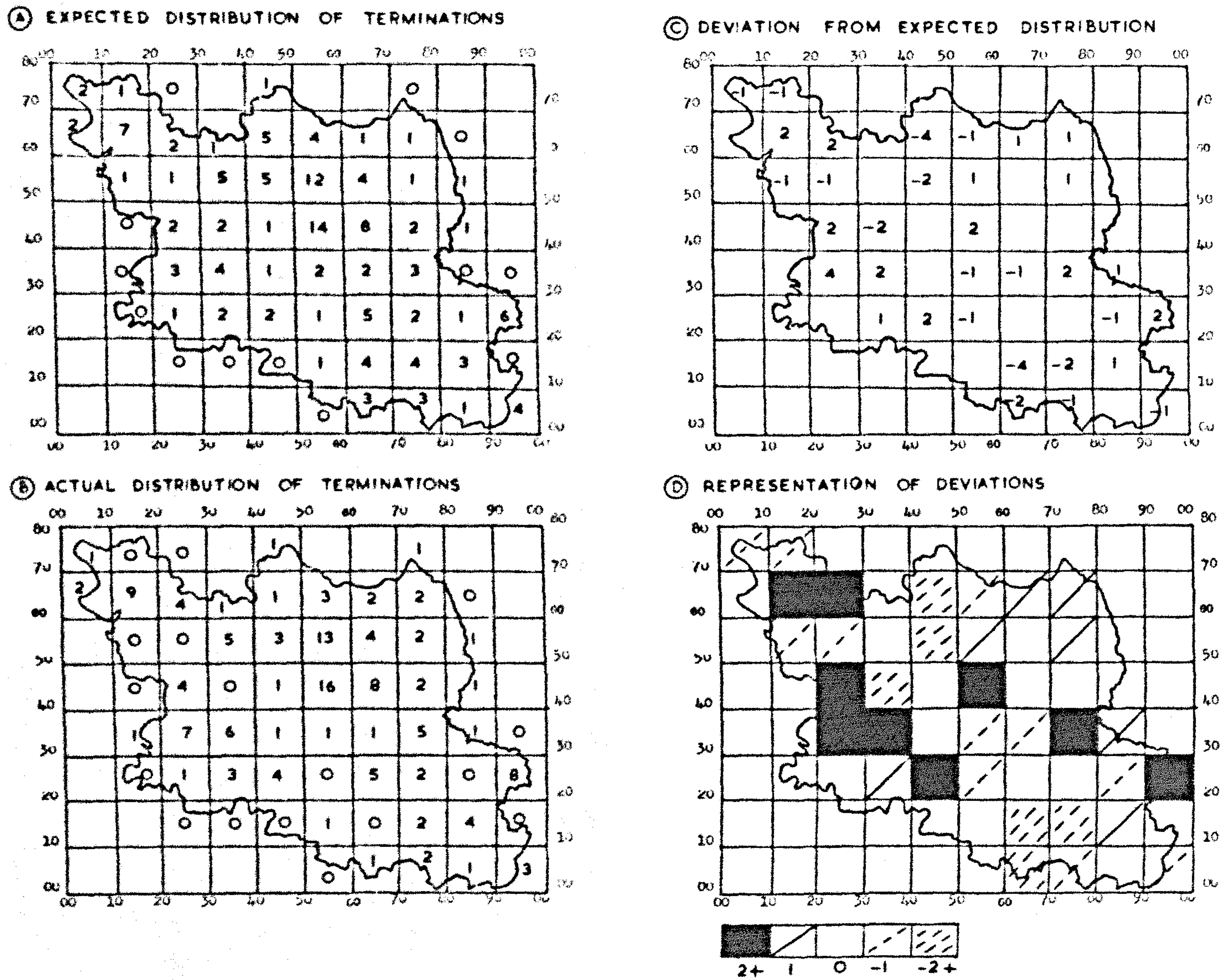
With regard to outlets that were terminated during the period 1973-1977, their mean centre has been calculated and plotted at 526423 in figure 4.4D. This was fairly close to the mean centre of all active outlets in the former year, lying some 1.7 kilometres to the north-west of that point. Further, as the standard distance of the terminated group had exactly the same value as that of the 1973 distribution, viz. 29.25 kilometres, it would seem reasonable to regard terminations, while fairly evenly spread throughout the study-area, as having had a slight tendency towards the north-western sector.[3]

This can be verified by a comparison between actual and expected terminations, the latter being calculated by allocating the 147 closures amongst the 10-kilometre grid squares in accordance with the distribution of active outlets in 1973. Whilst expected numbers of closures have been plotted in part A of figure 4.5 and actual closures in part B, parts C and D indicate the rate of deviation of actual from expected closures.[4] The most striking feature here was the remarkable degree of correspondence between actual and expected closures, with almost a half of all squares, 27 in all, recording the expected number. A further 18 squares deviated by only one outlet each from their projected number, so that by combining these two groups 75% of all squares may be regarded as having approximately matched expectations. Thus, the actual distribution of closures may be regarded as having been fairly uniform throughout the study-area.

Whilst this was a reasonable reflection of the general situation, it was apparent that those squares which exceeded their expected numbers of closures by 2 outlets or more contained either the larger urban centres such as Stoke, Newcastle, Chester and Burton, or else were rural areas with relatively small numbers of vehicles. In the former category, each of the squares represented were still classified in figure 4.4C as areas of over-provision in 1977 and could therefore probably be regarded as having experienced slightly more terminations than were forecast owing to the nature of competition for sales within the larger towns. It will be demonstrated in Chapter 6 that competition was more severe within urban areas where price-cutting was a prominent feature

3. While values for 1973 are not plotted on maps, they appear in table 4.2.
4. Part D of figure 4.5 is a visual representation of part C.

FIGURE 4.5



(A) EXPECTED DISTRIBUTION OF TERMINATIONS
(B) ACTUAL DISTRIBUTION OF TERMINATIONS
(C) DEVIATION FROM EXPECTED DISTRIBUTION
(D) REPRESENTATION OF DEVIATIONS
2+ 1 0 -1 -2+

during the post-1973 period. A study of figure 4.5D will reveal that the south-western sector of the study-area recorded the greatest rate of deviation, this being the area where actual terminations most exceeded expectations. Thus, the trend revealed by the position of the mean centre and the standard distance of terminated outlets, which suggested a tendency for closures to have been greater towards the north-west, was not fully supported by such evidence. However, both indicated a bias towards the western sector in general, so that it appeared that the rural parts of North Shropshire and South-west Cheshire experienced the greatest rates of closures. In terms of absolute numbers on the other hand, the highest totals occurred within those areas that contained the largest numbers of outlets, these being the larger towns.

This view must, however, be qualified, as it is apparent in figure 4.5D that the south-east, which included a number of major towns, was an exception. Within this sector, the main feature was a deviation in the opposite direction, actual closures being considerably fewer than had been projected. This was the area in which population growth had been most marked during recent years, and thus, by implication, had recorded a greater increase in vehicle numbers. This would probably have resulted in a more favourable marketing situation than that which prevailed elsewhere, thus reducing the rate of terminations.

It would be relevant at this stage to refer briefly to the changes that occurred during the period 1973-1977 in the distributional patterns of outlets by brand categories. Such changes were considered in terms of actual types of location at the end of the previous chapter, although this referred specifically only to the central sector of the study-area. With regard to the whole area, apart from 147 closures and 24 openings that characterised this period, there were a further 75 cases of brand-change, this being shown in table 4.1. For each of the two years concerned, 1973 and 1977, the mean centre of each brand distribution has been listed in table 4.2, this also indicating the amount of movement that took place.

It will be realised from a study of tables 4.1 and 4.2 that most brands experienced considerable changes in their membership composition between 1973 and 1977, and that, in turn, such changes resulted in shifts in their mean centres of distribution. Some of these

Table 4.1 : Establishments, terminations and brand changes, 1973-1977.

Brand.	Numbers in 1973.	Closures.	Loss by change.	Gain by change.	Openings.	Numbers in 1977.	Net gain/ loss.
Shell	182	23	16	2	3	148	-34
Esso	182	30	14	7	2	147	-35
Texaco	79	15	11	4	6	63	-16
B.P.	69	17	1	5	-	56	-13
National	64	11	3	10	2	62	- 2
Fina	36	9	-	3	-	30	- 6
Group I	612	105	45	31	13	506	-106
Mobil	42	5	3	1	2	37	- 5
Jet	31	2	1	3	-	31	.
Elf	29	5	4	1	1	22	- 7
Total	29	5	3	3	2	26	- 3
Amoco	17	4	3	-	3	13	- 4
Burmah	13	-	2	6	-	17	+ 4
Apex	7	-	2	1	1	7	.
Chevron	8	1	1	-	-	6	- 2
Gulf	6	-	1	1	-	6	.
Murco	3	-	-	3	1	7	+ 4
Group II	185	22	20	19	10	172	-13
ICI	8	-	2	6	1	13	+ 5
Globe	17	9	4	7	-	11	- 6
Sotro	3	1	-	6	-	8	+ 5
Tops	3	1	1	1	-	2	- 1
M.P.	7	3	1	1	-	4	- 3
Nafta	3	-	2	-	-	1	- 2
E.P.	2	-	-	-	-	2	.
Dragon	1	1	-	1	-	1	.
Sheaf	1	-	-	-	-	1	.
Ultramar	-	-	-	1	-	1	+ 1
Enerco	-	-	-	1	-	1	+ 1
Thames	-	-	-	1	-	1	+ 1
(Freedom, Pure, Summit, UK	4	4	-	-	-	-	- 4
Group III	50	20	10	25	1	46	- 4
TOTALS	847	147	75	75	24	724	-123.

Table 4.2 : Mean centres of brand distributions, 1973 and 1977.

Brand.	1973	1977	Movement - in kms.
Shell	525415	520415	0.50
Esso	544412	560400	0.80
Texaco	582355	585359	1.75
B.P.	519433	527432	2.00
National	584363	567359	0.50
Fina	576425	580440	1.55
Group I	546404	550400	0.56
Mobil	549454	528456	2.10
Jet	574351	569362	1.20
Elf	561360	606310	6.73
Total	526493	521495	0.54
Amoco	571393	571416	2.30
Burmah	232649	325579	11.64
Apex	606463	609463	0.30
Chevron	534418	583397	5.33
Gulf	540465	455497	9.10
Murco	813273	680366	16.23
Group II	537432	536432	0.10
ICI	464525	529499	7.00
Globe	530478	555501	3.40
Sotro	383213	439356	15.36
Group III	474465	507458	3.37
All outlets	540414	544411	0.50

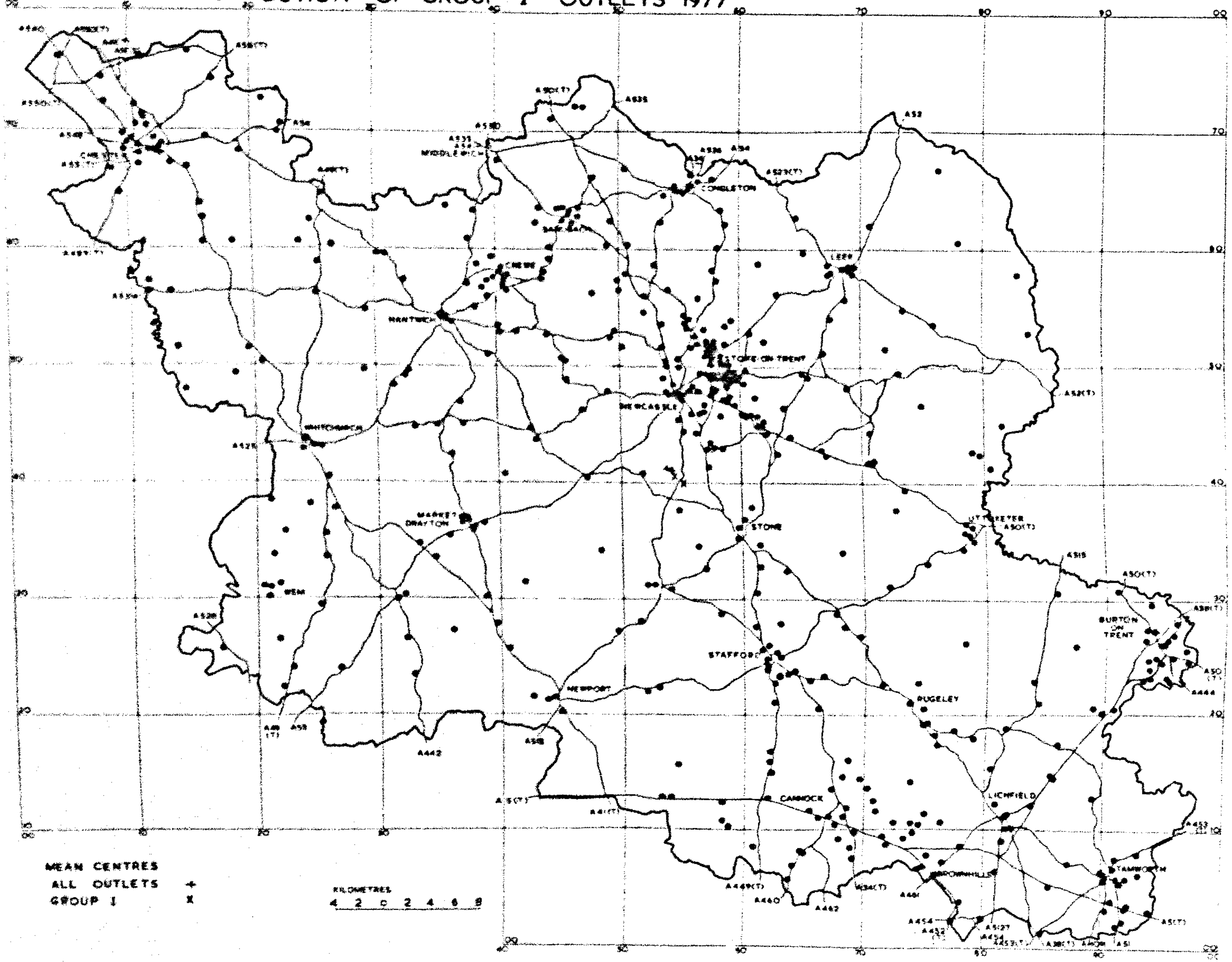
movements were substantial, in particular amongst the brands of Groups II and III, whereas, in contrast, no Group I brand recorded a shift of more than 2 kilometres. In view of the degree of movement that took place, it is somewhat surprising to realise that the sum of such changes expressed on a group basis was quite small. Thus, the mean centre of Group II hardly changed, while that of Group I only moved through 0.6 kilometres and Group III by 3.4 kilometres. Even the latter represented a movement that seemed slight in comparison with many individual members of Groups II and III. The main reason for such small movements in the mean centre of each group was the fact that their respective brands recorded shifts in a number of different directions, most of which cancelled each other out.

The distribution of outlets in each of the three groups in 1977 is shown in figures 4.6 and 4.7, and of terminated sites in figure 4.8. It was established at the end of the previous chapter that each of these groups revealed a characteristic type of location within the central sector of the study-area, as follows :-

Group I	-	widespread representation, generally present in every settlement ;
Group II	-	distinct concentration within urban areas, generally on major roads ;
Group III	-	fairly evenly distributed amongst both urban and rural areas, and major and minor roads.

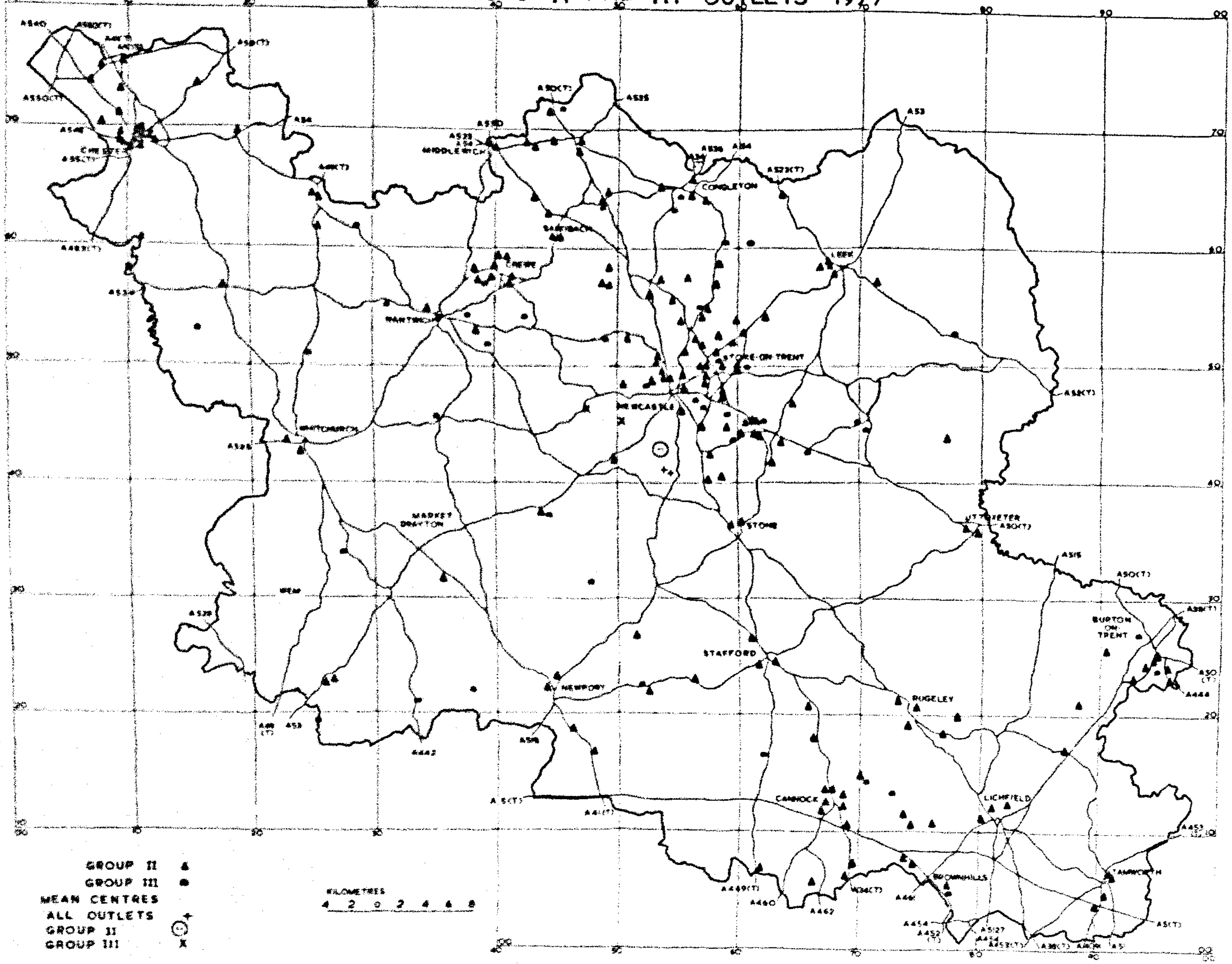
A study of figures 4.6 and 4.7 would substantiate the validity of the above characteristics as being typical of each group. In fact, the distribution of Group I outlets was very similar to that of the entire population of outlets, their respective mean centres in 1973 being only 1.2 kilometres apart. Further, both recorded shifts in the same direction, to the south-east, and remained at the same distance apart in 1977. It is not altogether surprising that such a similarity existed, as the majority of all outlets, approximately 70%, belonged within this category, and it is apparent in figure 4.6 that the term 'widespread representation' was certainly applicable to their distribution in 1977. If a visual comparison were to be made with the entire distribution as shown in figure 3.3, a definite similarity could be seen to have existed.

FIGURE 4.6 DISTRIBUTION OF GROUP I OUTLETS 1977



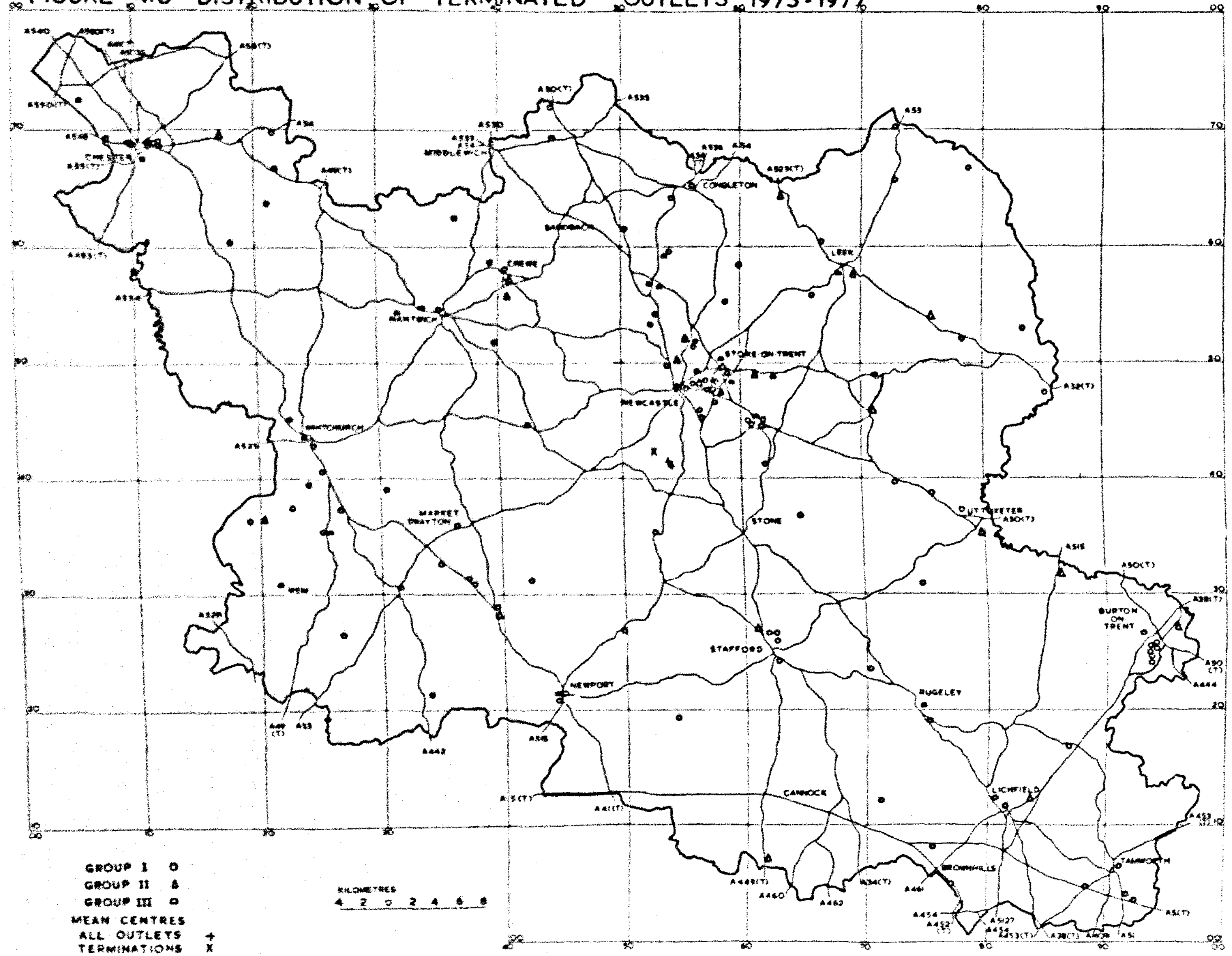
(Based on personal fieldwork)

FIGURE 4.7 DISTRIBUTION OF GROUPS II AND III OUTLETS 1977



(Based on personal fieldwork)

FIGURE 4.8 DISTRIBUTION OF TERMINATED OUTLETS 1973-1977



(Based on personal fieldwork)

There was further agreement in terms of standard distances, those for all outlets having been 29.25 kilometres in 1973 and 29.13 kilometres in 1977, and for Group I outlets, 30.1 kilometres in both years. Such statistical evidence, which is fully supportive of the visual impression, must therefore be accepted as confirmation of the close degree of similarity that existed between these two patterns.

As regards Group II, figure 4.7 indicates the distribution of outlets in 1977, and by a simple count of locations it was evident that 85% were situated on major roads. Again, the great majority, 82%, were within or on the fringe of urban areas, such a degree of concentration being emphasised by the fact that only about 8% of the study-area could be regarded as being built-up land. The mean centres in both 1973 and 1977 were fairly close to those of the overall pattern of outlets, lying some 1.8 and 2.2 kilometres from the latter in each of these two years. There was further similarity in standard distances where that of Group II was reduced from 30.2 to 29.0 kilometres, and thus in 1977 approached very closely the value of 29.13 that was recorded for all outlets.

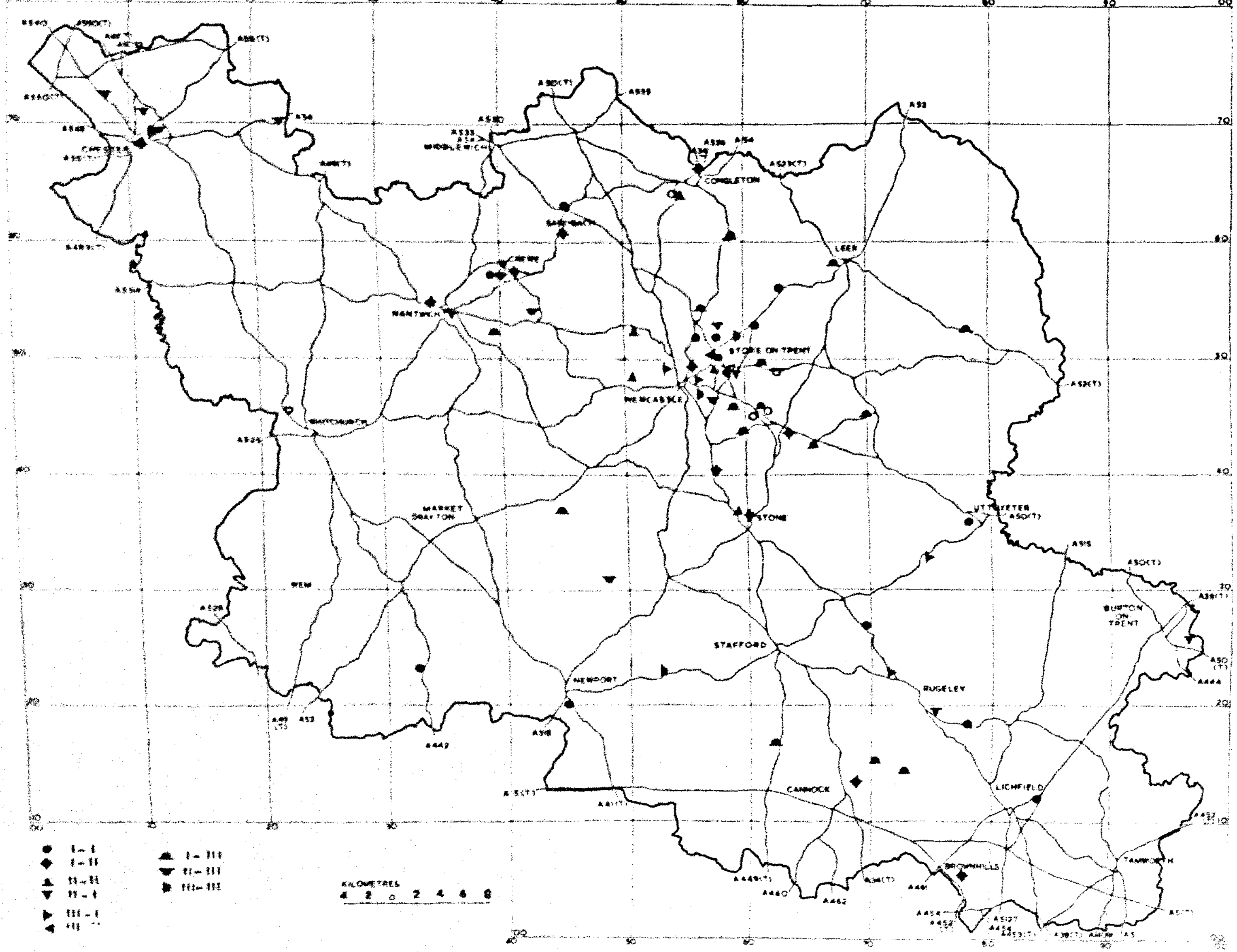
It will be seen in figure 4.7 that Group III mean centres differed most from those of the overall distribution, although the gap between them was reduced from 8.3 kilometres in 1973 to 6.0 kilometres in 1977. However, in comparison with Groups I and II, this still represented a considerable gap, which suggested that maximum differences existed between the respective distributions of all outlets and those of Group III alone. The standard distance of Group III was reduced from 29.28 kilometres in 1973, when it had virtually the same value as that of all outlets, to 26.00 kilometres, by which time it had become much smaller than the latter in 1977. As the mean centre of Group III lay to the north-west of that of all outlets in both years, the distribution of the former must have been biased in this direction.

With regard to changes in the mean centres of individual brand distributions, as shown in table 4.2, it is apparent that those of Group I experienced only slight variations between 1973 and 1977. The greatest extent of movement was in the case of Esso, this having shifted through 2 kilometres, while Shell, with virtually the same number of outlets, moved only 0.5 kilometres, the latter having exactly the same value as that of all outlets in total. The mean centre of each brand in Group I would have been included within a circle of radius 5 kilometres in both years, so that each distribution was broadly similar to that of other members of the same group. It is perfectly apparent that Group II brands revealed greater variation in their distributions, as is indicated by the positions of their mean centres, although, if brands having very small numbers of outlets were to be excluded from this consideration, the difference would be very much less. With the exception of Burmah's very strong bias to the north-west, probably reflecting its greater representation on Merseyside through its Ellesmere Port refinery, the distribution of the remaining brands approximated towards those of Group I companies. Whilst this was so, it would have required a larger circle to enclose Group II mean centres, such a circle having had to be larger in 1977 than in 1973. Regarding Group III brands, only Globe and ICI possessed more than 10 outlets each in 1977, their mean centres being situated in the general vicinities of those of Groups I and II.

A total of 75 outlets changed their brand of petrol between 1973 and 1977, their spatial distribution being shown in figure 4.9. This was a substantial number, accounting for 8.7% of all outlets active in 1973, but, as only 6 of these were subsequently terminated, their share of 1977 survivals was 9.4%. Thus, almost one in every 10 outlets changed allegiance in terms of retailed brand during this period, and it would seem possible that some may even have managed to survive by this means, as is explained below.

It has been apparent over the last several years that certain supplying companies have been following one of two courses of action, viz. either attempting to recruit outlets to their own brands due to their proven ability to achieve very large throughputs, or else withdrawing deliveries to stations unable to maintain an adequate sales level. Some of the suppliers have, in fact, pursued both lines simultaneously in order to create a network composed of fewer but better outlets. In this respect, both Shell and Esso in particular have

FIGURE 4.9 CHANGE OF BRAND 1973 - 1977



(Based on personal fieldwork)

discontinued supplies to many of the smaller stations whilst, at the same time, being involved in the development of a number of new establishments. It will be demonstrated below, in the subsequent chapter, that each of these companies opened new stations within the study-area during the period 1973-1977. Further, evidence has been obtained to support this personal interpretation of company policies, as it also has to confirm the claim that Group III companies are normally prepared to supply any outlet, irrespective of throughput.

Thus, two contrasting trends have characterised the market during recent years :-

(a) an attempt by some of the Group I and Group II companies to recruit outlets having large annual throughputs, this resulting in the transfer of a number of stations both into and within these groups ;

(b) the withdrawal of deliveries by some of the larger Group I and Group II companies from some outlets unable to sell adequate amounts, viz. at least 3,000 gallons weekly, resulting in transfers both into and within Group III.

It could further have been expected that each of the above categories would have been characterised by outlets possessing markedly different locational attributes. Each category could have been expected to have largely consisted of, respectively, outlets situated on main roads especially in urban areas, and those on side-streets or in less-populated districts. Table 4.3 shows the location of those outlets that changed their brand between 1973 and 1977 :-

Table 4.3: Locations of outlets that changed their brands, 1973-1977.

Nature of change.	Urban areas		Rural areas		Totals
	'A' or 'B' road.	Side-street.	'A' or 'B' road.	Minor road.	
(a) I to I	12	3	2	-	17
I to II	11	-	-	1	12
II to II	4	-	1	-	5
II to I	7	-	2	-	9
III to I	2	-	2	-	4
III to II	2	-	-	-	2
Category totals	38	3	7	1	49
(b) I to III	5	4	4	2	15
II to III	1	1	2	2	6
III to III	-	2	2	-	4
Category totals	6	7	8	4	25
Totals	44	10	15	5	74

It is perfectly evident in the above table that transfers both into and within Groups I and II largely involved outlets with sites that satisfied two desirable criteria, viz. being on main roads in areas of relatively large car populations. In fact, 38 of the 49 outlets were of this type, with another 7 located on 'A'-class roads in rural areas, thus, although lacking a local concentration of vehicles, having access to substantial flows of traffic. Whilst a site on a main road in an urban area could not be regarded as providing a guarantee of commercial viability,it is apparent that its likelihood of success would certainly have been greater than that of a back-street or country lane location. It can, therefore, be claimed that some of the companies of Groups I and II, although revealing an overall net reduction in their total numbers of outlets during 1973-1977, were still prepared to recruit to their ranks some additional stations as long as such stations possessed suitable sites.[5]

However, within category (a) in the above table, a small number of outlets failed to meet the required criteria, although not one of these involved an 'up-grading' from Group III. In fact, the 3 outlets that were transferred between members of Group I, as figure 4.9 indicates, were all situated very near to main roads, but not one depended primarily on petrol sales for its continued existence. Each of these 3 stations was essentially either a car-dealership or a service station, so that their change of brand carried little significance to their respective suppliers. The one outlet located on a minor road changed its brand from Esso to Burmah, but again, annual throughput would not have been great, so that such a transfer had but slight importance. The only explanation that can be offered to account for this change is that Esso, like Shell in particular, has decreased its complement of outlets by stopping deliveries to some of the smaller stations. At the same time, Burmah, in company with National, has apparently been prepared to supply even very small outlets so as to increase total representation, thus behaving in a manner similar to Group III companies. The outlet concerned, sited on the edge of an expanding village outside Brownhills, would have relied entirely on the

5. Information of this type, relating to company policies, was obtained during interviews granted by some of the leading suppliers, including, Shell, Esso, Texaco, B.P., Mobil and Total.

local car population as it was situated well away from the major roads of the area. Thus, it could not possibly have had a substantial throughput, clearly being mainly reliant on repairs and on the proceeds from a general store which was operated in conjunction with the station.

With regard to the second category, (b) in table 4.3, it is apparent that some relatively poorly sited outlets were transferred both into and within Group III. As many as 11 of the 25 outlets in this category were, in fact, either located on urban side-streets or on country lanes, thus creating a definite contrast with those of the first category where only 4 out of the 49 outlets concerned could be so described. Only 6 outlets of category (b) could be regarded as having possessed really desirable locations, on urban main roads, each of these being a 'down-grading' from Groups I and II. As there were 38 stations in the first category that occupied such sites, the contrast between them was very marked.

Such contrasts could be further emphasised by the fact that each outlet within category (b) was privately operated, whereas the first group contained 13 tenancies and 3 company-managed outlets. Not surprisingly, each of these was located on a main road within an urban area, thus clearly indicating the attraction of such outlets, especially when it is realised that transfers of this nature would have involved inter-company negotiation. A change of brand by a privately-owned station would have been much simpler to arrange, being a matter for the operator himself to obtain an alternative supply on the expiry of his previous contract. In relation to this point, as has been stated, some privately-operated outlets would have been forced into this situation owing to the cancellation of their deliveries from the larger companies, thus being faced with a choice of either selling a lesser-known brand or withdrawing from petrol retailing altogether.

The study-area, comprising 4,312 square kilometres, experienced a net reduction in outlets from 847 in 1973 to 724 in 1977. Clearly, the resultant density decreased in value, from 0.19 to 0.16 in response to this decline in total numbers, while the mean distance between outlets increased from 0.87 to 0.96 kilometres. A calculation of R, the nearest neighbour statistic, revealed a slight increase in value from 0.77 in 1973 to 0.78 in 1977.

For a completely random pattern of outlet distribution, corresponding values would have been 1.13 and 1.23 kilometres respectively, so that in both cases there was revealed a distinct tendency towards clustering. The nature of the items concerned meant that in no way could either a uniform or a completely clustered pattern have been expected as vehicles were distributed in an irregular manner throughout the study-area, and it has already been established that quite a strong correlation existed between the distributions of both vehicles and outlets. Again, a random pattern of outlets would have been highly unlikely for the same reason, so that the existence of a tendency towards a clustered distribution was hardly surprising. An interpretation of the above values would suggest that outlets were distributed in a slightly more clustered pattern than could have been expected in a random distribution, with this tendency having been reduced by 1977. The latter reduction must have been largely due to the great number of terminations that occurred during the period concerned, so that the resultant pattern of outlets in 1977 was slightly more uniform than that of 1973. Such a change, although not greatly marked, would have meant a slight improvement in the overall distribution of outlets.

Although some outlets possessed several functions, as will be considered in the following chapter, in terms of their petrol retailing activities a very significant factor would have been distance to nearest neighbours. Each outlet may be regarded as having been in competition with its neighbours, so that it could have been advantageous to have been relatively isolated. This would then have given an outlet a potential catchment area for which it would have been the nearest source of petrol. Unfortunately, however, the reality of the situation would have been rather different, as such an area would almost certainly have been sparsely populated and largely devoid of vehicles. The degree of correlation found to exist between the distributions of outlets and vehicles made this virtually certain.

Thus, a desirable type of location would have been one that was situated in an area of vehicle concentration but where distance to competing stations was substantial. To aid the process of analysis, 3 categories of outlets may be recognised :-

(a) those situated less than 0.96 kilometres, the mean nearest neighbour distance, from a competitor ;

(b) those situated between 0.96 and 1.92 kilometres (the latter being twice the mean nearest neighbour distance) from a neighbouring station ;

(c) those situated more than 1.92 kilometres, twice the mean nearest neighbour distance, from the nearest competitor.

However, before considering the spatial distribution of these categories of outlets, reference must be made to the actual distribution of vehicles. Although this has already been indicated in a general sense in figure 3.2, figure 4.10 has been constructed to show the distribution in much greater detail. This figure is an estimate of vehicle numbers per square kilometre for 1977 and is based on enumeration district totals from the 1971 Census.[6]

Clearly, the larger concentrations of vehicles were within urban areas, the highest totals of all being generally recorded in sub-urban districts. Although the latter feature was not apparent in all centres, in particular in Chester, towns such as Stafford, Burton and Tamworth closely reflected this pattern. As could have been expected, lesser totals were located in villages, whilst the only area completely devoid of even minor concentrations was the moorland in the north-east. Clearly, although vehicle distribution was closely related to population distribution, the latter is not depicted as it is the former which is of most significance in petrol retailing.

The distribution of the 3 categories identified above is presented, for clarity, in two separate maps. The first of these, figure 4.11, is devoted to categories (a) and (c), whilst (b) is shown in figure 4.12. Each map contains an outline of those squares with, respectively, more than 250 and between 100 and 249 cars, this having been transposed from figure 4.10.

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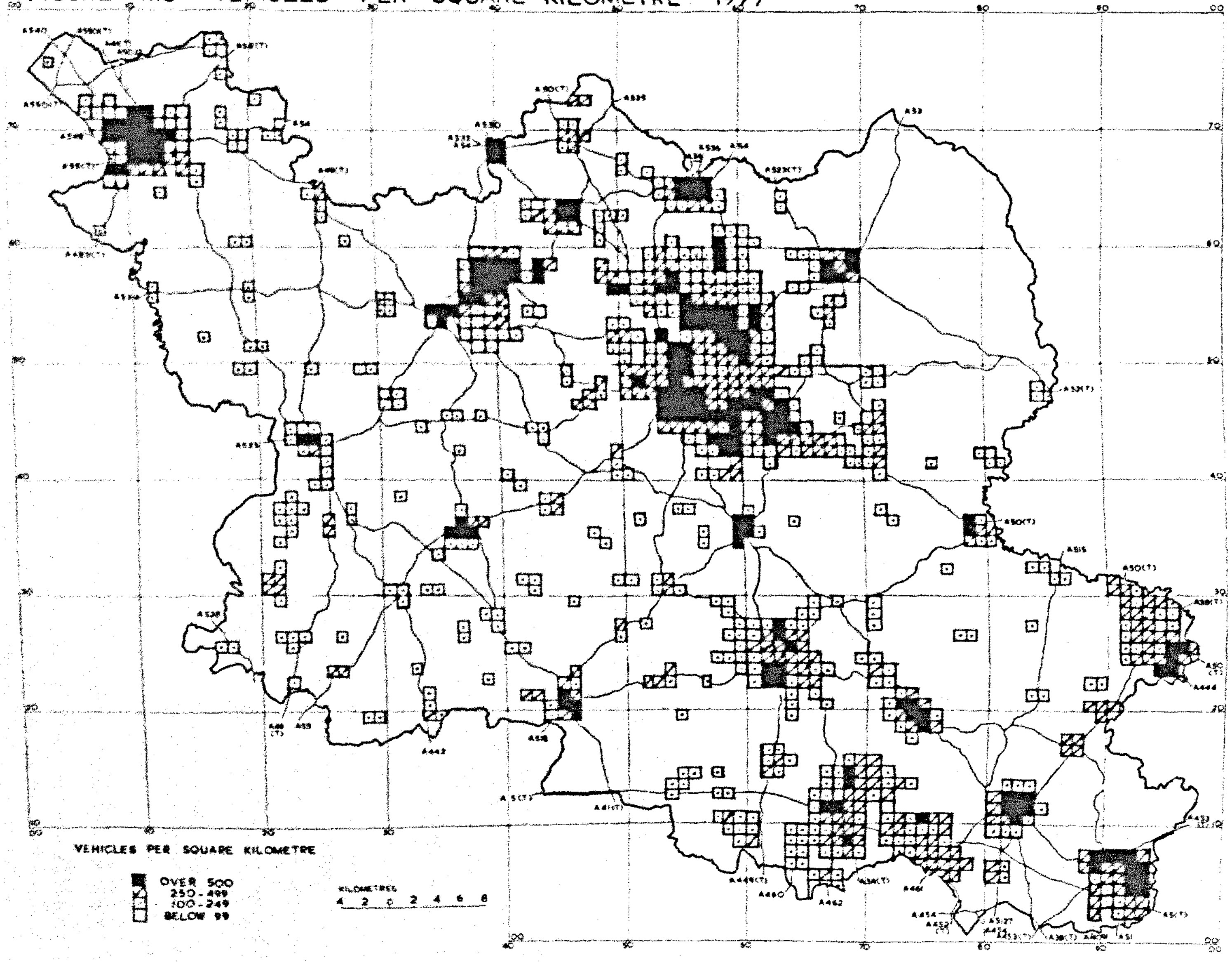
6. Data supplied by the County Planning Departments.

FIGURE 4.10 VEHICLES PER SQUARE KILOMETRE 1977



(Based on 1971 Census, at Ward and Civil Parish level, with later material from the County Planning Departments)

FIGURE 4.11 SPACING OF OUTLETS - CATEGORIES (a) AND (c), 1977

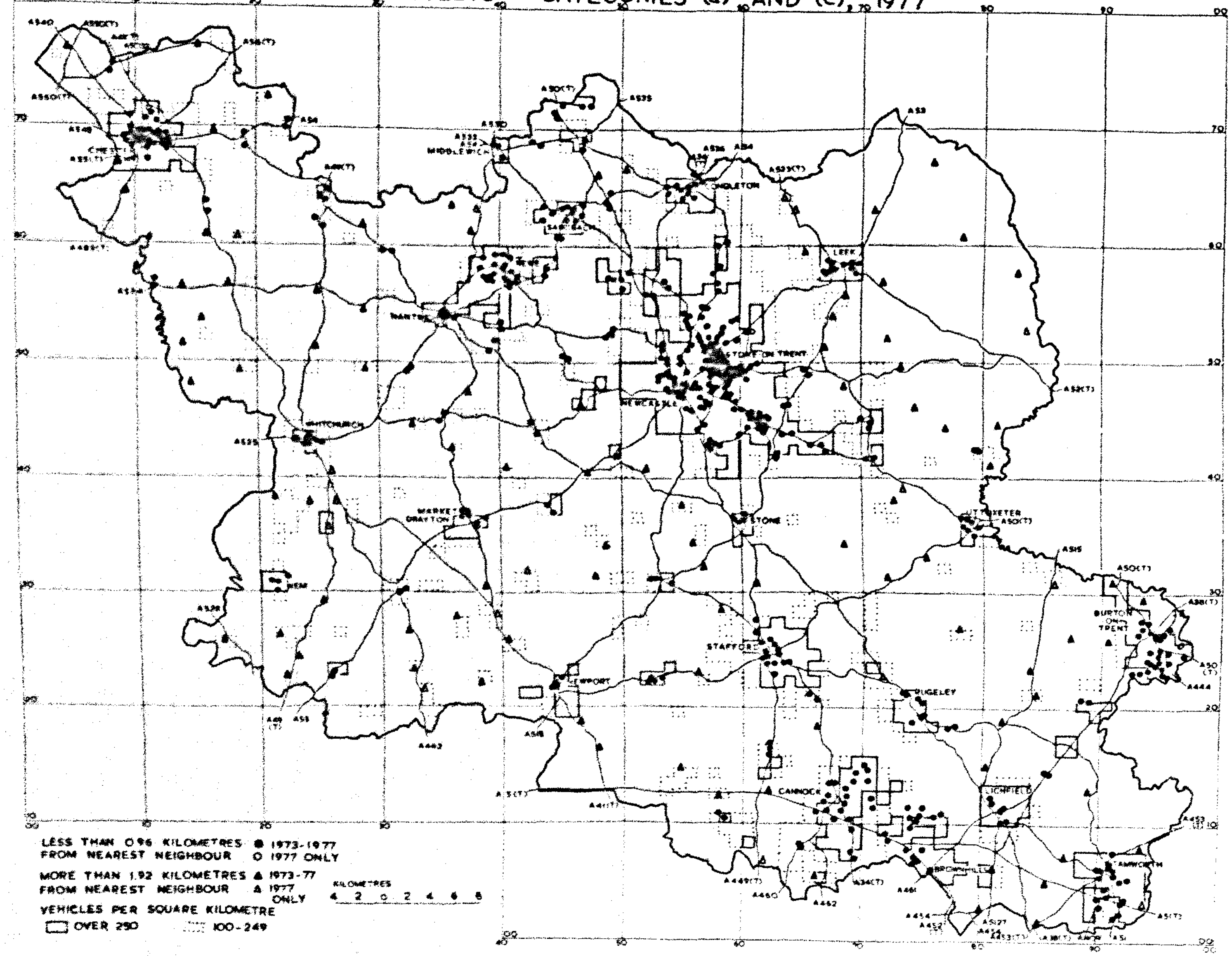
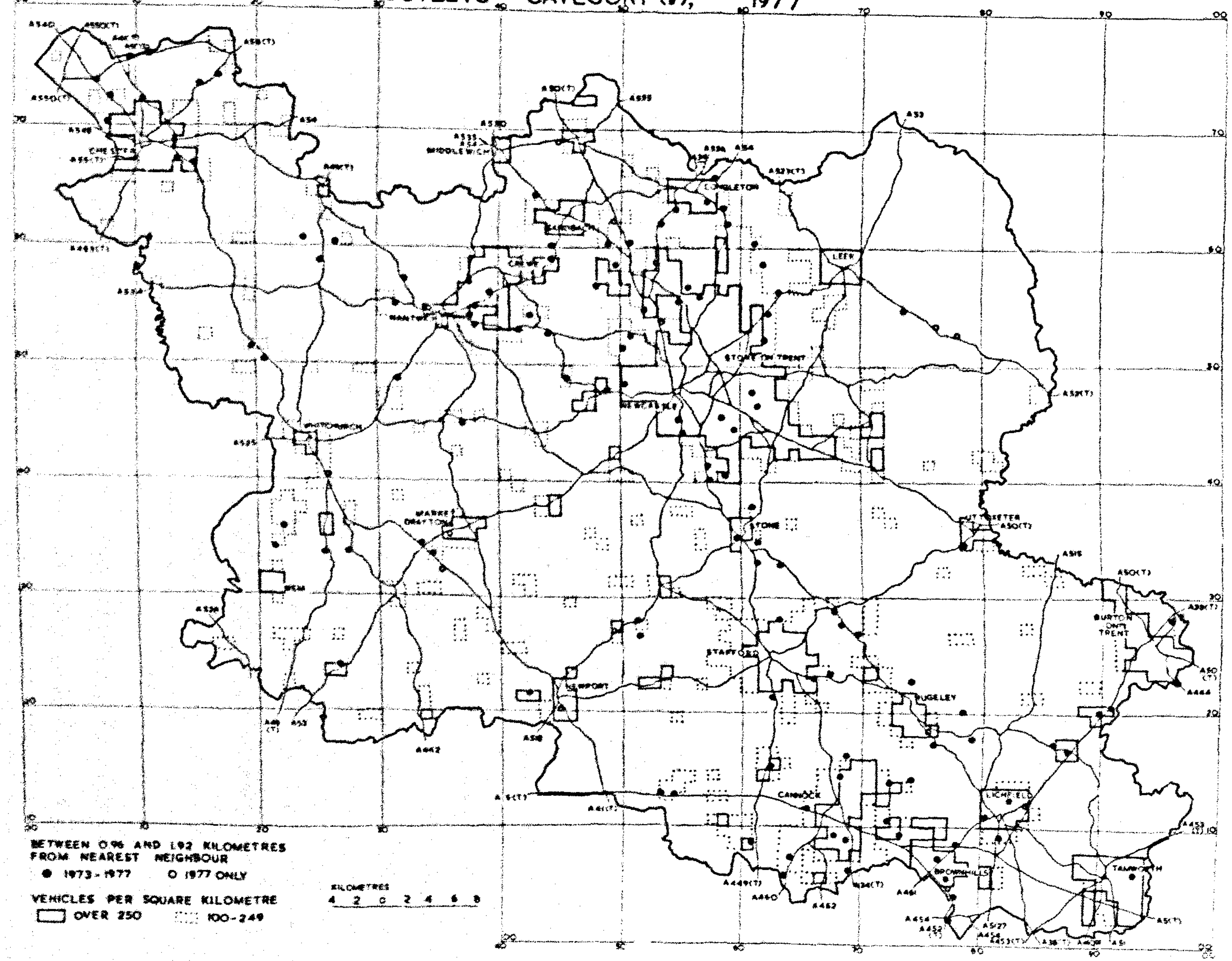


FIGURE 4.12 SPACING OF OUTLETS – CATEGORY (b), 1977

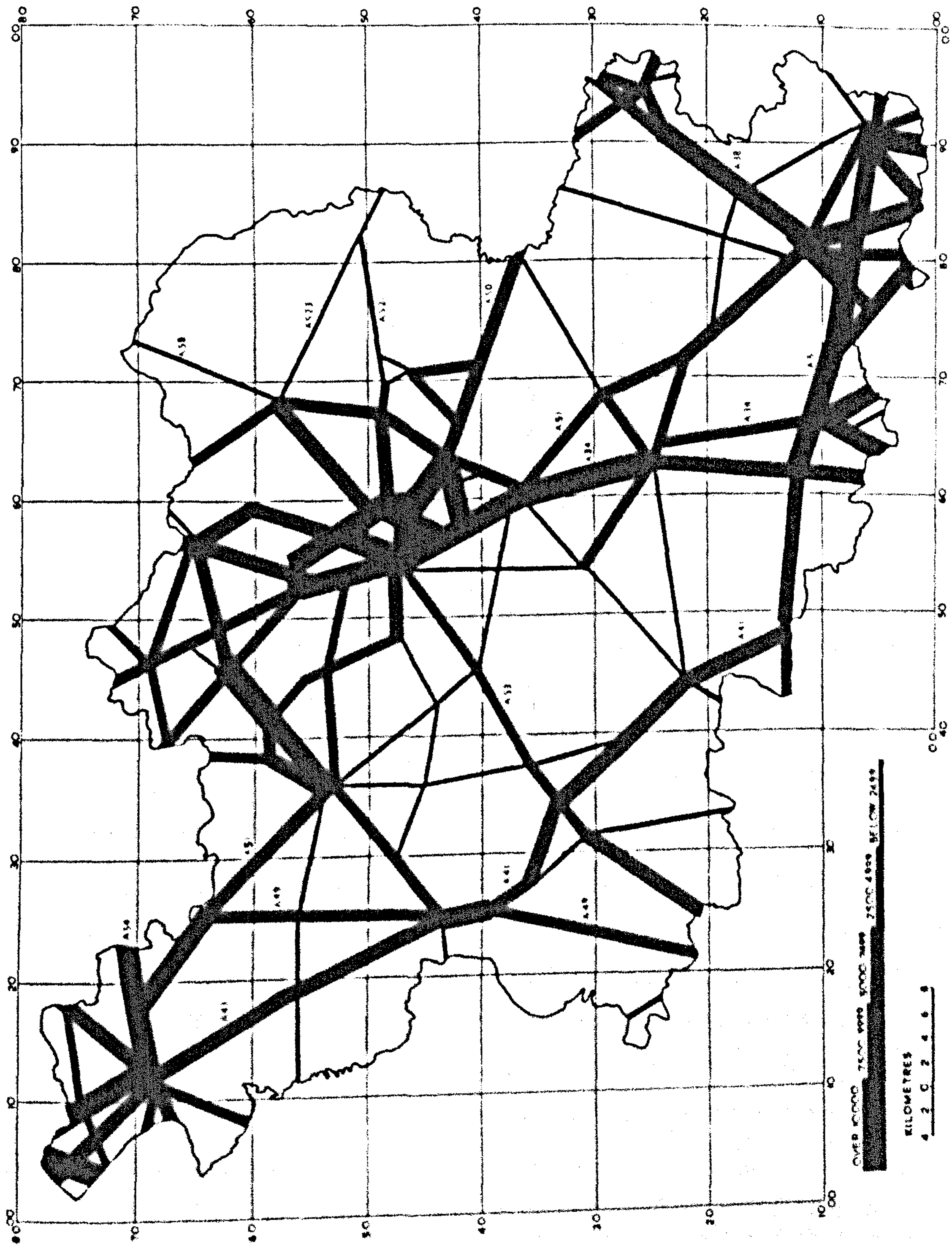


It will be seen in figure 4.11 that outlets of category (a) were largely within squares having more than 250 cars. This, naturally, could have been expected, as outlets were clearly concentrated in areas of high vehicle numbers, thus giving relatively small distances between neighbouring stations. In fact, 79% of this group were within squares that contained more than 250 cars and a further 12% lay within the next highest grading. In general terms, it could therefore be maintained that those areas of greatest competition for sales, by virtue of having outlets located close together, did in fact contain large numbers of vehicles.

In complete contrast, 9% of this category were apparently very poorly located, being not only close to neighbouring stations but also lacking adjacent concentrations of vehicles. Thus, whilst those outlets located within areas of vehicle concentration could not be regarded as being guaranteed a level of sales sufficient to maintain viability, the 45 outlets lacking this factor could certainly have been expected to have experienced difficulty in surviving. However, apart from a very small number of stations situated between Cannock and Brownhills on 'B' roads, every other outlet was sited on 'A'-class roads. Thus, although some of these roads such as the A530 between Nantwich and Whitchurch were not particularly busy, most of this group of stations had access to substantial volumes of traffic, as is indicated in figure 4.13. As a result of this advantage, such outlets seem to have survived, although, by lacking adjacent vehicle concentrations, their continued existence may well be precarious. It is possible that some of these outlets survived by fulfilling functions other than petrol retailing, but this aspect will not be considered until the following chapter.

With regard to category (c) which included outlets located more than twice the mean nearest neighbour distance apart, figure 4.11 reveals that the majority were sited outside areas of vehicle concentration. In fact, out of a total number of 110 stations, 61 were of this type, and thus offered a very marked contrast to most of the outlets of (a). In view of the relationship between outlets and cars, such a feature could certainly have been expected, so that the advantage offered by the lack of nearby competitors tended to be offset by a paucity of petrol-using vehicles. However, 39 outlets of category (c) were located within

FIGURE 4.13 MEAN DAILY TRAFFIC ON 'A' ROADS MAY 1977



(Based on traffic statistics supplied by the County Surveyors Departments of Cheshire, Shropshire and Staffordshire) squares having between 100 and 249 vehicles, and could thus have been regarded as having potential for petrol sales. In addition, a further 10 outlets were in squares of over 250 vehicles, although 6 of these were located on urban side-streets and the other 4 in villages.

Figure 4.12 reveals the distribution of outlets in category (b), these having been more equitably distributed in terms of vehicle numbers than those of the other categories. Of the 137 outlets involved, 49 were in squares of over 250 vehicles and 35 in those of between 100 and 249, with the remaining 53 in less-populated squares. This category clearly contained approximately the same number of well-situated and poorly-situated outlets, at least in relation to local vehicle populations, and was therefore very different to categories (a) and (c).

In summary, the following were the absolute and percentage numbers by type of square within each category :-

	Categories (a) No.	%	(b) No.	%	(c) No.	%
Total number of outlets	477		137		110	
(i) in squares of over 250 cars	377	79	<u>49</u>	36	<u>10</u>	9
(ii) in squares of 100-249 cars	55	12	35	25	39	35
(iii) in squares of less than 99 cars	<u>45</u>	9	<u>53</u>	39	61	56

It could be reasonably claimed that the best-located outlets were in the groups underlined in line (i), and that the worst-located were those similarly marked in line (iii). However, as such claims related entirely to vehicle populations, it is necessary to consider traffic volumes, as the latter could have had an important bearing on the quality of location of these outlets. To this end, figure 4.13 has been constructed to represent mean daily traffic volumes along the 'A' roads in 1977.[7] It should be stressed that commercial vehicles have been excluded from this calculation so that resultant values consisted entirely of cars and light vans, these being the purchasers of petrol.

7. Traffic statistics have been obtained from the various Planning Departments and Surveyors' Departments of Staffordshire, Cheshire and Shropshire.

A comparison with figure 4.10 will reveal that most traffic movement was in and around the areas of greatest vehicle concentration, that is to say the major urbanised tracts, with heavy flows also crossing the study-area by means of the A38 especially. It was also evident that many 'A' roads carried comparatively little traffic, in particular most of those in a broad east-to-west configuration. As the actual range of traffic volume was from 800 cars on the A52 to over 16,000 on the A34 between Stafford and Newcastle, it is clear that this had to be taken into account in any consideration of locational quality. By means of a comparison between, on the one hand, figures 4.11 and 4.12, and on the other hand, figure 4.13, the following tabulation has been compiled in which the groups underlined above have been further subdivided according to the traffic volumes that used the roads on which the outlets concerned were located:-

Table 4.4

I. Outlets apparently possessing good locations in terms of vehicle populations -

Outlets located on roads having daily traffic flows of -	Categories (b)	(c)
over 10,000	7	-
7,500-9,999	5	-
5,000-7,499	12	1
2,500-4,999	2	3
below 2,499	5	4
on other roads	18	2
Total number of outlets	49	10

II. Outlets apparently possessing poor locations in terms of vehicle populations -

Outlets located on roads having daily traffic flows of	Categories (a)	(b)
over 10,000	3	4
7,500-9,999	4	5
5,000-7,499	12	11
2,500-4,999	15	13
below 2,499	3	8
on other roads	8	12
Total number of outlets	45	53

With regard to I, it is apparent that only 24 outlets of category (b) were located on 'A' roads that carried more than 5,000 cars and vans daily, thus fewer than a half could be regarded as having occupied sites of very great potential. As, in addition, category (c) had only one such outlet, it must be concluded that of these stations concerned only 25 possessed both a large local vehicle population and enjoyed sites on busy roads. In II it is clear that an apparently poor location in terms of vehicle population was certainly not always compensated by being on a busy road, as only 19 and 20 outlets of categories (a) and (b) respectively enjoyed the latter advantage. However, during the course of Chapter 6, the actual performance of these outlets in terms of their petrol sales will be assessed, so that the relative significance of these locational attributes may then be estimated.[8]

At this point it would be meaningful to consider, as was first mentioned on page 129, whether there existed within the study-area an adequate provision of petrol retailing facilities. In the first place, it can be very clearly demonstrated that comparatively little of the whole area was without a local station, although the definition of the term 'local' could lead to some difficulty. In this context, it is suggested that as the mean nearest neighbour distance for 1977 was found to be 0.96 kilometres, those parts that lay within twice this distance of an outlet should be regarded as having formed its local area or hinterland. This was the basis adopted in the construction of figure 4.14, which indicates those parts of the study-area that lay within 1.92 kilometres of a petrol retailing outlet. In order to estimate the extent of such a coverage, an overlay subdivided into 100 square kilometres was used on the original larger version of figure 4.14. This revealed that in 1977, 70% of the total area of 4,312 square kilometres was within 1.92 kilometres of an outlet, so that in areal terms most of the study-area had access to a nearby station. However, as actual numbers of vehicles within these hinterlands would have been of greater significance than their actual areas, a comparison between figures 4.10 and 4.14 would be instructive. It is apparent that each of the squares that contained more than 500 cars lay within such hinterlands, as also did those with between 250 and 499, these two groups together accounting for some 457 squares. A further 478 squares contained between 100 and 249 cars, and, of this total, only 36 lay

8. see page 256.

FIGURE 4.14 OUTLET HINTERLANDS - 1973 AND 1977

outside the delimeated hinterlands. Thus, if it is assumed that each of the latter squares contained 175 vehicles, the mean value for this category, then only some 6,300 cars would have been resident more than 1.92 kilometres from their nearest source of petrol.

However, the situation would not have been quite as simple as this, as a number of vehicles were situated within squares having fewer than 100 units. In order to estimate the possible numbers of cars in such squares, and lying outside station hinterlands, a number of assumptions must be made. If the lowest possible numbers were taken for the more-populated squares, viz. 500, 250 and 100 cars, by multiplying these with their respective numbers of squares, the following would result :- 90,500 ; 69,000 ; 47,800. This would have produced a total number of 207,300 compared with the actual 1977 total of 258,460. In turn, this would have implied that 51,160 vehicles were distributed amongst the lesser-populated squares, but, as many of the latter lay within station hinterlands, the actual total would have been smaller.

As it has been established that only 30% of the study-area lay more than 1.92 kilometres from an outlet, it can be further assumed that the number of squares with fewer than 100 cars would have been 30% of 4,312. In other words, the number of cars in such squares outside station hinterlands would have been 30% of 51,160, viz. 15,348. This, together with the 6,300 cars already identified, would have given an absolute total of 21,648. However, the actual number was certain to have been considerably smaller, as numbers of vehicles assumed to be within more-populated squares were taken as absolute minima. If these values were to be only slightly upgraded to give more realistic numbers, say 525, 275 and 125 respectively, a total of 230,675 would result. This would then have left a difference of 27,785, and 30% of this value, being 8,335, when added to 6,300, would have given a grand total of 14,635. This is felt to be a more realistic assessment of the likely number of vehicles lying outside delineated hinterlands, so that, in conclusion, it is probable that only some 5% or 6% of the study-area's cars and vans were resident more than 1.92 kilometres from their nearest source of petrol.

In view of the large number of terminations that occurred between 1973 and 1977, it could reasonably be expected that much more of the study-area would have been within station hinterlands in the former year. However, rather surprisingly, this does not appear to have been the case, as an estimate again based on the original of figure 4.14 reveals. Admittedly, this is with reference to the index figure of 1.92 kilometres selected for 1977, although it is not felt that a value of twice the 1973 mean nearest neighbour distance of 1.74 kilometres would have substantially altered the result. The actual area that lay within station hinterlands in 1973 was only 165 square kilometres greater than that for 1977, so that in spite of so many terminations the reduction in hinterland area was only of the order of 5% of the former figure. Clearly, therefore, the implication is that closures must have been largely within tracts that possessed more than one outlet, so that it is very probable that it was competition for sales that led to most terminations.

Further, as a result of the reduction of hinterland areas, 11 squares that held between 100 and 249 cars in 1977 and another 154 less-populated squares were left more than 1.92 kilometres from their nearest outlets. However, as such squares together could hardly have held more than a few thousand vehicles, it must be concluded that terminations had but little effect in this sense and caused inconvenience to a comparatively small number of motorists.

It would appear that the study-area could hardly be regarded as having suffered from an under-provision of outlets, with the possible exception of those few parts referred to in the above paragraphs where vehicles were resident more than 1.92 kilometres from their nearest outlets. Still, even if some 15,000 fell into this category, as long as they were within 3 or 4 kilometres of an outlet, which they were, it could not realistically be claimed that more outlets were required.

In terms of the whole of the study-area there were in 1977, 724 outlets to provide for the total vehicle population of 258,460, thus giving, in crude terms, 357 cars per outlet. As the national average annual petrol consumption per vehicle was 345 gallons, then the average sale for all outlets would have been 123,165 gallons. It is not possible to consider the amount of petrol purchased within the area for vehicles resident elsewhere in the country, although in view of the existence here of some important through-routes such as the A34 and the A38, such amounts might well have been substantial. In any case, this would have been offset by purchases outside for vehicles normally located within the area, so that there would be little to be gained in attempting such a task. For the present purpose, therefore, it will be assumed that all the resident total of 258,460 vehicles relied entirely and solely on the 724 outlets within the study-area. The mean annual sale for 1977 may therefore be taken as 123,165 gallons, which was rather less than the recorded national average of 167,725 gallons for that year.

A similar situation prevailed in 1973 when the area had 847 active outlets and an estimated 244,890 cars and vans. At that time there were 289 vehicles per outlet, and, as average consumption was 349 gallons, the average outlet would have sold 100,861 gallons compared with the national mean of 142,500 gallons. Thus, although not achieving values as high as mean national levels, an improvement took place from an aggregate of 71% of the latter figure in 1973 to 73.4% in 1977. As it was established at an earlier stage that the study-area had experienced a greater rate of terminations between 1973 and 1977 than the country as a whole, such an improvement may be placed in perspective as having been achieved mainly through the reduced number of outlets. The fact that the 1977 value was still far below the national average can only be explained by reference to pages 91-94 where it was stated that for only 2% of the nation's cars, the study-area had 2.46% of its petrol outlets.

The study-area must, therefore, be regarded as having experienced an over-provision of outlets during this period, although the overall trend suggested that a point of balance might lie not too far in the future, but in all probability, achievable only through a further reduction in outlets while vehicle numbers increased. It could be claimed that, in order to have achieved parity with the national situation in 1977, for outlets to have had average throughputs of 167,725 gallons, it would have been necessary to have had 478 cars per station. This would have meant that instead of 724 outlets, no more than 541 would have been required, and in turn that the comparative total for 1973 would have been 600 rather than 847. Thus, it is evident that the degree of over-provision of outlets was very considerable, but it is more than probable that even these reduced numbers would have been excessive.

The point implied in the latter statement is that, whereas an annual sale of 167,725 gallons at a garage or service station would have probably been adequate, it would have been totally insufficient for a specialised filling station with no other substantial source of income. It was stated on page 78 that such an outlet would have had to sell over 250,000 gallons annually in order to be successful, and, in the knowledge that the study-area contained many of this type, then it must have meant that a number of other stations lacked viability. This topic will be analysed in detail in the subsequent chapters when stations will be classified by their respective functions, in the first place, and secondly, assessed in terms of their annual throughputs in order to identify those stations that are viable.

Chapter 5 : Functional Analysis and the Classification of Outlets.

Following a consideration of the evolution and spatial distribution of outlets within the study-area, attention will now be directed to a detailed examination of their roles as retailers of petrol. As it is apparent that great variations exist in terms of degrees of dependence on petrol sales as sources of station income, the first stage is the identification of groups of outlets on a functional basis. Once this has been achieved, an analysis of locational factors and site-attributes can be attempted, with a view to assessing the potential of all outlets within the designated area. This will then be followed in the subsequent chapter by a consideration of threshold requirements in relation to actual functions and degrees of dependence on petrol sales, together with a consideration of the whole question of viability.

Each outlet was originally visited between September 1973 and April 1974, the purpose being to record all relevant features relating to both location and facilities. Subsequent checks were made at intervals during 1975 and 1976, and a fully comprehensive survey was completed during the last four weeks of 1977. This allowed all changes and modifications made to individual stations during the post-1973 era to be incorporated into the final record, which, therefore, specifically referred to the situation pertaining in December 1977. In addition, information relating to vehicle numbers and traffic volumes has been obtained from other sources, so as to supplement details gathered from personal observation.[1]

All of this material, recorded for every station active during any part of the period indicated above, has been tabulated in Appendix A in a series of indices so that comprehensive details of each outlet may be readily consulted. Further, each outlet has been marked by means of a reference number in figures 5.1 to 5.6, so that it is possible to locate an individual station on one or other of these maps. Due to the size of the study-area, extending approximately 100 kilometres from east to west and 80 kilometres from north to south, together with the concentration of outlets in urban areas, it was necessary to prepare 6 maps in order to allow the identification of reference numbers.

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1. This material has been obtained from the County Planning Departments.

FIGURE 5.1 INDEX TO OUTLETS

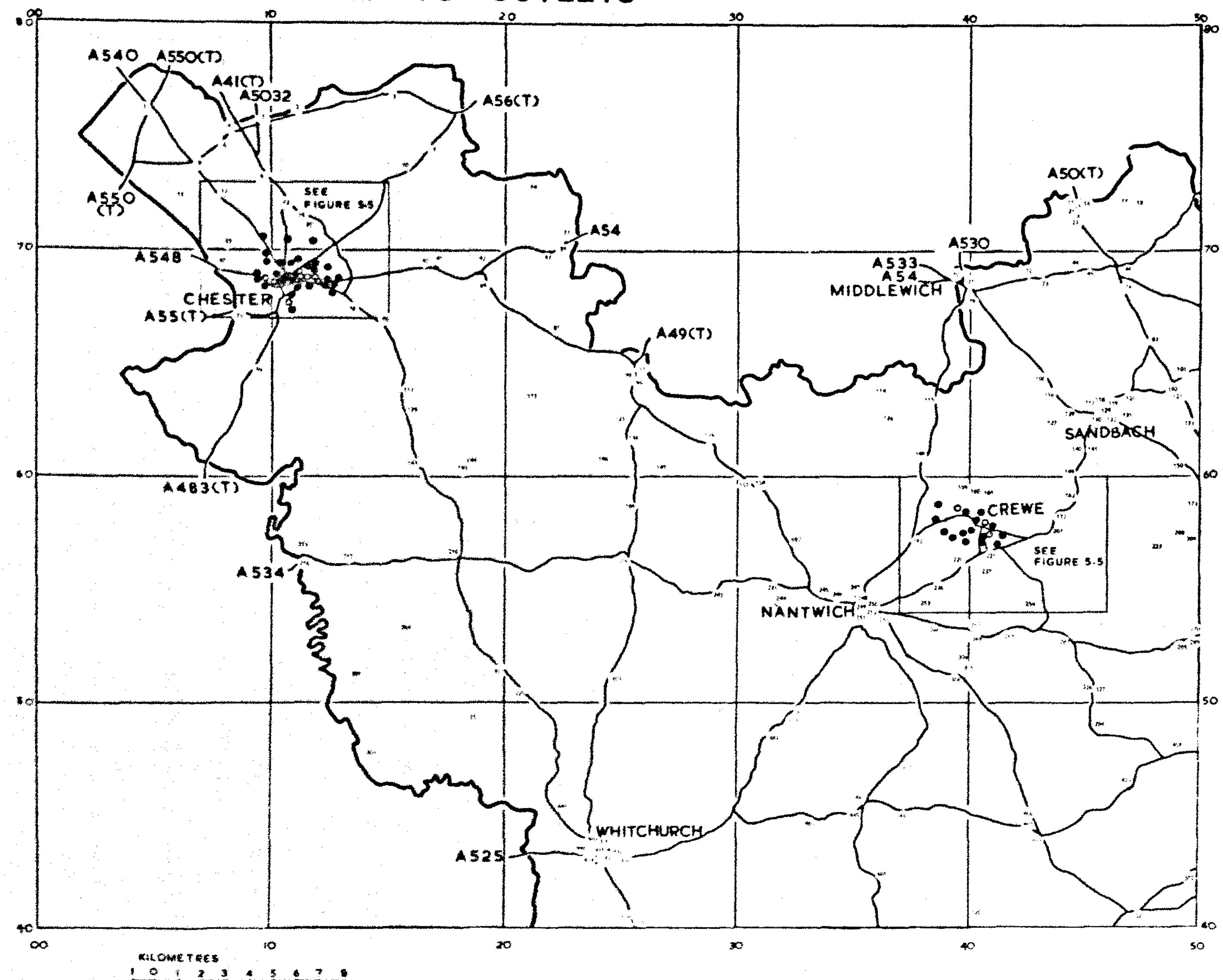


FIGURE 5.2 INDEX TO OUTLETS

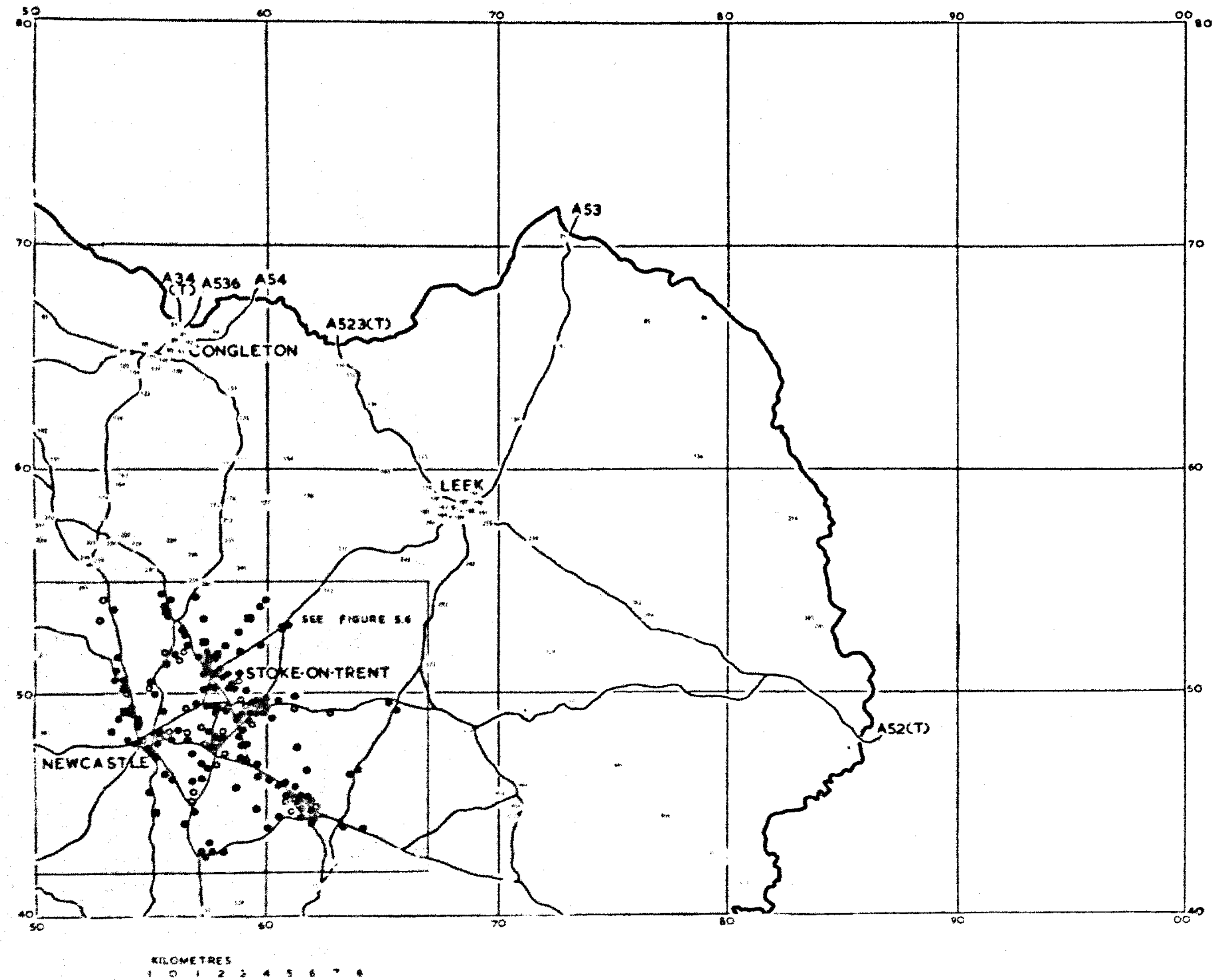


FIGURE 5.3 INDEX TO OUTLETS

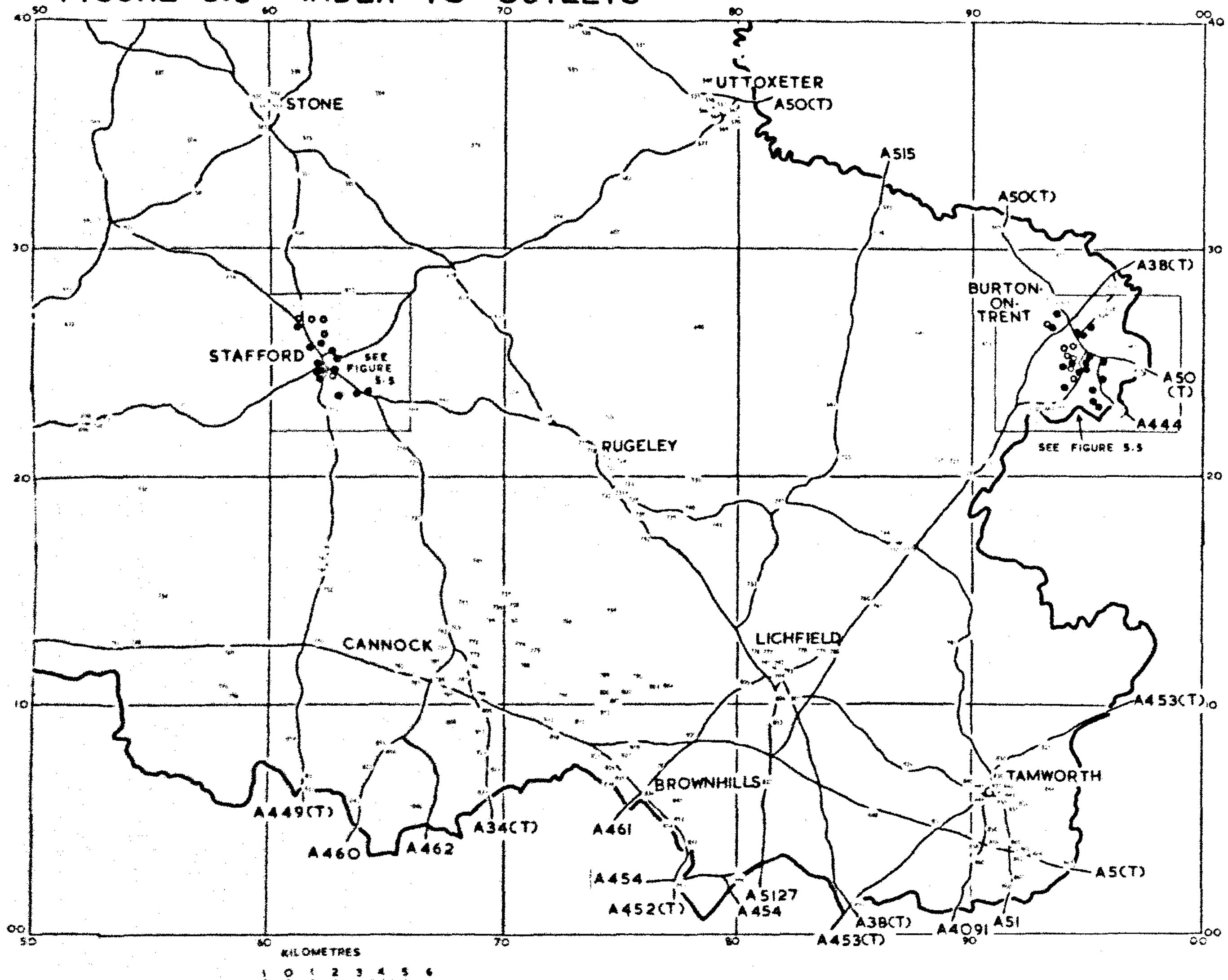


FIGURE 5.4 INDEX TO OUTLETS

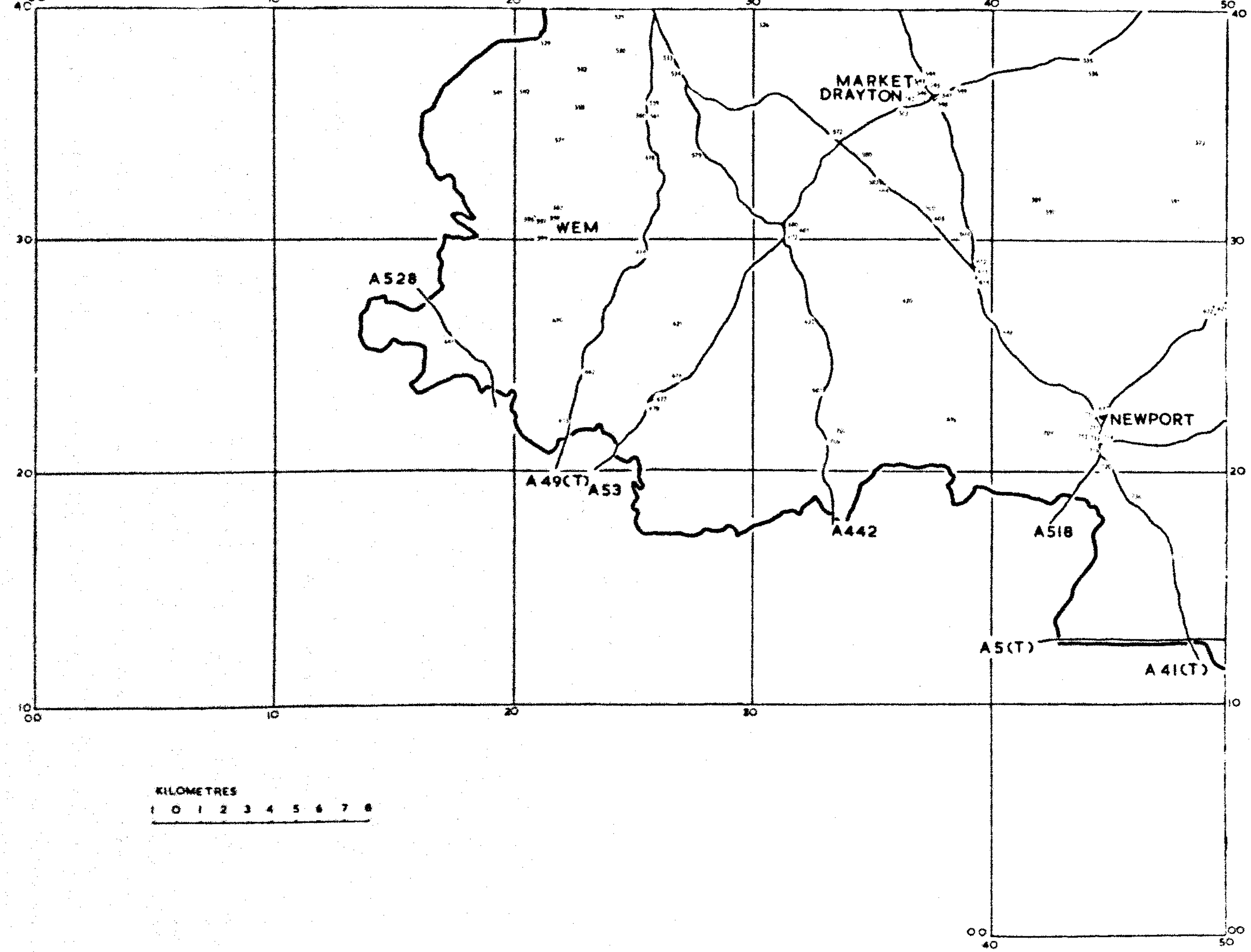
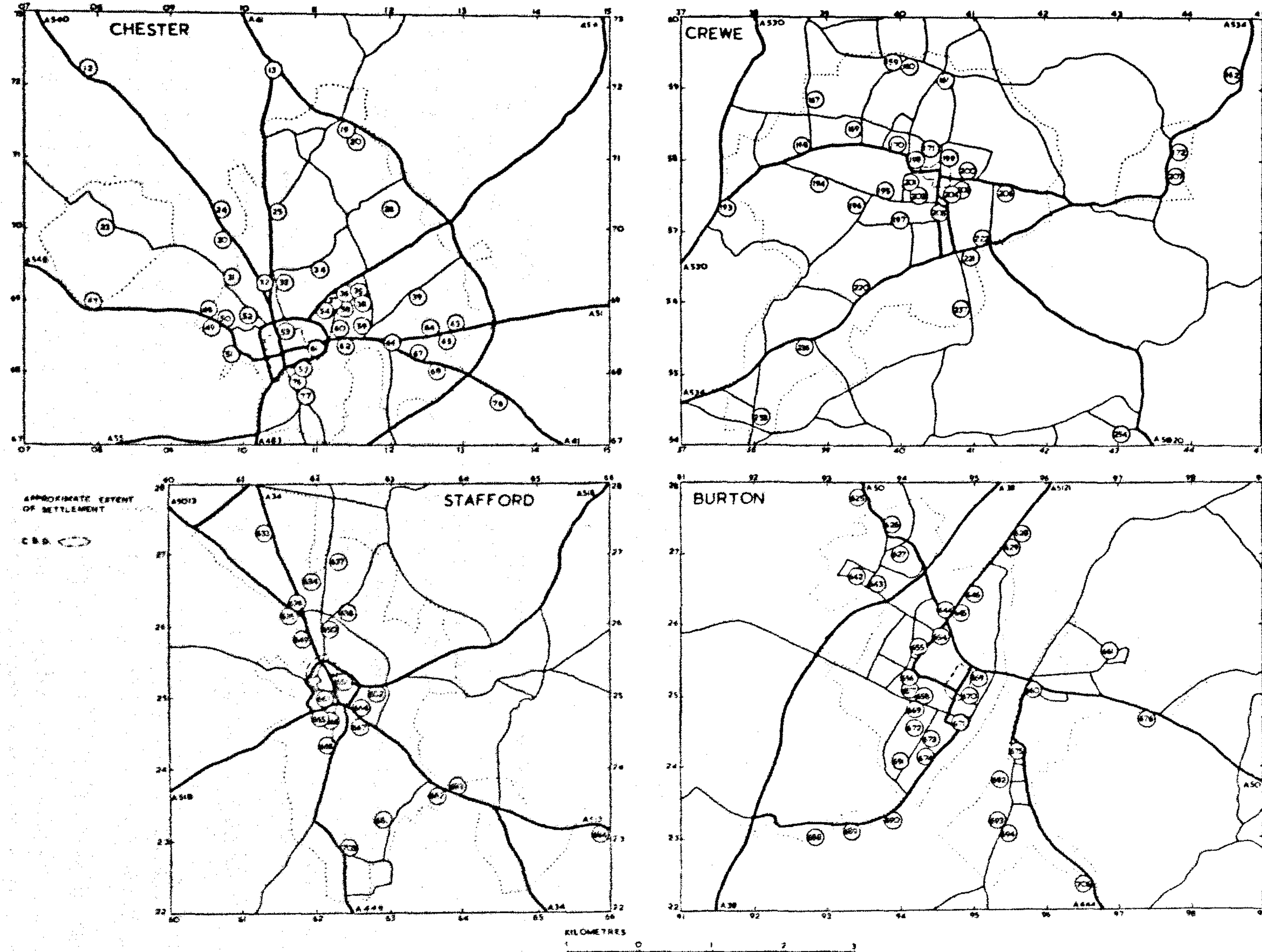
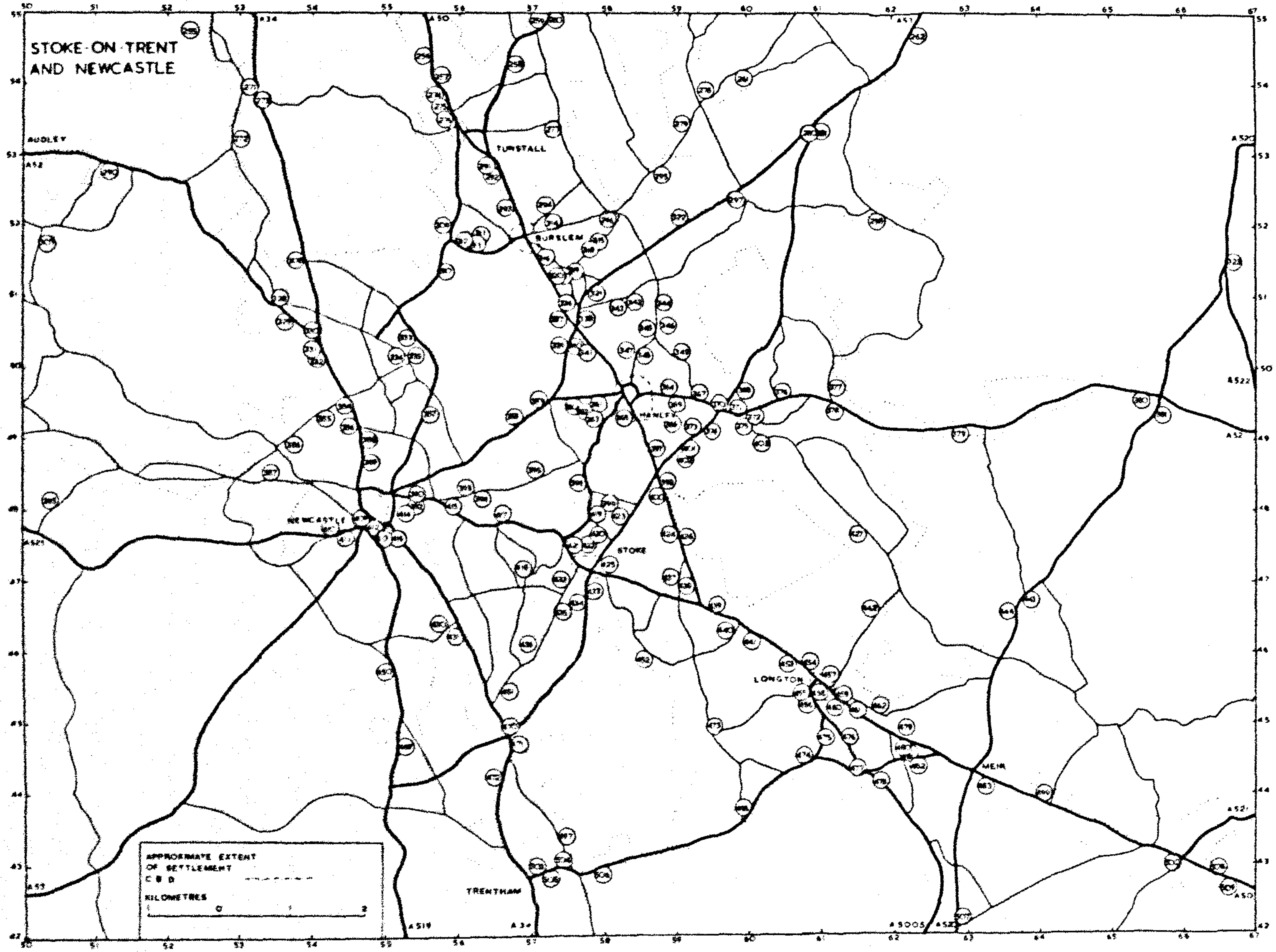


FIGURE 5.5 INDEX TO OUTLETS



174.

FIGURE 5.6 INDEX TO OUTLETS



Each outlet listed in Appendix A has 22 indices grouped into 5 sets, with sub-totals for Sets 2 to 5 being shown separately. In Sets 1 and 5, individual indices are either 1 or 0 according to whether or not particular items are present. In the remaining sets, indices are recorded as 2 or 1 or 0 in terms of criteria explained below.

Set 1, containing 4 indices, records whether a station possessed major sources of income other than that deriving from the sale of petrol. The presence of any of these activities is shown by the figure 1 in the appropriate column, so that a station having any sequence other than 0000 in Set 1 must have possessed a source of income additional to petrol sales. Such a station, therefore, could not be classified as a filling station, although it would not preclude the possibility that the latter activity could have provided the bulk of income. The items recorded in Set 1 are as follows:-

column 1 : vehicle repairs and maintenance.

column 2 : vehicle sales, whether new or used.

column 3 : vehicle rental.

column 4 : a retail outlet not necessarily related specifically either to vehicles or to motorists, e.g. ironmongery, grocer, post office, public house, etc.

Set 2, containing 6 columns, records both general and detailed factors of location, in each case the figure 2 denoting the most desirable level. Thus, the higher the sub-total score for Set 2, the better the location, the highest possible grading being 12. As the purpose here is the assessment of site-quality as indicating potential for petrol sales, the items listed must be seen as having significance specifically only for that particular activity. The actual criteria used for each item are as follows :-

column 5 : general location.

(2) urban major road (1) other major road (0) urban side-street or rural minor road.

column 6 : numbers of vehicles within 0.96 kilometres, this being the value of mean nearest neighbour distance in 1977.

(2) 500 or more (1) 250-499 (0) less than 250.

column 7 : weekday traffic volume, excluding commercial vehicles.

(2) 10,000 or more (1) 5,000-9,999 (0) less than 5,000.

column 8 : actual location of site.

(2) at roundabout or 'A' road junction	(1) within 300 metres of a roundabout or 'A' road junction	(0) other.

column 9 : statutory speed restrictions.

(2) 48 k.p.h. (= 30 m.p.h.)	(1) 64 k.p.h. (= 40 m.p.h.)	(0) de-restricted.

column 10 : visibility of station.

(2) at least 300 metres from any direction	(1) at least 100 metres from nearside	(0) other.

With regard to column 5, it could be claimed that the best type of site would front on to an urban major road, other categories being less desirable. Column 6 seeks to differentiate stations according to actual numbers of petrol-driven vehicles within their immediate neighbourhoods, as the bulk of regular customers can be shown to reside locally.[2] The criteria adopted in column 7 would seem to be uncontroversial, as, in general terms, the greater the volume of traffic, the greater the number of potential customers. Column 8 seeks to apply a more-refined measurement to the actual site than was possible in column 5, as it could be claimed that a station located at or near an 'A' road junction or roundabout should possess the potential to attract custom from more than one road.[3]

In addition, a location at a point where traffic is required to reduce speed would be desirable, as it seems logical that vehicles are more likely to stop and purchase petrol when having to slow for other reasons. Column 9 is also included for this reason, as, clearly, less effort is required to stop the vehicle when moving at low speeds than when moving at a faster rate on a road that is de-restricted. Further, motorists proceeding at low speeds will have more time to decide whether or not to stop at a station, and, unless the site has very poor visibility, are unlikely to have moved past before registering the existence of such a site. Again, column 10 is concerned with the latter aspect, as it would seem axiomatic that a station should be visible to

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2. A survey commissioned by National in 1971 indicated that some 50% of a station's regular customers resided within 3 kilometres.

3. Claus, R.J. & Rothwell, D.C. Gasoline Retailing. Tantalus Press, Vancouver, B.C. 1970. pp. 35-42.

the approaching motorist from a considerable distance. However, as the average driver of a moving vehicle would be unlikely to register the location of a station at distances in excess of about 350 metres, unless the station possessed an unusual display designed for maximum visibility,[4] a score of 2 has been awarded here for those stations capable of being seen from at least 300 metres. For a vehicle moving at 64 k.p.h. (= 40 m.p.h.), such a distance would be covered in some 17 seconds, so that, even with maximum visibility, little time exists in which to make the decision to stop.

The actual role of visibility in the success of an outlet is probably not great, as most rely on regular customers who would obviously know the exact location of their favoured station. This was apparent as a result of data presented in Chapter 3, and also as a result of the material collected during the survey of outlets where it was clear that although relatively few stations reckoned to have as much as 30% of their total custom in a non-regular capacity, those that claimed to have the highest percentages tended to be the leading retailers in terms of annual throughputs.

In summary, a score in the range of 8 to 12 for Set 2 would mean that a station had good locational features and possessed the potential to become a substantial retailer of petrol. However, as entries in Set 1 would indicate, the station mihgt be more concerned with activities other than petrol sales, so that a site shown by Set 2 to possess the necessary attributes would not necessarily be operated for the purpose of maximising sales of petrol.

The items included in Set 3 are again concerned with locational aspects, as follows :-

column 11 : distance to nearest neighbour.

(2) more than 1.92 kilometres (1) between 0.96 and 1.91 kilometres (0) less than 0.95 kilometres.

column 12 : other outlets within 1.92 kilometres.

(2) none (1) 1 - 2 (0) 3 or more.

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4. It is uncommon to find such displays in the U.K., but in the U.S.A. it is normal practice to mount an illuminated and rotating brand insignia on a 40' pole.

It is apparent that many stations having high scores in Set 2 would have low totals in Set 3 owing to the concentration of outlets in urban areas. This is the reason for separating locational indices in this manner, as otherwise the result would have been to depress total scores for these items. As a consequence, many stations possessing high quality sites in terms of Set 2 would not be readily identifiable. It must be said, however, that a good Set 3 score would partially compensate for a low grading in Set 2, and that a station scoring high marks in both sets would occupy a prime location.

Whereas Sets 2 and 3 are concerned with locational factors, Sets 4 and 5 refer to the various attributes pertaining to the actual development of sites. These might be termed internal features as opposed to the external factors of location.

Within Set 4 are listed 6 indices, graded 2 or 1 or 0 according to the following criteria :-

column 13 : nature of access and exit.

(2) excellent (1) adequate (0) difficult.

column 14 : width and depth of forecourt.

(2) at least 15 x 12 metres (1) 10 x 7 metres or above (0) other.

column 15 : pumps and pump stands.

(2) 4 or more pumps, on separate stands (1) 4 or more pumps, on 2 or 3 stands (0) other.

column 16 : nature of service offered.

(2) self-serve (1) attendant (0) attendant-mechanic.

column 17 : availability of purchases by credit card.

(2) 2 or more cards (1) one card (0) none.

column 18 : ownership and operation.

(2) company-owned, manager-operated (1) company-owned, tenant-operated (0) private.

The allocation of indices in column 13 has been somewhat subjective largely due to the number of variants involved. However, in order to gain a grading of 2 the station would require wide ingress and exit lanes leading easily from and to the roadway, so that vehicles had ample time and space in which to manouver. A score of 1 would indicate a less-desirable situation, possibly leading to a cramped forecourt, while a 0 grading would be the result of an awkward entry- or exit-lane. Although based on a subjective assessment, the fact that only one person allocated the indices meant that the same standard was maintained throughout the survey.

As stations with very good entry and exit facilities tend also to possess sizeable forecourts, a score of 2 in each of columns 13 and 14 implies a well-designed site. Similarly, a score of 00 would indicate a small, cramped site. However, a station can possess a large forecourt without having a particularly good entry lane, although it would be rare to have very good access leading to a small forecourt.

The size of the forecourt, indicated in column 14, is defined as the area available for vehicles waiting to approach the pump stands, and also leaving the latter. This is an important factor in the maintenance of sales, so that a very small forecourt, implying that vehicles might have to stop on the highway to await their turn to enter, would act against the encouragement of custom.[5] The forecourt is normally considerably less than the entire ground area of the site, less building space, as some provision might also exist for the display of vehicles for sale or the parking of cars awaiting repair. The assessment of the index in column 14 represents the forecourt as defined above, and clearly the specialised filling station is likely to have all of its area available for this purpose. In spite of this, it is most uncommon to find forecourts larger than 20 metres in length and 12 metres in width, this only allowing adequate space for about 8 vehicles. Again, ideally, the bulk of waiting-space should lie between the entry point and the pump stands, with the latter being located close to the exit lane, but, in actual fact, this is a rare occurrence, pump stands generally occupying a central position on the forecourt. Part of the reason for this type of layout is that vehicles are usually allowed to enter from either direction, so that each lane is used for both entry and exit. However, as the bulk of customers are known to enter from the nearside lane it is surprising that this is so.[6]

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5. Queuing on the roadway is now illegal, so that a large forecourt is essential for the specialised petrol station.

6. Observations at many stations in the study-area show that some 70% to 80% of total custom commonly enter from the nearside lane.

Column 15 represents an assessment of the arrangement of pumps, this again being an important factor in the maintenance of sales. Clearly, if a station possesses 4 well-spaced pump stands, 4 vehicles can be served at one time and 4 more can wait on the other side of the stands. In contrast, a station having its pumps placed close together on one linear stand might only be able to cater for 2 vehicles at the same time as each vehicle would occupy most of the available space on each side of the stand. Thus, in order to reduce waiting-time, a number of separate stands are desirable, the best solution being to have 4 or more, with substantial gaps for the movement of vehicles between such stands.

It must also be added that the relative siting of pumps in their relation to each other might have some significance, especially in cases where pumps deliver single grades of petrol. Thus, a station possessing such pumps would experience comparatively little demand for its 3-star and 5-star grades of petrol, so that such equipment might now prove uneconomic and simply form an obstacle to those vehicles that required the more popular 2-star and 4-star grades.[7] It is true to state that the best equipment possible would be a number of blender pumps capable of delivering any grade, with possibly one additional 4-star pump as this forms the bulk of sales. In column 16, an index of 2 would normally refer to the latter type of station, as separate stands are almost invariably occupied by blender pumps. Further, as such equipment is more costly to install than a number of single-grade pumps, the implication is that the station has a high capital value and must therefore view the retailing of petrol as a very important function.

Column 16 indicates the manner in which petrol is sold, this again having a bearing on total sales. The reason that self-service at the pumps carries the highest index is not due to its greater popularity amongst drivers, but to the fact that such outlets aggregate much higher throughputs than manned sites.[8] In fact, many women-drivers especially shun such stations, much preferring an attendant to perform the task for them. However, it must be accepted that self-serve sites sell greater amounts of petrol, and also represent a higher capital investment, so that they must be awarded the highest form of grading in this category.

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7. An estimate for 1979 was that 4-star petrol would account for 65.1% of the total sold, with 2-star accounting for another 15.4%. Economist Intelligence Unit. op. cit.

8. see pages 75-76.

Further, a number of vehicles can be supplied simultaneously, so that waiting-time is reduced, thus increasing the number of possible transactions in any given period of time. In contrast, the attended station can normally only deal with one car at a time, although even this is considerably better than the category where service is provided by a person such as a mechanic who has other duties to fulfil.

In summary, the type of service offered is a clear indicator of the degree of importance placed upon petrol sales, and certainly those outlets with an index of 0 in column 16 may be regarded as of very little consequence. Such stations would either be garages or shops or public houses, and their possession of pumps would be more for the convenience of customers visiting the site for purposes other than to buy petrol. Further, in a period of price-cutting, such facilities might prove more of an embarrassment than a convenience to a customer able to buy cheaper petrol elsewhere, as this type of station would normally sell at the full price owing to the lack of volume required to support a policy of discounting.

Column 17 represents the degrees to which purchases by means of credit cards are encouraged. The financial companies responsible for such cards stipulate that the facility must be displayed so that the recording of this item offered no difficulty. The rationale for its inclusion is that the average purchase by means of credit card is greater than that by cash,[9] so that the numbers of cards accepted will have an influence on total sales. No account has been taken of the traditional method of allowing regular customers to pay at monthly intervals, as this is a practice discouraged by most stations to whom petrol sales are significant. The reason is that deliveries from the supplier companies must be paid for on receipt, so that income from sales cannot therefore be delayed. This type of credit has been greatly reduced during recent years largely due to the increased precariousness of petrol retailing since 1973.

The final index in Set 4, column 18, is concerned with the ownership and administration of the outlet. The phrase 'company-owned' refers to the practice followed by most oil companies in actually owning a proportion of their branded outlets. Thus, as the purpose is to further sales of their own petrol, all company-owned sites can be

9. see page 76.

expected to rely largely or entirely on this particular activity. This, in turn, means that such stations will invariably have high total scores in Set 4, as they will either have been planned or modified to achieve maximum sales volumes. As such, a score of 2 is awarded to the outlet which is completely under the control of an oil company, even to the extent of employing a salaried manager who is usually paid a bonus in relation to petrol sales. An index of 1 is applied to a site, owned by an oil company but operated by a tenant, such a person having access to loans for improvement from the company but otherwise reliant for profitability on his own business acumen. It is apparent that company-managed stations are likely to be better-equipped, and in all probability better-located than tenanted sites, although this will be subsequently examined.

A score of 0 is allocated to those stations that are owned and operated by private individuals on the basis that few such stations could command the capital investment required either to purchase a prime location or to undertake improvements on the scale followed on company-owned sites. Thus, column 18, to a considerable extent, is an assessment of attitude towards petrol retailing. It is very much a reflection of the other indices in Set 4, most of which require capital investment in order to achieve high scores, and may therefore be regarded as the means whereby improvements are either possible or not.

It is perhaps arguable that other criteria might also have been considered, in particular the brand of petrol sold and the presence or absence of discounting. The former item is regarded as fairly important as some brands have more popular appeal than others, and it has already been stated on page 78 that average sales vary from brand to brand. This whole question is excluded from the present assessment as it is intended to subsequently examine the relationship of brands of petrol with the results of this analysis. Again, discounting has been excluded due to its widespread adoption in recent years at virtually every station to whom petrol sales were a significant source of income. It will, however, be analysed in the following chapter.

Set 5 consists of 4 further site-attributes, indices being recorded as either 1 or 0 according to whether or not a particular feature is present. The 4 items are as follows :-

column 19 : a shop, as a subsidiary activity, selling 'convenience' items.

column 20 : a canopy over the pump stands.

column 21 : toilets for customers.

column 22 : a car-wash.

The type of shop recorded in column 19 normally relies mostly on 'impulse purchases' such as confectionery, cassettes, clothing and a variety of car-accessories. The location of the display is invariably next to the cash-desk, so that the customer is faced with these items when actually involved in paying for petrol. This type of shop is now seen as a useful supplement to petrol retailing, and tends to be a feature present at most stations where the latter activity is important. It has developed from the earlier practice of stocking replacement-items such as light bulbs, specifically for vehicles, but is now more for the benefit of the motorist himself. In a few cases within the study-area it has been observed that stations have developed the idea of the shop even further, at least one offering a wide range of groceries including bread, viz. reference number 63, and one which operates an off-licence within the building that houses the cash-console, station number 221.[10]

Whereas it is not always apparent from the outside whether a shop is present, the possession of the other 3 facilities is usually fairly obvious. The most visible feature is clearly the canopy, this being very much a hallmark of stations that rely greatly on petrol sales. It is a useful facility for conducting the activity during wet weather particularly, and suggests that the comfort and convenience of the motorist has been regarded as important at that station. It could be suggested that the provision of a canopy might be more for psychological reasons than for any real benefit, however, as during rough weather it tends to create a 'wind-tunnel' effect. In any case, whether or not it really represents a substantial improvement, it is now regarded as an essential requisite to cover the pump stands in this manner.

10. Such sites are, nevertheless, primarily retailers of petrol, these activities being subsidiary functions.

Column 21 records the presence or absence of toilets and washrooms specifically for customers. Clearly, all business premises must possess these for their own staff, so that the figure 1 in this column refers to such facilities being additionally available for customer usage. The possession of such facilities is usually prominently displayed on the outside of the station building, so that it may be claimed that a restroom provides part of the visible attributes.

Finally, a less-common feature, namely a car-wash is sometimes installed towards the rear of the premises. As this represents a substantial capital investment it could not be expected to feature at many privately-owned stations, but rather to be part of well-equipped company-owned sites.[11] The favoured location for a car-wash would be at a station in an urban area, and especially one that relied on custom from the neighbourhood. It is known that such machines are used mainly over the weekend, so that it would appear that the automatic wash is in competition with those motorists who wash their cars manually at regular intervals. Thus, a car-wash would be little-used at a station in which sales to vehicles on long journeys formed a substantial proportion of total custom. With regard to cost of usage, it was estimated that an economic price in late-1976 was 40p. per vehicle. As it was found that charges within the study-area some 12 months later in December 1977 were either 30p. or 40p., the conclusion has to be that the car-wash was regarded as a loss-leader to attract custom to the station for the purpose of buying petrol. In fact, some stations were still offering free washes with a purchase of 4 or more gallons at that time, so that, clearly, the facility was being used as a means to further the sale of petrol.

Before commencing an analysis of performance in terms of recorded indices, it should be emphasised that the maximum possible aggregate for the ideally-located and best-equipped station is 32, derived as follows :-

Set 2	-	12	locational factors (external)
Set 3	-	4	
Set 4	-	12	site-attributes (internal)
Set 5	-	4	

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11. Some 75% of all car-washes in the U.K. are installed at company-owned sites, their average cost in late-1977 being £6,000. Economist Intelligence Unit. op. cit.

Further, as indices have been designed to estimate potential for petrol retailing, all conclusions must be related to this particular activity rather than to other possible sources of income such as repairs or vehicle sales, although a station might well rely more on one of these activities than on petrol sales. In addition, as already stated, site-attributes such as car-washes are intended mainly to attract customers to a station in the hope that they might also purchase petrol rather than to generate income in their own right, whereas convenience shops, although provided partially for the greater benefit of motorists, are essentially to create extra income for the station.[12]

Appendix A will be seen to contain another 4 columns placed to the right of the Set sub-totals. The first of these columns has a capital letter, F, as a heading, this standing for 'Function'. This is explained below, as also is the second column headed 'Gp.', this being an abbreviation for the group or class into which the station has been allocated. The third column, Age, indicates the period during which the station was established, as follows :-

5. pre-1928
4. 1929-1939
3. 1945-1964
2. 1965-1973
1. post-1973.

The final column conveys the brand of petrol sold at each station at the end of 1977, with closed outlets being indicated by parentheses.

The statistical material set out in Appendix A will now be analysed in order, first, to recognise a functional division of the whole population of outlets, and secondly to assess individual stations according to their potential for petrol sales. Descriptions of the three categories of petrol retailers, originally presented on page 40, are worth reproducing at this stage, these being :-

Filling station	-	a site existing solely for the sale of petrol and oil.
Garage	-	a place in which cars are repaired and maintained, and also having, for the convenience of customers, a petrol pump.
Service station	-	to all intents and purposes, having all the features of a garage, but being more or less equally concerned with the sale of petrol.

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12. It was estimated that some 5% of tobacco sales and 4% of confectionery sales in 1976 were at retail petrol forecourts. These would amount to £137,500,000 and £32,000,000 respectively. E.I.U. op. cit.

Although first suggested more than 50 years ago in 1925 when marketing conditions were very different, only slight modifications are required to make these definitions relate more specifically to the present period:-

Filling station	-	a site existing solely for the sale of petrol and oil, but possibly having minor sources of income in the form of a car-wash or a convenience shop.
Service station	-	a site having more than one major source of income, one of which is petrol retailing.
Garage	-	a place in which cars are supplied or repaired or rented, and having, for the convenience of customers, a petrol pump or pumps.
Other type of retail outlet	-	a site possessing a petrol pump or pumps, but which exists primarily for a purpose having no specific relation to either vehicles or motorists. (e.g. grocer, post office, public house)

Clearly, according to the above definitions, it is relatively simple to recognise filling stations as they will have indices of 0000 in Set 1. As this means that no other major activity takes place at the station, it naturally follows that the bulk of total income must derive from the retailing of petrol. The letter F has been placed under the Function (F) heading in Appendix A to identify those outlets identified as filling stations.

There is no difficulty involved in the identification of stations belonging to the category of "other types of retail outlet" as such stations will have an index of 1 in column 4 of Set 1. In fact, their Set 1 entry will be 0001. These outlets have the letter R in the Function column and are sites where petrol sales form only an incidental part of total income.

With regard to garages and service stations, it is less simple to differentiate these from each other. However, it is apparent that the garage group will consist entirely of stations for which petrol retailing has but little significance, so that it could be expected to include the following types of sites :-

(a) dealer sites where the trading of vehicles formed the bulk of activity ;

(b) vehicle-rental businesses, where direct sales of petrol would be mainly to persons hiring cars ;

(c) specialised centres dealing in the supply of batteries or tyres, possibly still retaining petrol pumps as a convenience to their customers ;

(d) vehicle-repair shops or garages, whose possession of pumps would date from an earlier period when such petrol sales would have been a useful source of income, but, as already stated, would now be of very little significance.

Having summarised the various types of stations that might be expected to fall into the 'garage' category, it must also be realised that some of the dealer sites and repair shops as outlined in (a) and (d) above might conduct their petrol retailing function as a significant part of their total activity. In such cases it would seem logical to place them in the category of service stations, as, in terms of the above definition, these are stations to whom petrol retailing represents one of a number of major sources of income.

As it is apparent that this proposed division has mainly to do with the actual degree of importance attached to the sale of petrol, it could possibly be accomplished subjectively. However, it is proposed to use specific criteria which should clearly demonstrate the attitude of stations to this particular activity, viz. the type of service offered. Thus, the index recorded in the fourth column of Set 4, column 16, is regarded as the key factor in the allocation of stations into these two groups. Clearly, an index of 2 will typify a station where the sale of petrol is a major source of income. Thus, any such outlet not already allocated to the filling station group must be placed in the service station category. Likewise, an index of 1, denoting the presence of a full-time attendant on the forecourt, would suggest that petrol sales are regarded as reasonably important, so that this type of site must again be seen as a service station. Finally, an index of 0 in column 16 clearly reveals the low regard paid to petrol sales, such stations being classified as garages unless previously placed in the "other retail outlet" group.

In summary, therefore, all stations not already designated as filling stations are allocated to the service station category if an index of 2 or 1 is recorded in column 16 and to the garage group if the index is 0. In order to facilitate identification in Appendix A, the letters S and G denote their respective functions. As there are also 3 other sites not specifically catered for in this classification, these being associated with hypermarkets, they are allocated to the filling station group as they are operated on the lines of large-volume filling stations, although existing primarily to attract customers to the stores by means of a policy of selling cut-price petrol.

It is probably true to state that other indices could have been used in the separation of service stations from garages, as the latter would be unlikely to possess high scores in either of Sets 4 and 5. Thus, a garage, in all probability, would have 0 indices in several of these columns, and would certainly have a 0 index in column 18 as ownership of a site by a supplying company would naturally mean that the sale of petrol would be the main function. Therefore, although it can be claimed that any station recording 0 indices in each of columns 13 to 17 will be a member of the garage group, as some may possess higher gradings in one or more of columns 13, 14 and 17 particularly, the allocation cannot really be based on these. Again, although a garage will not score more than 0 in column 18, some of the filling stations and service stations will also record a 0 in this instance. Thus, in view of a possible lack of precision arising from a reliance on some of these indices, column 16 remains as the one most likely to lead to the correct allocation of stations. As a result, this is the only index actually employed in the separation of service stations and garages.

The results of the identification of stations on a functional basis in Appendix A yields the following numbers in each category :-

Category	1973 totals	1973-1977 openings	1973-1977 terminations	1977 totals	Net gain/ loss.
Filling stations	151	20	18	153	2
Service stations	484	4	42	446	38
Garages	177	0	67	110	67
Other retail outlets	34	0	19	15	19
Totals	846	24	146	724	122

The above table reveals that service stations were the most numerous types of outlets, and that they increased their share from 57.21% in 1973 to 61.60% in 1977. Whilst it is clear that such a percentage increase obscured an absolute decline of some 38 outlets, the filling station group increased its membership in both respects. Thus, in 1977, 82.73% of all outlets were seriously engaged in the retailing of petrol. In contrast, as already established, garages and other retail outlets had to be regarded as being less concerned with this activity, so that these outlets were of minor significance only.

With regard to the closure rate between 1973 and 1977, it is clear that the latter groups bore the brunt in both absolute and percentage terms. Whereas the overall rate for all types of stations stood at 17.26% within the study-area, those for garages and other retail outlets were 37.85% and 55.88% respectively. Thus, whilst it is clear that most terminations involved sites where the retailing of petrol was not greatly significant, it should be emphasised that the closure rate for filling stations and service stations in total was only 5.67%. In this sense, an apparently high overall closure rate is put into perspective, and it becomes apparent that comparatively few stations at which petrol sales represented a major activity had to be closed.

As a result of the summation and averaging of set sub-totals on both a functional and an ownership basis derived from the data in Appendix A, the following table is presented :-

Table 5.1 : Mean set scores, all Outlets, 1977.

Group	Number of Outlets	Means of Sets 2.	3.	4.	5.
All outlets	724	6.55	0.97	5.69	1.84
Filling stations	153	7.48	0.83	8.26	2.63
Service stations	446	6.89	0.82	6.00	1.91
Garages	110	4.31	1.54	1.53	0.72
Other retail outlets	15	3.47	2.80	0.80	0.07
Filling stations,					
Company managed	42	10.21	0.12	11.43	3.19
Company tenanted	64	7.86	0.63	8.56	2.89
Privately owned	47	4.70	1.75	5.04	1.76
Service stations					
Company tenanted	120	8.25	0.47	8.21	2.48
Privately owned	324	6.39	0.96	5.17	1.70

(as there were only 2 company-managed service stations, their results are not included)

As criteria were selected to identify the differential potentials of outlets, it could have been expected that those most reliant on petrol sales would aggregate the highest mean scores. This is clearly shown in the above table, with the exception of Set 3, and also in the graph, figure 5.7, where group mean scores in Set 2 are plotted against those of Sets 4 and 5 combined. On a group basis, filling stations and service stations emerge with the higher locational factor scores, thus implying better potentials for sales, and they also possess much better site-attributes than the garages and other retail outlets. Again, as could have been expected owing to a lack of alternative sources of income, filling stations enjoyed the highest ratings of all, followed by the service station group in second place. The other groups are shown to have been greatly inferior in terms of both locational factors and site-attributes. The overwhelming proportion of service stations is emphasised by the fact that their position on the graph lies nearest to that of all outlets.

It will be seen that figure 5.7 also indicates positions on an ownership-operational basis. The clear lead enjoyed by company-managed filling stations is very apparent, especially in comparison with those in private ownership. It is virtually certain that such differences can be traced to the amount of capital available, both in terms of costs of purchasing prime locations and of developing such sites. This also applies to company-owned sites operated by a tenant or licensee,[13] as these again occupy positions well above those of the private sector. However, one surprising result can be seen where tenanted service stations stand above tenanted filling stations, although the difference between them is very slight. Again, privately-owned service stations occupy substantially better locations than privately-operated filling stations, although in terms of site-attributes, there is little real difference. Both of these features might be due to service stations experiencing healthier incomes than filling stations as there would be less reliance on one particular activity, viz. petrol sales, during a difficult marketing period.

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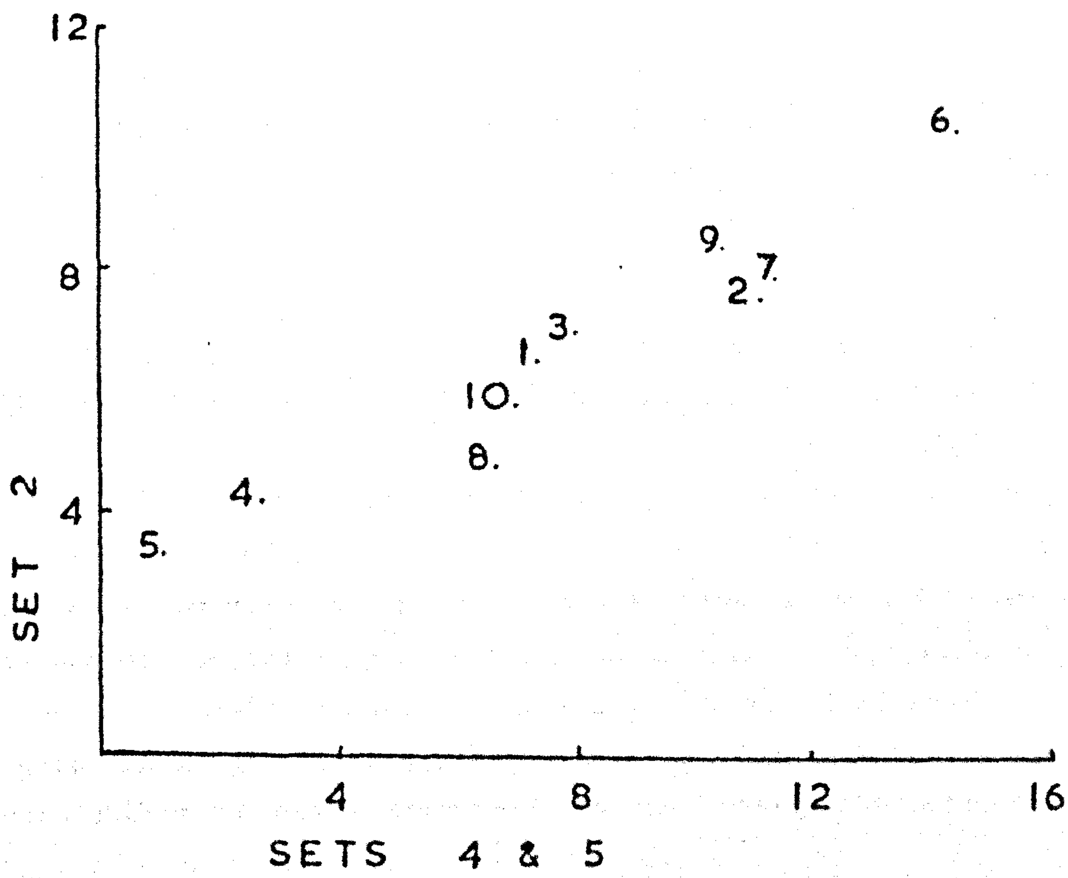
13. A licensee has less security of tenure than a tenant and is thus less likely to attempt improvements to the site. Unfortunately, as this is a sensitive area, it has not proved possible to identify such sites, their numbers being included in the company-tenanted group.

FIGURE 5.7 LOCATIONS & ATTRIBUTES



1. All Outlets
2. Filling Stations
3. Service Stations
4. Garages
5. Other Retail Outlets
6. Company-managed Filling Stations
7. Company-tenanted Filling Stations
8. Privately-owned Filling Stations
9. Company-tenanted Service Stations
10. Privately-owned Service Stations.

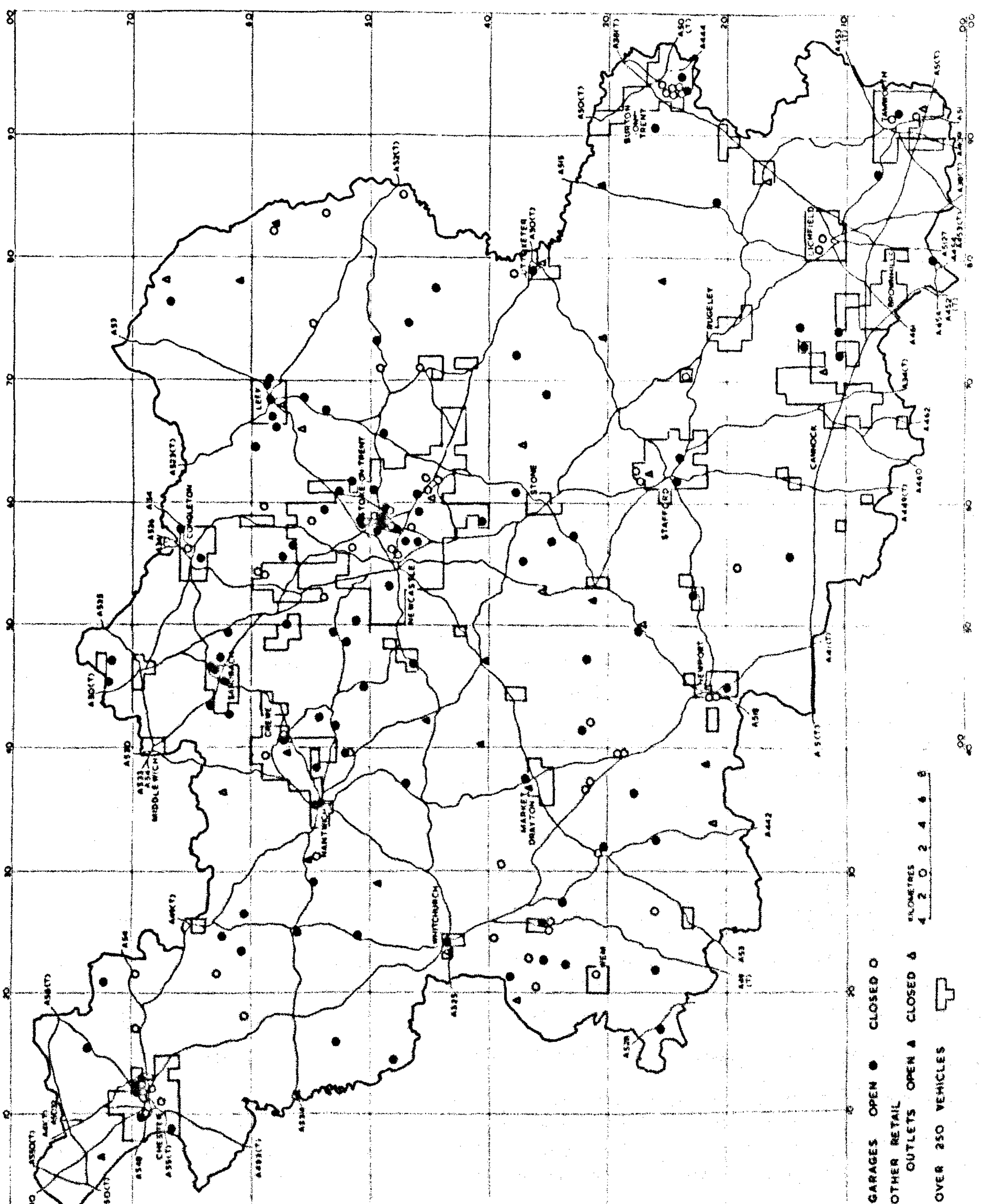
With regard to Set 3 it is clear that the ordering of mean scores is completely different to those of the other sets. In this respect, it is the groups occupying the lowest positions on the graph that possess the highest ratings. As it will be recalled that this set is based both on distance to other outlets and the actual number of nearby stations, it clearly illustrates the fact that most of the seemingly major retailers of petrol are located in areas having a concentration of outlets. Thus, a low score in Set 3 can be expected to match high scores in Sets 2, 4 and 5 in the case of the filling stations and service stations.

With regard to the groups identified above as having less significance for the sale of petrol, viz. garages and other retail outlets, their distribution throughout the study-area is shown in figure 5.8. In addition, figures 5.9 and 5.10 show locations in greater detail within the major urbanised sectors, that is the parts which might be expected to provide the major markets as here are concentrated large proportions of the total vehicle population. First, with reference to figure 5.8, which also indicates those areas having more than 250 vehicles per square kilometre, it is apparent that the other retail outlets are very much within the rural districts and are largely situated away from the major road network. This reflects their major purpose which is usually that of a village post office or store, and this is further emphasised by their general absence from figures 5.9 and 5.10. In fact, the latter contain only one surviving member of this group, in Crewe, with 2 terminated sites in Longton and Stafford. Thus, the low Set 2 score and the high Set 3 score, both generally characteristic of this group, are easily explained.

As these sites are not specialist retailers of petrol, they invariably lack the site-attributes associated with filling stations and service stations. In fact, 9 of the 15 surviving outlets scored 0 in both Sets 4 and 5, so that they possessed nothing more than kerbside pumps. In terms of potential for sales, therefore, they would not rate any further attention, except that in some cases their sheer remoteness from other stations would guarantee a measure of custom. This would apply to the 9 sites that recorded a maximum score of 4 in Set 2 and to another one that scored 3.[14] In fact, 7 of these sites also scored

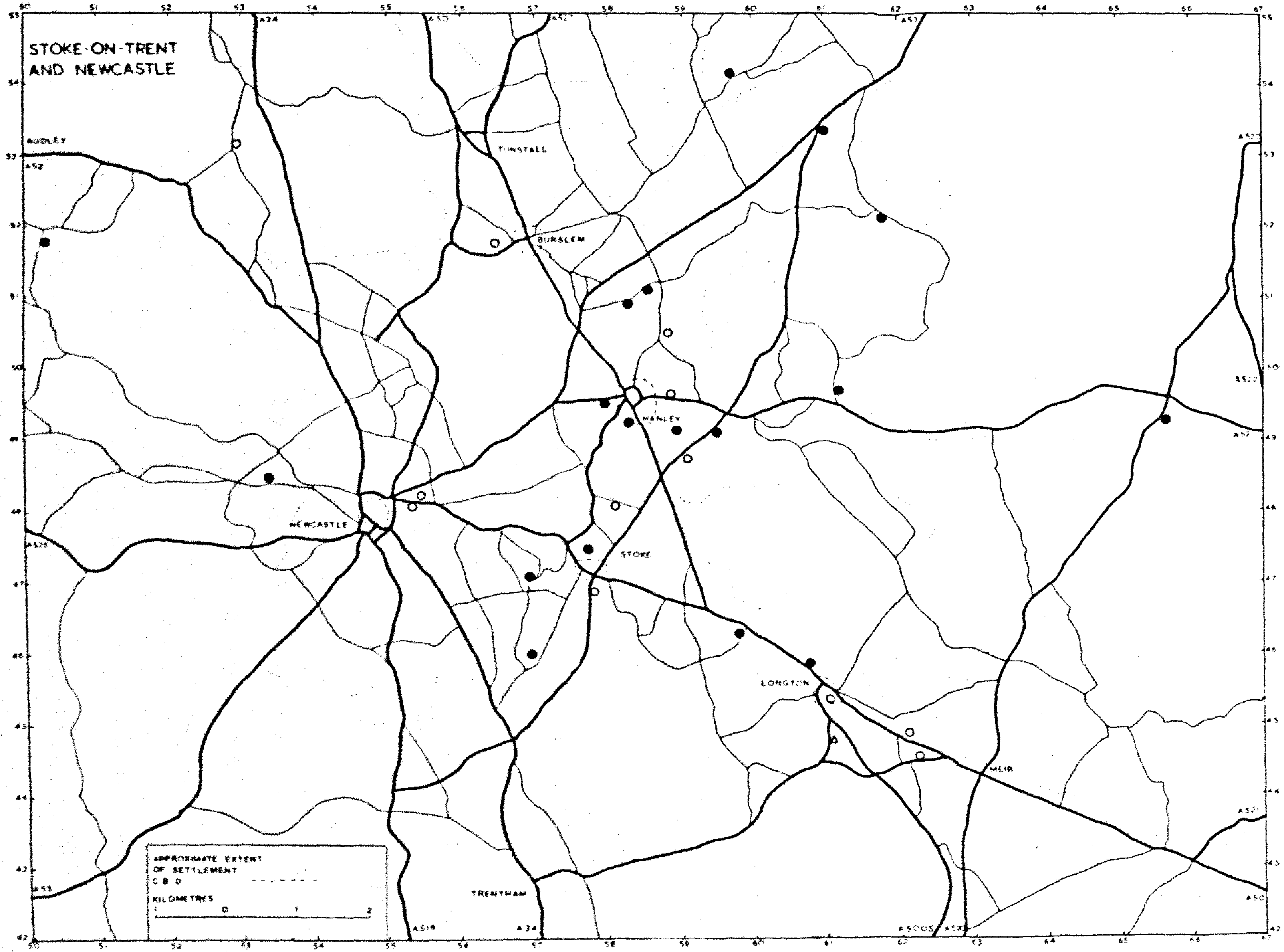
14. Reference numbers 156, 214, 286, 351, 520, 521, 608, 640, 696, 235.

FIGURE 5.8 GARAGES AND OTHER RETAIL OUTLETS



(Based on personal fieldwork)

FIGURE 5.9 GARAGES AND OTHER RETAIL OUTLETS

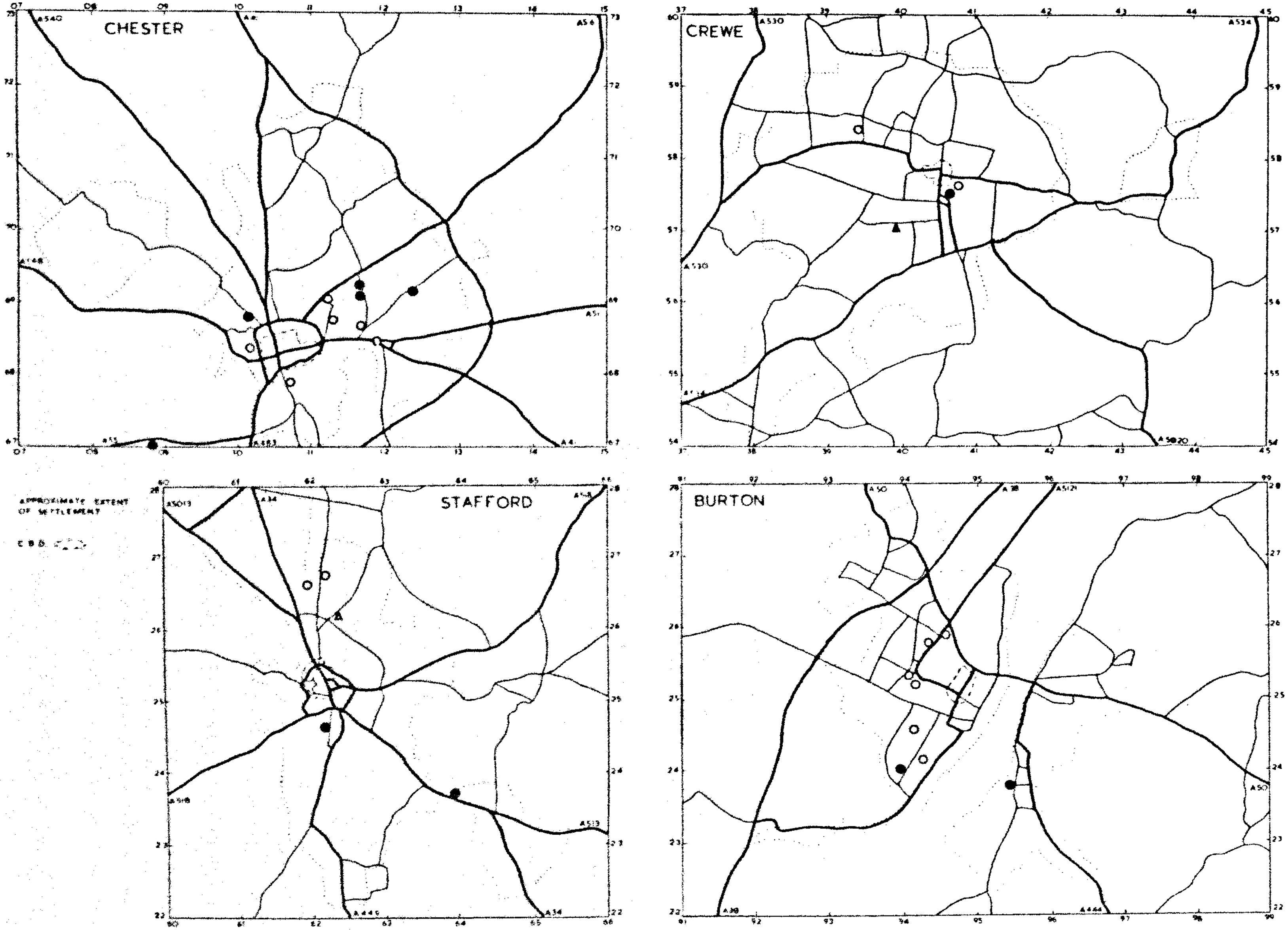


GARAGES — OPEN ● CLOSED ○ OTHER RETAIL OUTLETS — CLOSED △

(Based on personal fieldwork)

(Based on personal fieldwork)

FIGURE 5.10 GARAGES AND OTHER RETAIL OUTLETS



GARAGES —— OPEN ● CLOSED ○

OTHER RETAIL OUTLETS —— OPEN ▲ CLOSED △

KILOMETRES 1 0 1 2 3

O in both Sets 4 and 5, so that, although partially blessed with a potential advantage in the lack of nearby competitors, no real development had taken place to actively attract custom. The latter feature can be explained by the sparseness of vehicles in the areas in which these sites are located, very few of them having as many as 100 cars per square kilometre. Further, only 5 out of this group of 15 are located on 'A' roads, so that little opportunity exists for the majority to attract additional custom on a non-regular basis.

It has to be accepted, therefore, that while some of these outlets might serve a need in sparsely-populated rural areas, their potential for substantial volumes of sales are virtually non-existent. Further, as there are only 15 members within this group, their total gallonage is certain to form a very small proportion of the total amount sold within the study-area. Thus, owing to their poor levels of potential, they may be expected to retail at well below average amounts, but might continue in operation as their thresholds will be correspondingly low. However, their continued survival must be regarded as uncertain owing to the current trend amongst the larger petrol companies of discontinuing small deliveries to low-volume sites.[15] These outlets are especially vulnerable as, of the 15 involved, 12 retail one or other of the major brands. The other 3, although not having experienced a change of brand during the post-1973 period, sell lesser-known products distributed by small independent companies, thus possibly having a better chance of continuing in operation.

The garages, like the other retail outlets, are all in private ownership,[16] another similarity being their mean scores in each set. Admittedly, their locational and site-attribute scores are somewhat better, but in each case fall well below those of filling and service stations. Reference to figure 5.8 will reveal that many garages, again as in the case of the other retail outlets, are located in villages and rural districts, with 59% of the total number situated on minor roads or on urban side-streets. Figure 5.9 reveals that only 5 garages out of a total of 18 are located on main roads in the Stoke-on-Trent and Newcastle areas, while figure 5.10 has only 2 out of 10 similarly placed.

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15. In February 1978, Shell announced that deliveries to some 1,300 outlets would be discontinued over the next 18 months due to their small throughputs. Other majors were quick to follow this lead.

16. A small number belong to local 'chains' but are subsumed in the private group as they are not owned by the supplier companies.

Thus, it is not difficult to understand the low mean value achieved in Set 2, especially as, in addition, 84% of all garages are on roads that carried traffic of the lowest category in column 7.

In contrast, although garages do not normally require the advantages sought by outlets more concerned with petrol retailing, 11 sites on urban major roads scored 8 or more in Set 2. Thus, it could be claimed that such sites possessed the potential required for outlets largely reliant on petrol sales, but their general lack of development is indicated by the fact that not one aggregated more than 5 out of a possible grading of 16 in Sets 4 and 5, these being the internal factors.

With a group mean score of 1.54 out of a possible 4 in Set 3, it is clear that many garages must occupy comparatively isolated locations as is readily apparent in figure 5.8. In fact, reference to Appendix A would verify that 45 individual garages scored 2 or more in this set, thus not experiencing much competition within their respective localities. However, in spite of such apparent advantages, the mean grade of these outlets in Set 2 was only 2.80 as compared with a mean of 4.31 for the whole population of garages. Thus, in effect, the implication is that those stations seemingly faced with minimal competition are actually disadvantaged by other facets of their locations, these being the very important items contained within Set 2. As a result, it can be seen that a generally inverse relationship will exist between scores in Sets 2 and 3.

Again, in common with the other retail outlets, the same type of brand-allegiance exists amongst the garages, the major companies of Group I accounting for 76% of their total number. This is a direct result of marketing developments of earlier years when the major companies sought to supply as many outlets as possible in order to obtain maximum representation. Also evident here is their general lack of attraction to the Group II companies, all of whom were and are essentially concerned with the maximisation of sales rather than of outlets. Thus, whilst only 5% of all garages sell Group II brands, 19% retail the products of the independent Group III companies.[17] In effect, therefore, the actual brand allegiance of the majority of garages displays the relatively low priority accorded by them to the retailing of petrol.

17. Brand allegiances are as follows :- Group I, 83 (including 25 Shell, and 23 Esso); Group II, 6 ; Group III, 21.

Many of the garages and other retail outlets rank amongst the longer-established outlets, at least within the central sector of the study-area. This was the part chosen in Chapter 3 to trace the evolution of the network of outlets, and, as it contained 57% of all surviving stations, it can thus be regarded as typical. A total of 118 garages within this sector survived until 1973, but 45 of this number have ceased to retail petrol since that year. With regard to the entire group of 118, 62% were first developed during the pre-1939 eras as compared with 58% for all surviving outlets. If terminated garages are excluded, the proportion of early sites remains the same at 62%, so that there is little significant difference between garages and the whole population of outlets. The main difference would be found by comparing the respective proportions of more recent developments, and, in this respect, only one garage entered into petrol retailing after 1965 whereas 52 or 12.5% of all outlets have commenced since then.

The difference is much more striking in the case of the other retail outlets, although only a small number were within the central sector. Of the 10 sites that have survived, 9 were opened before 1939, and, of the 13 terminations, 11 originated during this period. It can, therefore, be claimed that the great majority of the non-specialist retailers of petrol were survivals from the years when major companies actively sought to recruit outlets irrespective of their sales potentials.

The distribution of filling stations throughout the study-area, shown in figure 5.11, offers a sharp contrast to that of garages and other retail outlets in figure 5.8. Whereas the latter were characterised by a reasonably-even distribution, with a tendency towards clustering in the larger towns being partially offset by the large numbers of rural sites, the filling stations are strongly oriented towards the urban centres where concentrations of vehicles and traffic exist. This is reinforced by the inclusion in figure 5.11 of those tracts that possess more than 250 vehicles per square kilometre, and it will be seen that some 80% of the 153 filling stations are either within or closely-adjacent to such districts. Thus, in general terms, the great majority are located within areas possessing large numbers of vehicles, and, in addition, 85% are located on roads graded 1 or 2 in column 7 of Set 2. This is an indication that most sites were on busy roads, and certainly, if figure 5.11 were to be compared with figure 4.13 in which the mean daily traffic on 'A' roads is represented, such a claim is substantiated. It will be seen that only 6 outlets were sited on 'A' roads that carried fewer than 2,500 vehicles per day in May 1977. Thus, the general impression conveyed is that most filling stations occupied locations having potential access to major concentrations of both resident vehicles and passing traffic.

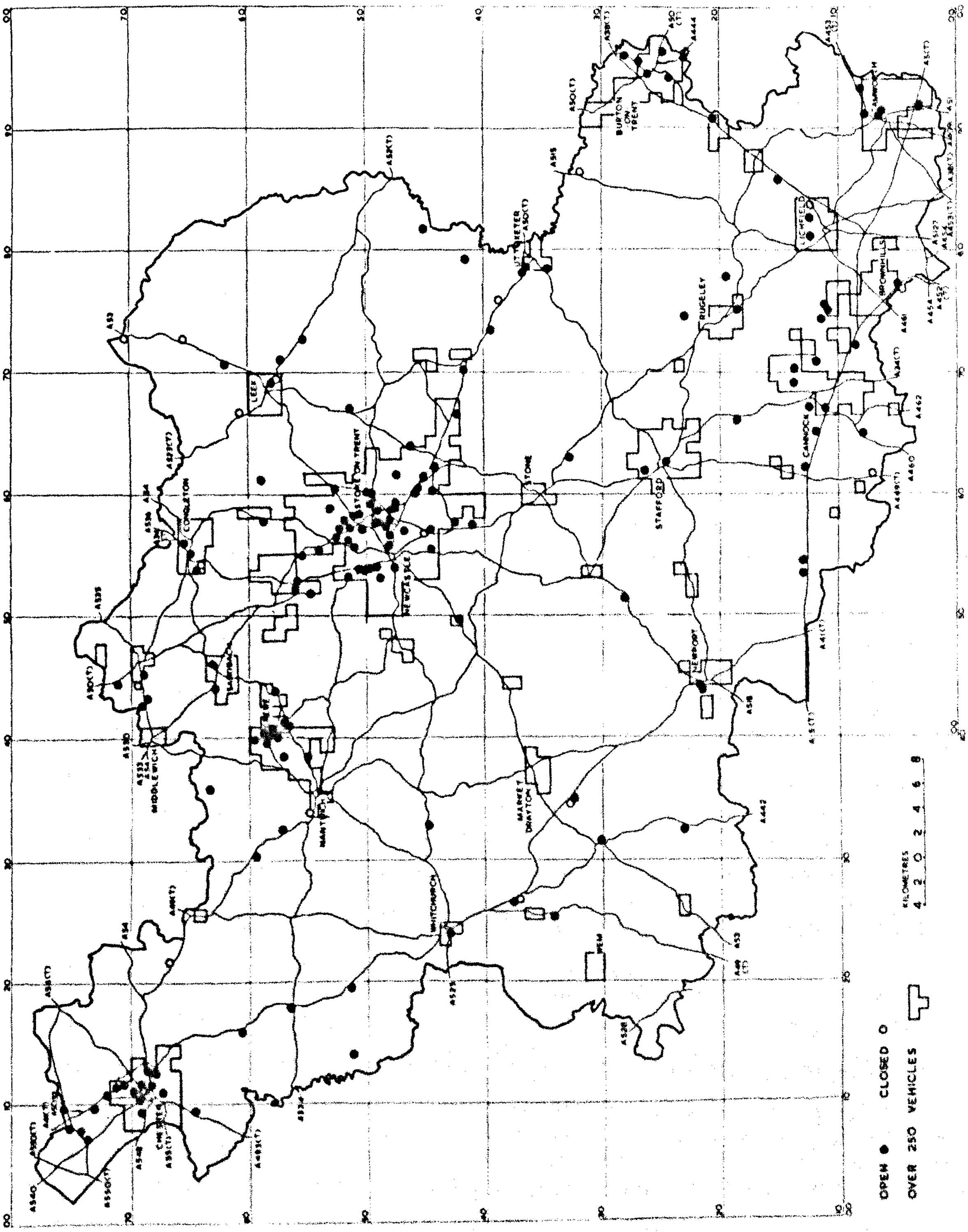
Figures 5.12 and 5.13 illustrate in greater detail the actual locations of sites within the principal urban areas. It will be seen that the great majority are on major roads, and that a substantial number are at or near main road junctions or roundabouts. These features are further emphasised by the generally high gradings awarded to filling stations in Set 2 of Appendix A, the following being a summary :-

column 5	:	52% scored 2,	94% scored 1 or 2.
column 6	:	66% scored 2,	73% scored 1 or 2.
column 7	:	48% scored 2,	85% scored 1 or 2.
column 8	:	13% scored 2,	35% scored 1 or 2.
column 9	:	65% scored 2,	79% scored 1 or 2.
column 10	:	44% scored 2,	97% scored 1 or 2.

This means that 94% of all filling stations were sited on 'A' roads and that 73% had more than 500 vehicles within a radius of 0.96 kilometres. As was stated above, 85% were on roads that carried substantial volumes of traffic and 35% were at or within 300 metres of a road-junction or roundabout. A total of 79% were located along roads subjected to statutory speed limits, 65% of these lying within the lower restriction of 48 k.p.h. (= 30 m.p.h.). Finally, 97% of filling stations were visible from at least 100 metres from their nearside approach roads.

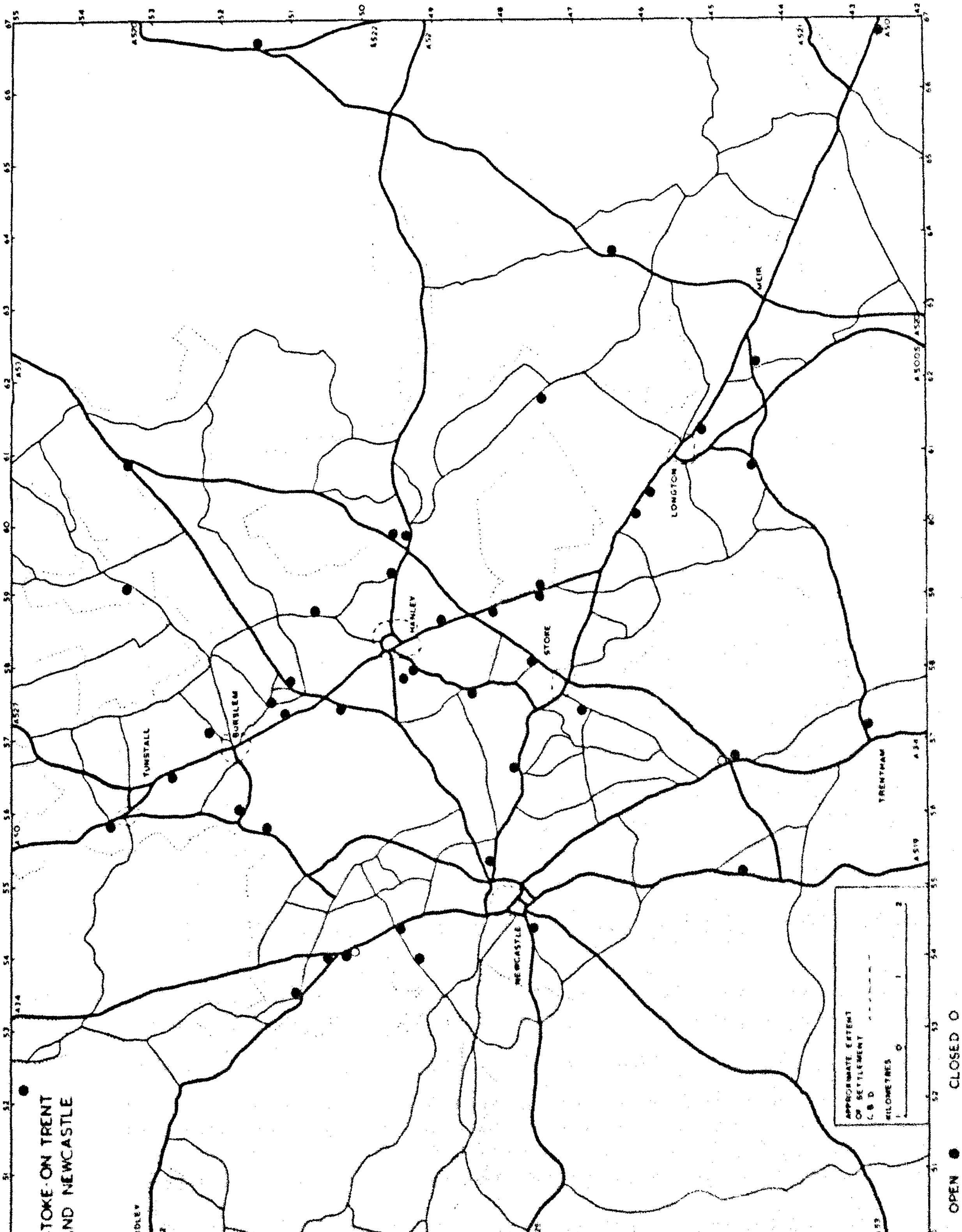
The mean score in Set 2, 7.48 out of 12, is the highest attained by any of the functional groups, but at 0.83 in Set 3 the filling stations scored least of all. As it has already been established that an inverse relationship exists between scores in these two sets, this is further confirmation that most filling stations possess good locations within areas in which many competing outlets are concentrated. This would also suggest that, as a group, they have the potential for substantial sales volumes, although it does not follow that every member has such advantages.

FIGURE 5.11 FILLING STATIONS



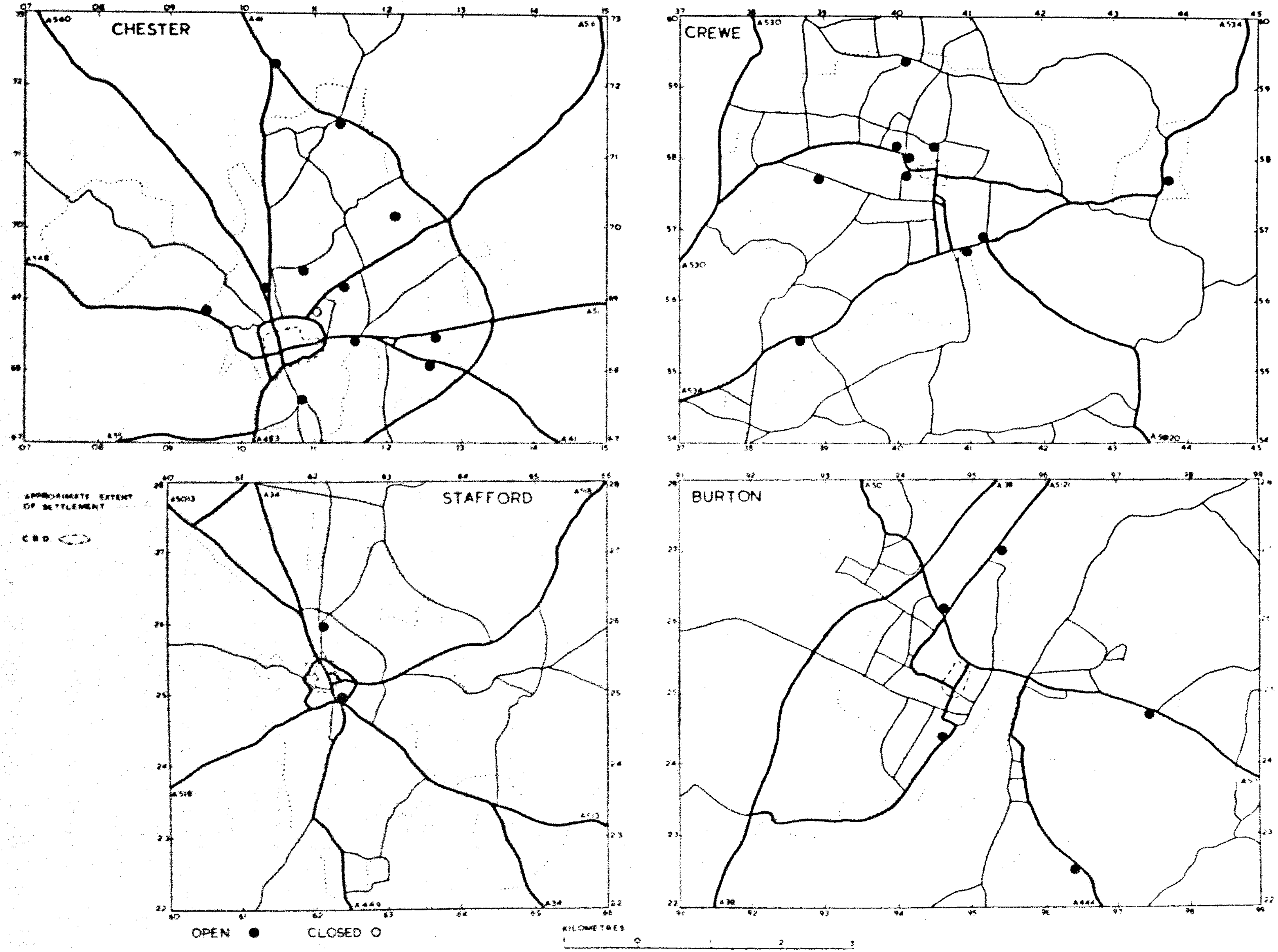
(Based on personal fieldwork)

FIGURE 5.12 FILLING STATIONS



(Based on personal fieldwork)

FIGURE 5.13 FILLING STATIONS



(Based on personal fieldwork)

It is clear that with mean scores of 8.26 and 2.63 in each of Sets 4 and 5 respectively, the filling station group has better site-attributes than any other group. This could have been expected as it is the only one to be completely reliant on petrol sales. An aggregate of 10.89 out of 16 would seem to indicate that, in addition to their good locational factors, most filling stations had been designed and built and were being operated to quite high standards. This aspect will be subjected to further consideration below once the service station group has been discussed.

With regard to the periods of origin of the filling stations, the 87 members of the group that are located within the central sector of the study-area are probably typical. Entries in Appendix A reveal the following division in terms of time periods :-

pre-1928	-	15	
1929-1939	-	18	
1945-1964	-	18	
1965-1973	-	20	
post-1973	-	16	(established since July 1973)

In contrast to the garages and other retail outlets, it is apparent that the majority were established during the post-1945 years. In fact, whereas 62% of the filling stations were in this category, 62% of the non-specialist retailers had their origins before 1939. A tabulation of the mean scores of filling stations grouped according to their periods of origin results in the following :-

	Set 2	Set 3	Set 4	Set 5
pre-1928	8.87	0.47	8.60	2.40
1929-1939	6.28	1.50	6.67	2.50
1945-1964	7.72	0.78	8.11	2.33
1965-1973	8.70	0.50	8.90	2.65
post-1973	10.31	0.13	11.38	3.19

Whilst it is apparent that the post-1973 filling stations are in general superior to the earlier establishments in terms of both locational factors and site-attributes, it is also evident that the pre-1928 outlets were not surpassed as a group until after 1965. In other words, whereas the earliest stations are seen to possess quite high scores, the rapid proliferation of the 1930's are characterised by markedly lower mean scores. Again, naturally, it does not follow that every individual station exhibits the features of its particular group.

In terms of brand-allegiance, the proportion retailing the products of Group I companies, 65%, is less than the 71% recorded for the entire population of all types of outlets, and also less than the 75% established in the garage group. However, a more striking difference is found in the numbers that market the brands of Group II companies. In this category are included 35% of all filling stations, this contrasting with only 22% for all types of outlets and as little as 5% for the garage group alone. Also, only one outlet sold a brand belonging to one of the independent Group III companies. Thus, in view of the discussion in Chapter 3 in relation to the characteristic features of the marketing activities and styles of the supplying companies, it is apparent that there is nothing of an unusual or unexpected natûre about the brand distribution of the filling stations. This aspect of filling stations, together with their division into separate categories based on ownership and operation, will be further discussed below following an initial consideration of the service station group.

The distribution of service stations throughout the study-area is shown in figure 5.14, and, if compared with figures 5.8 and 5.11, will be seen to present a pattern that is intermediate between those of the non-specialist retailers and the filling stations. Whereas the former outlets were dispersed and the latter clustered, the service stations quite clearly reflect a distribution that is more scattered than the filling stations but which, like them, relates strongly to centres of vehicle concentration. The subjective impression conveyed by figure 5.14 is that while most service stations are either in or very near to urban centres, many are also located along major roads connecting the principal towns. It should be stressed that outlets in the Stoke-on-Trent and Newcastle urban areas are not shown on this map as there are so many of them, so that if they were located on figure 5.14, the concentration in areas of vehicle numbers would be much more apparent.

However, this deficiency is remedied by figure 5.15, and it will be seen that most of the urban service stations are located on major roads. This feature is reinforced in figure 5.16, at least in the cases of Chester and Stafford, but is not as apparent in Crewe and Burton. The likely explanation for the different patterns is that the latter towns, unlike the former, do not possess radial systems of 'A' roads, but, if those lesser roads that carry a traffic-grading of 1 or 2 in column 7 of Set 2 are included, no more than 2 sites in Crewe and one in Burton are excluded.

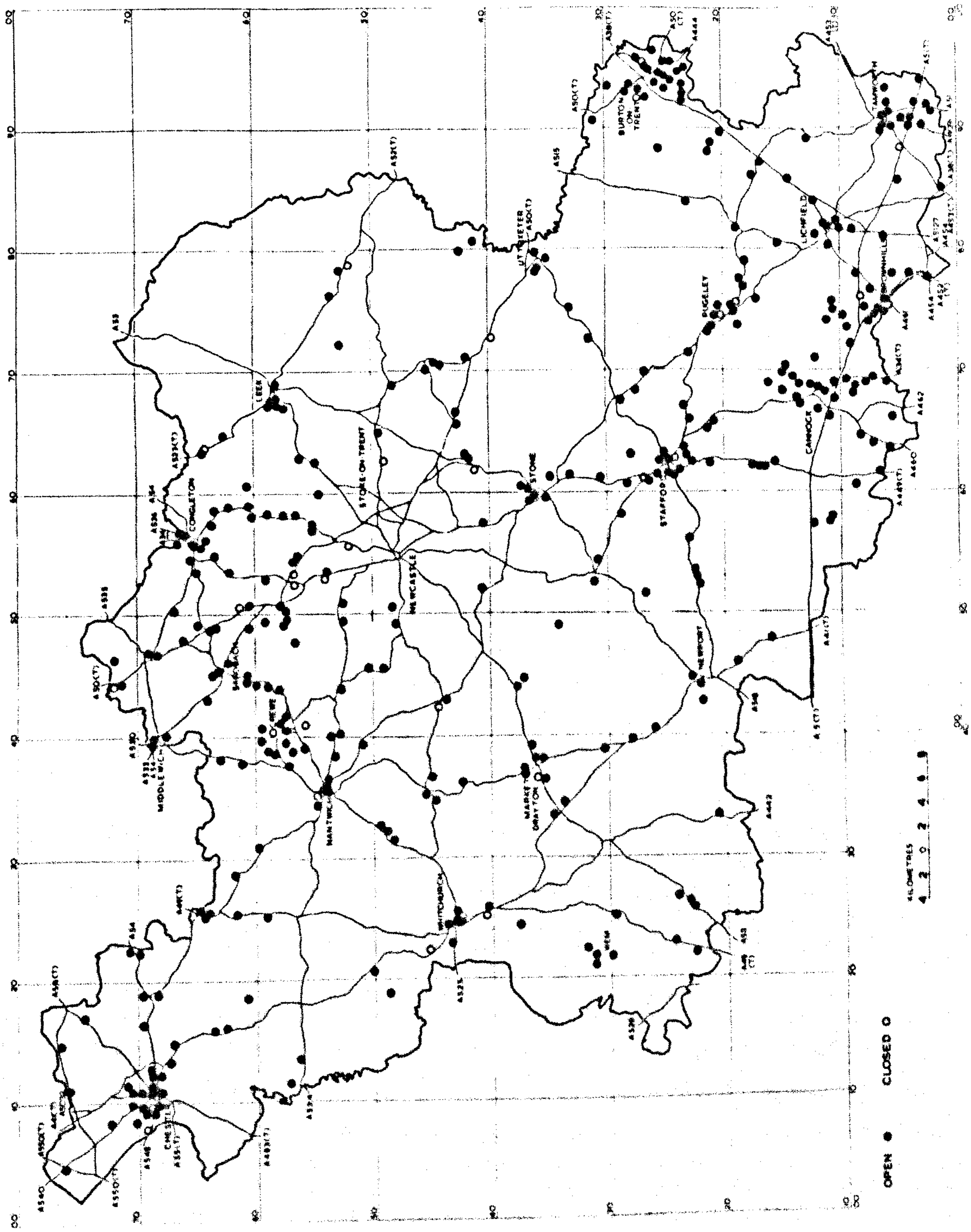
As the proportion of outlets scoring 1 or 2 in the columns of Set 2 were compiled for filling stations, the same has been done in the case of service stations, as follows :-

column 5 : 40% scored 2, 88% scored 1 or 2.
column 6 : 63% scored 2, 78% scored 1 or 2.
column 7 : 35% scored 2, 71% scored 1 or 2.
column 8 : 11% scored 2, 30% scored 1 or 2.
column 9 : 66% scored 2, 89% scored 1 or 2.
column 10 : 31% scored 2, 92% scored 1 or 2.

A comparison between these numbers and those of the filling stations will indicate that the latter, as a group, possessed slightly better locational features in general terms. However, such differences were not very great, so that it is probable that some individual service stations outranked some of the filling stations, as will be subsequently considered.

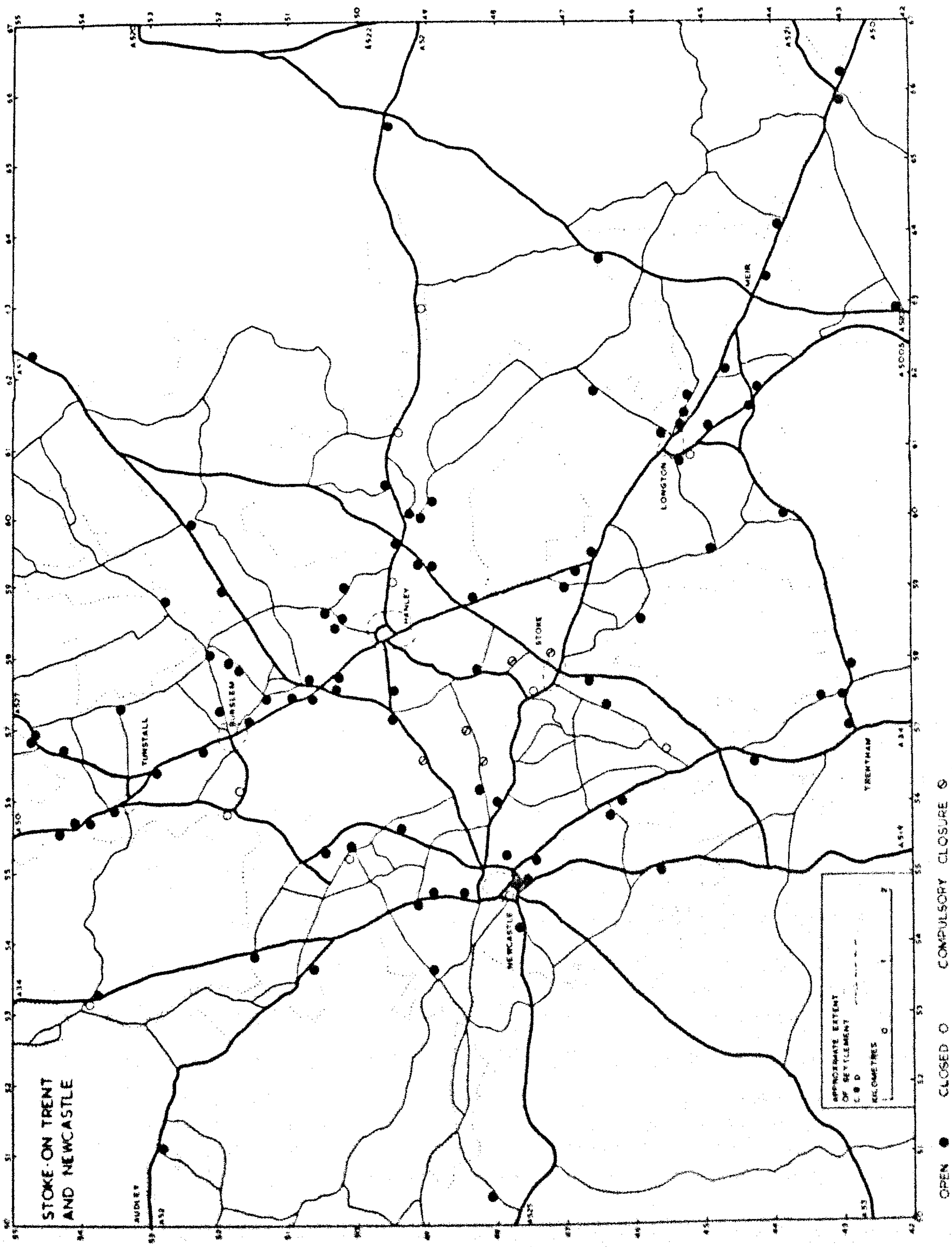
With mean scores in Sets 2 and 3 of 6.89 and 0.82 respectively, it is clear that this group is not very different to the filling stations in a locational sense. Thus, although it could be expected that a reasonable degree of potential might exist for petrol sales, its actual realisation is unlikely to be as great owing to a markedly poorer score in terms of site-attributes. In this respect, the service station group has an aggregate mean score of 7.91 in comparison with 10.89 for the filling stations. Thus, in general, the service station group is unable to match the facilities of the filling stations, although, again, it is certain that each individual member will not necessarily comply with these results. An average of 7.91 represents only 49% of the maximum

FIGURE 5.14 SERVICE STATIONS



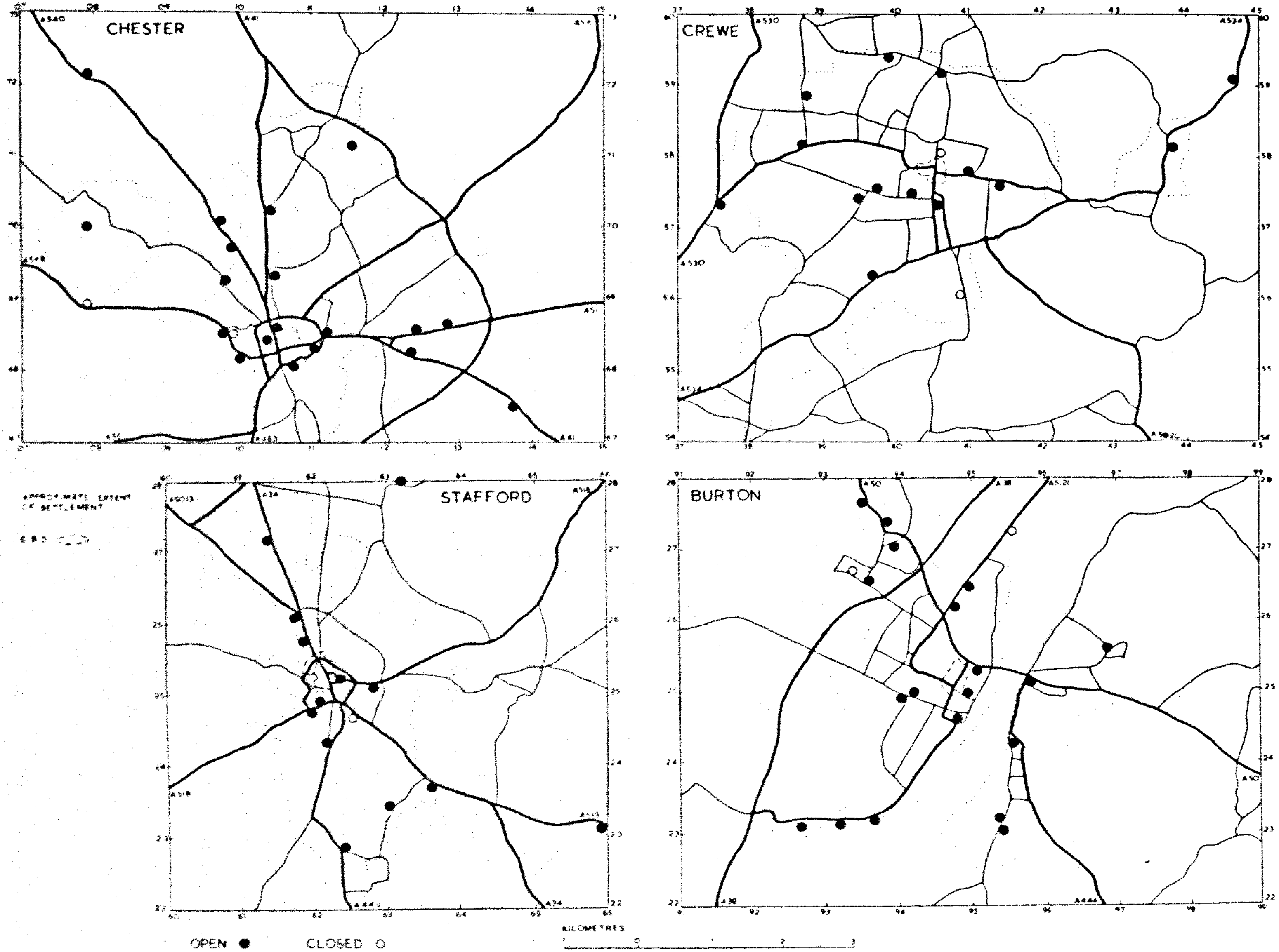
(Based on personal fieldwork)

FIGURE 5.15 SERVICE STATIONS



(Based on personal fieldwork)

FIGURE 5.16 SERVICE STATIONS



(Based on personal fieldwork)

score, this being lower than might have been expected, especially in view of the mean locational score in Set 2 which accounts for 57% of its possible score of 12. This would suggest that, as a group, the service stations have not fully capitalised on their locational advantages.

Another significant difference from the filling station group is to be found in terms of periods of origin of the service stations within the central sector of the study-area. Of the 244 sites concerned, the following is a division by origin :-

pre-1928	-	57	
1929-1939	-	97	
1945-1964	-	70	
1965-1973	-	19	
post-1973	-	1	(established since July 1973)

It is of interest to note that, in complete contrast to filling stations but in common with the non-specialist petrol retailers, as many as 63% of service stations were established before 1939. Thus, it is certain that many of their number date from a period in which sites were developed without due regard to individual sales potential, as the following list suggests. Mean set scores for service stations grouped into age-categories are as follows :-

	Set 2	Set 3	Set 4	Set 5
pre-1928	8.07	0.46	5.56	1.81
1929-1939	6.66	1.08	5.64	1.59
1945-1964	7.21	0.49	6.30	1.94
1965-1973	7.89	0.37	7.21	2.16
post-1973	(7.00)	(0.00)	(6.00)	(2.00)[18]

The poorer relative scores of service stations originating from the 1930's is very marked, thus being similar to the filling station group in this respect. Particularly noteworthy is their considerably higher Set 3 mean score, thus substantiating the validity of the claim that such stations were indiscriminately sited outside urban areas during the 1930's. Again, as was seen in the case of filling stations, the pre-1928 establishments were generally well-sited in terms of locational features, and were not matched by any other group before 1973 except in the case of site-attributes which reveal a continued upward trend.

18. These are actual scores as only one outlet fell into this category.

Finally, before attempting an analysis of specialist retailers on the basis of ownership and operation, it is worth noting that 70% of service stations sold the brands of Group I companies, thus closely resembling the 71% of such outlets in the total national population. Only 25%, as compared with 35% of filling stations, retailed Group II brands, this being slightly above the overall proportion of 22%. Although this difference is not great, it does match the expectation that specialist sites are more likely to sell the products of companies in Groups I and II, especially as only 5% of their number are concerned with Group III brands.

It has already been stated in the course of this chapter that a considerable degree of variation exists amongst the specialist petrol retailing stations according to their ownership and operation. In this sense, there are 3 groups:-

(a) those sites owned by petrol companies and operated by a salaried manager ;

(b) those sites owned by petrol companies and operated by a tenant or licensee ;

(c) those sites in private ownership.

It has also been claimed that, in general terms, their ranking on a basis of locational factors and site-attributes supports this division, with the above hierarchical order being clearly apparent. Reference to figure 5.7 would support such a claim, as aggregates of mean set scores place company-owned sites well above private outlets in both respects.

The following shows the numbers of stations in each category, together with their individual proportions in relation to all 599 specialist outlets :-

Category	Total number	Proportion
Filling stations, company-owned and managed	42	7
Filling stations, company-owned and tenanted	64	11
Filling stations, private	47	8
Service stations, company-owned and managed	2	-
Service stations, company-owned and tenanted	120	20
Service stations, private	324	54
Total	599	(100)

Figure 5.17 has been constructed on the basis of this sample, but with the exclusion of company-owned and managed service stations as there are only 2 representatives of this category.

Reference to figure 5.17 will substantiate the claim that company-owned sites occupy much better locations and possess more extensive facilities than those in private ownership. Further, it is also evident that stations in company-management rank higher than tenanted sites, particularly so in terms of their attributes.[19] A general conclusion that might be reached is that whereas privately-operated stations are largely at or below 50% of both possible scores, those in company-ownership tend to be well above such a level in both respects. This is certainly due to the greater availability of capital which would have allowed the purchase or establishment of well-located sites, together with their subsequent development. Thus, it can be expected that those sites gaining high scores in Set 2 and also in Sets 4 and 5 will be mainly in company-ownership.

As has already been stated above, privately-owned service stations seem to rank above privately-owned filling stations, this being also indicated in figure 5.17, although only a tentative conclusion should be drawn from the latter as it contains only 8 members of this group. It is difficult to account for this feature in terms other than financial, in the sense that service stations, by virtue of having more than one major source of income, are less at the mercy of uncertain trading conditions in the petrol market. Thus, in relation to privately-owned filling stations, they enjoy a more-assured cash-flow and are generally able to occupy better sites with more facilities than this group.

As mean set scores are seen as indicators of potential for sales of petrol, it is further claimed that such potential can be hierarchically-ordered, as follows :-

1. Company-managed filling stations.
2. Company-tenanted service stations.
3. Company-tenanted filling stations.
4. Privately-owned service stations.
5. Privately-owned filling stations.

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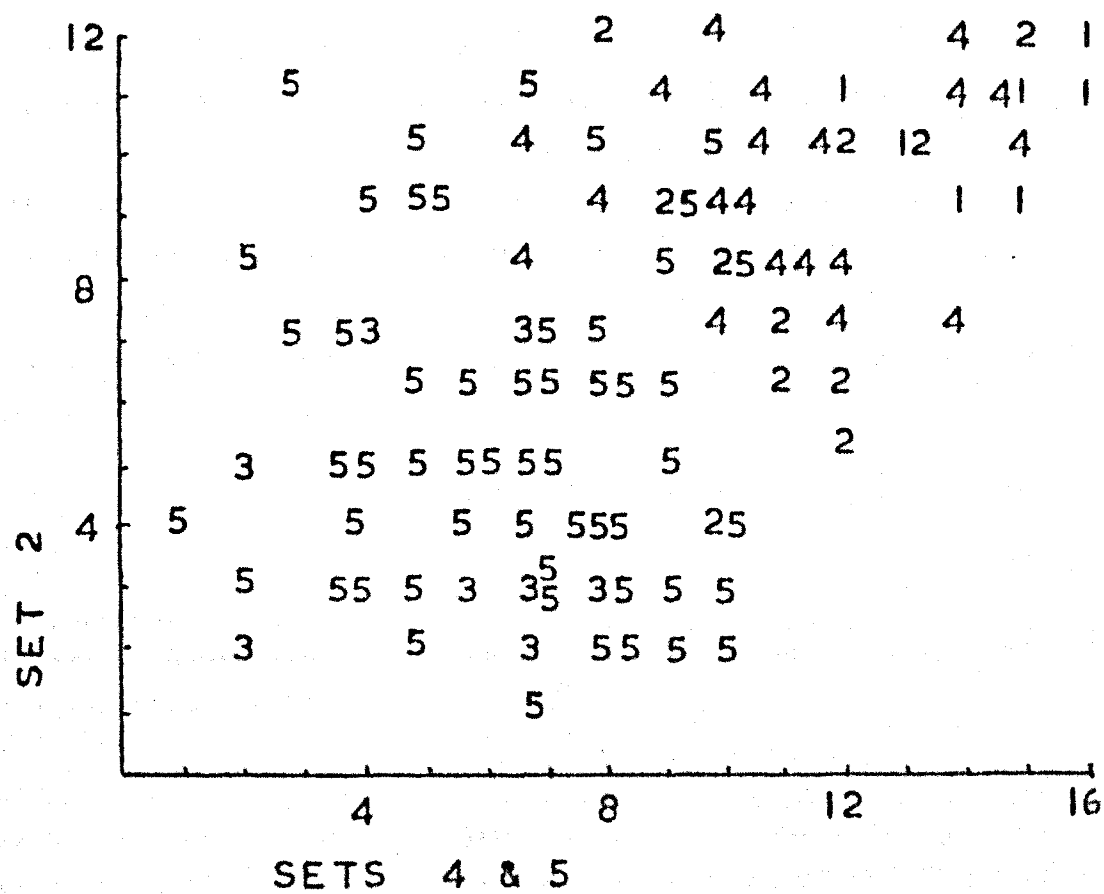
19. The Set 4 score includes an award for company ownership. In spite of this, the overall relationship to private stations remains constant.

FIGURE 5.17 SAMPLE SCORES



1. Company-managed Filling Stations
2. Company-tenanted Filling Stations
3. Privately-owned Filling Stations
4. Company-tenanted Service Stations
5. Privately-owned Service Stations.

Although there will be anomalies in the above ordering on an individual basis, all that is being claimed is that there is a greater likelihood that most members will conform to such a hierarchy.

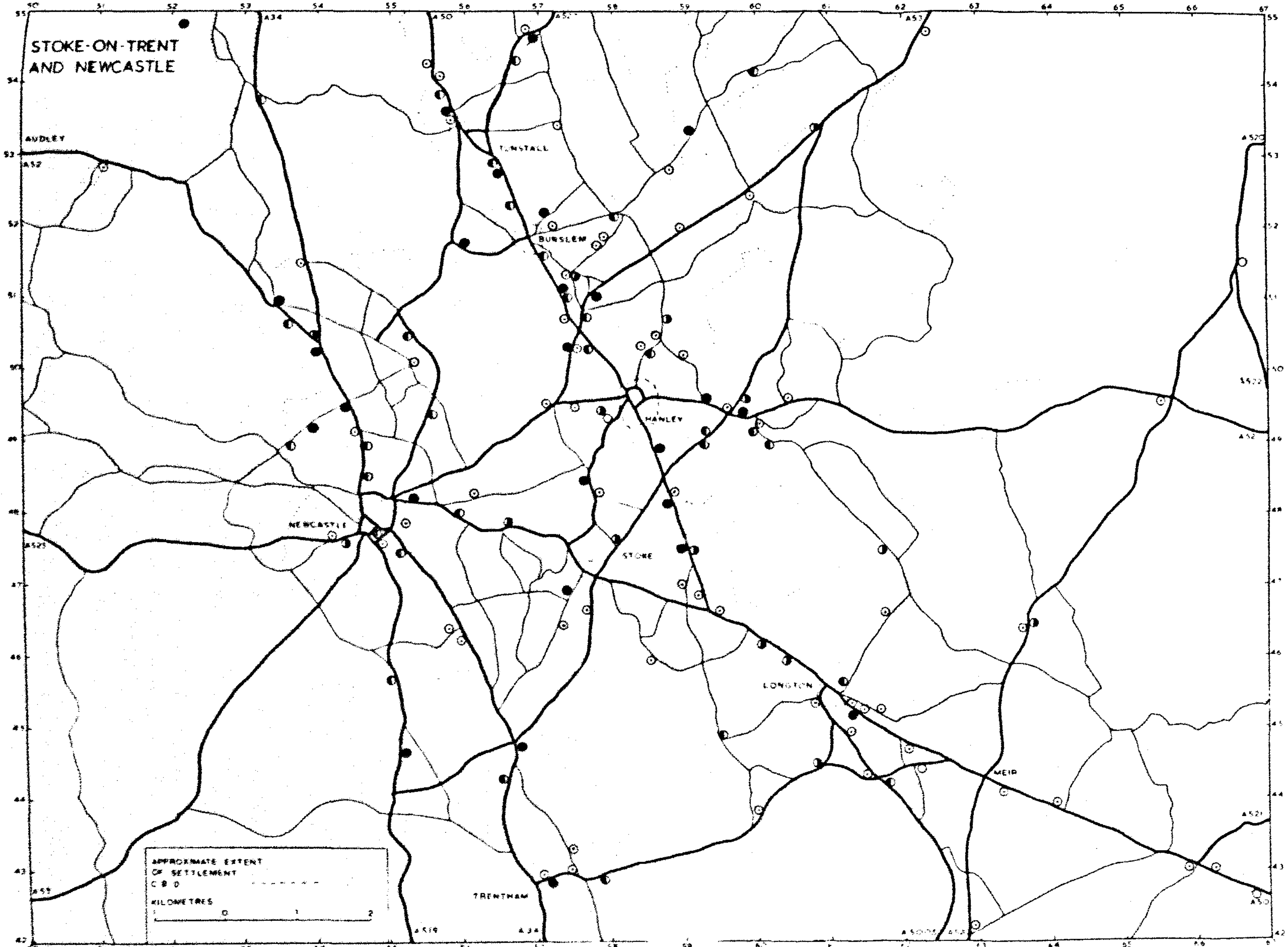
Reference to figures 5.18 and 5.19, which illustrate the locations of specialist petrol retailers within the principal urban centres, will reveal very clearly the dominance of company sites in relation to private stations. As, within the whole of the study-area, it is the latter which are in the majority, with 62% of the total population of specialist outlets, the implication is clearly that company sites are strongly concentrated within the major marketing areas. The following is the result of a simple count of such stations in terms of ownership :-

Area	Company sites	Private sites	Total
Study-area	228	371	599
Stoke-on-Trent/ Newcastle (figure 5.18)	72	64	136
Other major urban centres, (figure 5.19)			
Chester	17	13	30
Crewe	10	14	24
Stafford	7	8	15
Burton	11	13	24

Thus, a considerable amount of evidence strongly indicates the probability that company sites, although in an overall minority, possess greater individual potential than those in the private sector, and are therefore likely to aggregate greater mean throughputs. This will be examined in the subsequent chapter when station performance in relation to locational factors and site-attributes will be assessed.

With more than a half of all company-owned stations in these named urban areas, it is clear that capital has been available to purchase high-quality sites within those parts having large concentrations of both resident vehicles and traffic. Thus, it is perfectly obvious that such stations have been carefully selected by their owners, the petrol suppliers, with the aim of achieving high sales volumes.

FIGURE 5.18 OWNERSHIP OF FILLING AND SERVICE STATIONS

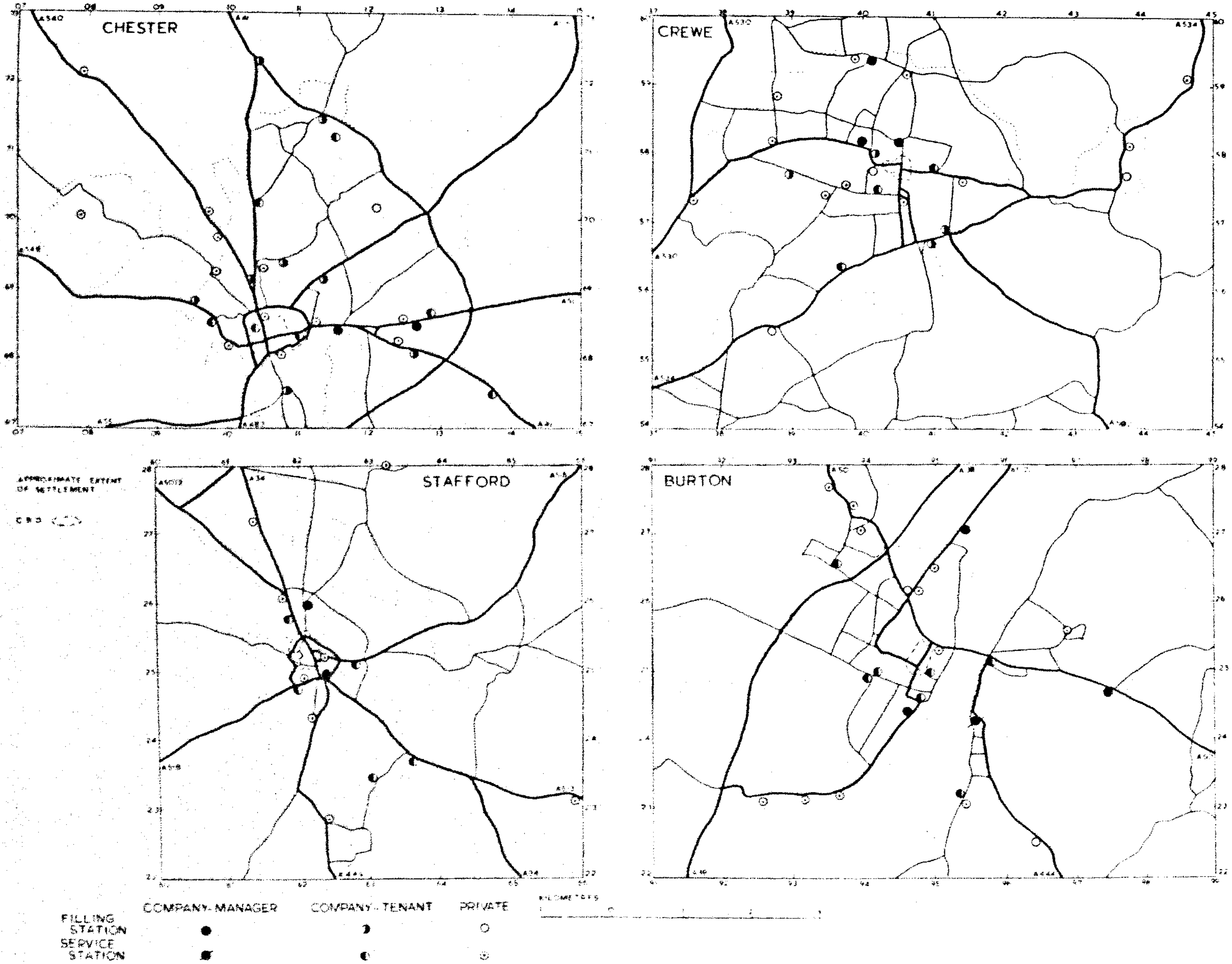


	COMPANY-MANAGER	COMPANY-TENANT	PRIVATE
FILLING STATION	●	◑	○
SERVICE STATION	●	◑	○

(Based on personal fieldwork)

FIGURE 5.19 OWNERSHIP OF FILLING AND SERVICE STATIONS

(Based on personal fieldwork)



As those sites developed before the mid-1950's must have originally been in private ownership, only those possessing an adequate measure of sales potential would have been purchased by such companies. Again, those more recent sites, established and developed by the same companies, would not have been opened at all had they not possessed sufficient potential.[20]

With regard to table 5.2 which presents a division of the 599 specialist petrol retailing sites in terms of ownership and operation, it is perfectly clear that it is only companies in Groups I and II that maintain their own stations in the study-area. It is further evident that Group II companies are much more significant in terms of their ownership of sites than would be suggested by their actual numbers in the entire population. This, in fact, bears out the points made in relation to their characteristic features in earlier chapters, viz. that they are concerned more with networks of high-volume sites rather than in supplying large numbers of stations irrespective of throughput. Whereas, within the total population of 724 outlets, these companies only accounted for 172 or 24%, amongst the company-owned specialist sites they account for 91 or 40% of that number. Further, as a proportion of company-managed stations, they account for exactly 50% of the 44 such outlets. Again, as a proportion of privately-operated specialist stations, Group II companies record a share somewhat below their overall representation, accounting for only 20% of the 371 sites in that category.

With a total of 91 company-owned sites and only 75 private outlets, Group II companies present a very different picture to that of Group I with its ratio of 137 company sites to 274 private stations. Within this overall situation, several brands emerge with a very high proportion of company-owned sites in relation to their total numbers. In this respect, with the exception of Jet's 30%, every Group II company has a proportion above 47%. The only Group I company with a similar proportion is Texaco with 53%, all the rest falling below 33%. In fact, such features are a close reflection of the national situation, as was discussed on pages 78–80. Further, with regard to the type of service

20. Companies undertake very thorough field surveys before either buying an existing station or establishing a new site. Major considerations are traffic flow and per capita car ownership, and their rates of growth.

Table 5.2 : Specialist outlets by ownership/operation and brand

Brand	Filling Stations Company-owned, managed.	tenanted.	Private	Service Stations Company-owned, managed.	tenanted.	Private
Shell	3	15	11	-	21	68
Esso	-	11	11	-	26	71
Texaco	16	3	3	-	10	23
B.P.	1	5	6	-	10	23
N.B.	2	4	4	-	4	38
Fina	-	1	3	-	5	13
(Group I	22	39	38	0	76	236
Mobil	1	5	-	-	11	18
Jet	4	2	5	-	4	15
Elf	3	-	-	-	7	9
Total	4	5	1	-	5	11
Amoco	2	3	-	-	7	1
Burmah	-	6	-	-	2	9
Apex	5	-	-	1	1	-
Chevron	-	2	1	-	2	1
Gulf	-	1	-	-	4	1
Murco	1	1	1	1	1	2
(Group II	20	25	8	2	44	67
ICI	-	-	-	-	-	10
Globe	-	-	-	-	-	6
Sotro	-	-	-	-	-	2
Tops	-	-	-	-	-	1
Enerco	-	-	-	-	-	1
Nafta	-	-	1	-	-	-
Thames	-	-	-	-	-	1
(Group III	0	0	1	0	0	21
Totals	42	64	47	2	120	324
		(153)			(446)	

offered, reference to column 16 (viz. the fourth column in Set 4) would establish that there is a greater likelihood that company-owned sites, rather than private stations, will be equipped with facilities for self-service. As this is a hallmark of high-volume stations, such a feature could have been expected, the following being a summary of self-serve outlets :-

Ownership/Operation	Filling Stations		Service Stations	
	with self-serve	without self-serve	with self-serve	without self-serve
Company-managed	40	2	2	0
Company-tenanted	27	37	36	84
Privately-owned	3	44	12	312
Total	70	83	50	396

An interesting feature of company-owned self-serve filling stations is that 34 out of the total of 67 belong to Group II companies. In other words, this group has a much greater representation in this category than its overall proportion would suggest. Further, if mean set scores are calculated for brand-groups on the basis of ownership, the following is the result :-

Self-serve sites:	Set 2	Set 3	Set 4	Set 5
Group I brands,				
company-managed	9.81	0.24	11.62	3.33
company-tenanted	9.00	0.09	9.27	3.18
Group II brands,				
company-managed	10.42	0.00	11.32	3.16
company-tenanted	8.69	0.31	10.38	3.31

Such means indicate that the company-managed self-serve Group II brand-outlets are the best located, followed in second place by those of Group I, with tenanted sites aggregating rather less. In terms of site-attributes, the same two managed groups are in the lead, although in this case the Group I companies are ahead of Group II. However, if an allowance is made for the contribution of the award in column 18 then it is the Group II tenanted sites that take second place.

The conclusion to be drawn at this point is that company sites, whether managed or tenanted, equipped with self-serve facilities, appear to possess considerable potential for sales. There is little significant difference between those retailing the brands of Groups I or II, so that all such outlets must be seen as potential high-volume stations. It is, perhaps, unfair to compare these with the privately-owned self-serve sites as there are only 3 such outlets. However, with means of 7.33, 0.00, 9.33 and 3.00, they are evidently not as well-located as company stations, but in terms of site-attributes they match the latter very closely.

With regard to the company-managed self-serve sites, it has proved possible to trace the period of origin of the 32 located within the central sector of the study-area, as was analysed in Chapter 3. Of this number, 21 have been established since 1965 and were therefore highly likely to have been designed with self-serve facilities from the start. Only 7 date from the pre-1939 period, so that it seems probable that companies have established a majority of such stations on virgin sites of their own choice rather than purchase existing stations for redevelopment.

Finally, to return to a further consideration of station-quality, irrespective of ownership, it is necessary to identify outlets in terms of their apparent potential for sales. In order to categorise all the specialist stations, a division may be made according to their set scores. Thus, with reference to table 5.1 on page 190, it could be justifiably claimed that any specialist outlet scoring grades higher than the mean values for its particular group should be regarded as possessing above-average potential. However, this does not necessarily mean that such an outlet is bound to achieve commercial viability even if its sales volume actually exceeds the average amount. All that could be claimed at this stage, in advance of an assessment of threshold, is that such a station could be expected to achieve a gallonage in excess of those of stations aggregating lower scores.

The most significant score in predicting potential is that of Set 2, which is a reflection of the degree of quality of a station's locational criteria. For each of the two groups, filling stations and service stations, their division into those which are above and below the mean Set 2 scores respectively should provide an indication of above- and below-average potential. A further division, based on the combined scores of Sets 4 and 5, should then indicate which outlets have attempted to capitalise on their site's locational quality.

Such a division would yield 8 separate groups of outlets, based on the following criteria :-

Filling Stations :-

Class	Set 2 score	Sets 4 and 5	Numbers
1.	8 or more	11 or more	65
2.	8 or more	below 11	21
3.	below 8	11 or more	24
4.	below 8	below 11	43
			(153)

Service Stations :-

Class	Set 2 score	Sets 4 and 5	Numbers
5.	7 or more	8 or more	159
6.	7 or more	below 8	89
7.	below 7	8 or more	94
8.	below 7	below 8	104
			(446)

Tables 5.3 and 5.4 summarise each of the above Classes in terms of ownership and operation, and brand allegiance. With regard to the former, table 5.3, it is clear that the type of ownership and operation characteristic of filling stations is reflected by their membership of particular classes as delineated above. Thus, most of the privately-owned stations are in Class 4 and all but 2 of the company-managed sites are in Class 1. As has been stated earlier, it seems certain that the relative extent of the availability of capital has been influential in allowing the supplying companies to purchase and equip the best sites. Reference to figures 5.20 and 5.21 will reinforce this view, as it is clear that company-owned sites are invariably either within the urban areas or alongside the major roads that link such centres, quite apart from their dominance in Classes 1 and 2. As regards private stations, 36 out of the total number of 47 are allocated to Classes 3 and 4, shown in figure 5.21, and their poorer mean scores are underlined by their concentration outside urban areas.

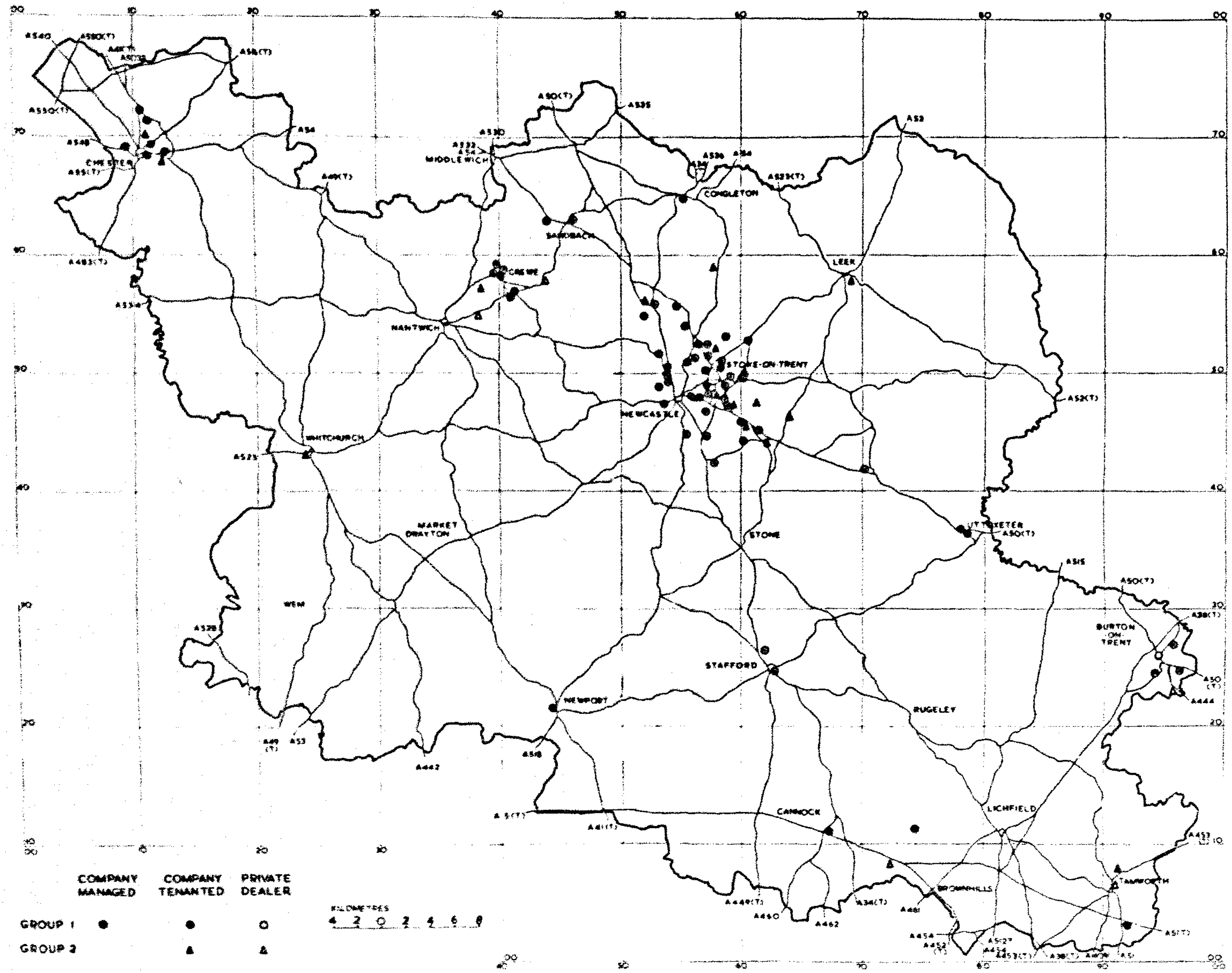
Table 5.3 : Classes of Filling Stations by ownership/operation and brand.

Brand.	Class 1			Class 2			Class 3			Class 4			Totals.
	(2)	(1)	(0)	(2)	(1)	(0)	(2)	(1)	(0)	(2)	(1)	(0)	
Shell	3	6	1	-	3	2	-	3	-	-	3	8	29
Esso	-	3	-	-	7	-	-	-	1	-	1	10	22
Texaco	15	-	-	-	-	1	1	2	-	-	1	2	22
B.P.	1	2	-	-	-	2	-	3	1	-	-	3	12
National	2	1	1	-	-	-	-	2	-	-	1	3	10
Fina	-	-	-	-	1	-	-	-	-	-	-	3	4
sub-total, Group I	21	12	2	-	11	5	1	10	2	-	6	29	99.
Mobil	1	4	-	-	1	-	-	-	-	-	-	-	6
Jet	4	1	-	-	-	-	-	1	1	-	-	4	11
Elf	3	-	-	-	-	-	-	-	-	-	-	-	3
Total	4	2	-	-	2	-	-	1	-	-	-	1	10
Amoco	2	2	-	-	-	-	-	1	-	-	-	-	5
Burmah	-	1	-	-	-	-	-	5	-	-	-	-	6
Apex	5	-	-	-	-	-	-	-	-	-	-	-	5
Chevron	-	1	-	-	-	-	-	1	-	-	-	1	3
Gulf	-	-	-	-	1	-	-	-	-	-	-	-	1
Murco	-	-	-	-	-	1	1	-	-	-	1	-	3
sub-total, Group II	19	11	-	-	4	1	1	9	1	-	1	6	53.
Nafta	-	-	-	-	-	-	-	-	-	-	-	1	1
sub-total, Group III	-	-	-	-	-	-	-	-	-	-	-	1	1.
Totals.	40	23	2	-	15	6	2	19	3	-	7	36	153.

Table 5.4 : Classes of Service Stations by ownership/operation and brand.

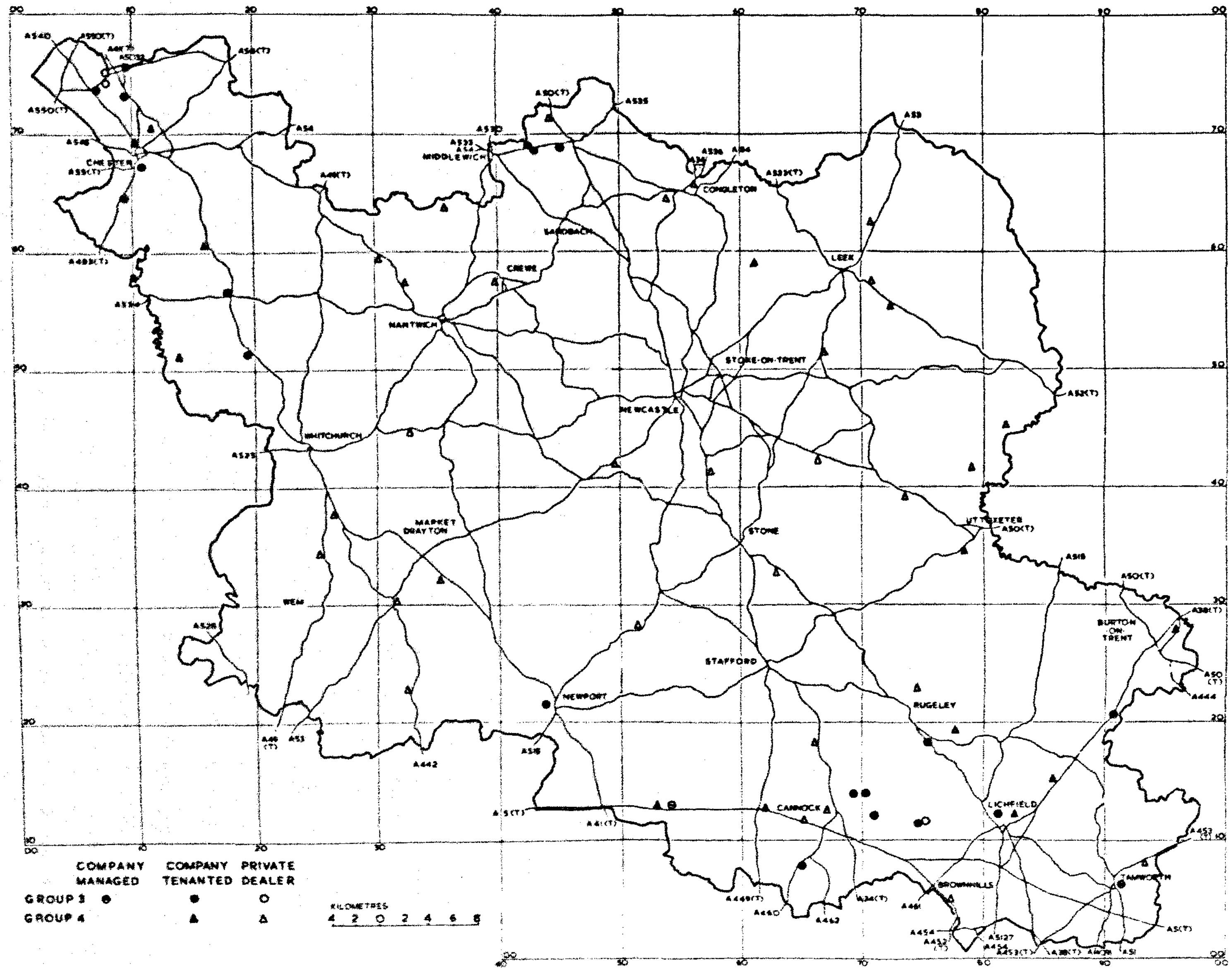
Brand.	Class 5			Class 6		Class 7		Class 8		Totals.
	(2)	(1)	(0)	(1)	(0)	(1)	(0)	(1)	(0)	
Shell	-	17	15	-	17	4	10	-	26	89
Esso	-	20	10	2	17	5	20	-	23	97
Texaco	-	7	8	-	4	3	4	-	7	33
B.P.	-	9	6	-	4	1	8	-	5	33
National	-	3	10	-	7	1	10	-	11	42
Fina	-	4	4	-	1	1	5	-	3	18
sub-total, Group I	-	60	53	2	50	15	57	-	75	312.
Mobil	-	8	5	2	7	1	2	-	4	29
Jet	-	2	3	2	3	-	4	-	5	19
Elf	-	4	1	-	2	2	2	1	4	16
Total	-	4	3	-	4	1	1	-	3	16
Amoco	-	6	1	1	-	-	-	-	-	8
Burmah	-	1	2	-	4	-	1	1	2	11
Apex	1	1	-	-	-	-	-	-	-	2
Chevron	-	1	-	-	-	1	1	-	-	3
Gulf	-	-	1	3	-	1	-	-	-	5
Murco	1	1	-	-	1	-	1	-	-	4
sub-total, Group II	2	28	16	8	21	6	12	2	18	113.
ICI	-	-	-	-	2	-	2	-	6	10
Globe	-	-	-	-	4	-	1	-	1	6
Sotro	-	-	-	-	-	-	-	-	2	2
Tops	-	-	-	-	-	-	1	-	-	1
Enerco	-	-	-	-	1	-	-	-	-	1
Thames	-	-	-	-	1	-	-	-	-	1
sub-total, Group III	-	-	-	-	8	-	4	-	9	21.
Totals	2	88	69	10	79	21	73	2	102	446.

FIGURE 5.20 FILLING STATIONS - GROUPS 1 & 2



(Based on personal fieldwork)

FIGURE 5.21 FILLING STATIONS - GROUPS 3 & 4



(Based on personal fieldwork)

It is also apparent in table 5.3 that it is the Group II companies which, overall, occupy the better sites, having 57% of their total number within Class 1 in comparison with only 35% of the longer-established major brands of Group I. However, the one exception to this general rule is Texaco, which, as was observed at an earlier stage, seems more typical of Group II than Group I.[21] With 16 of its 22 stations in company-management, and 15 of these within Class 1, Texaco could be expected to be very much to the fore when actual sales of petrol are assessed in the following chapter.

With regard to service stations, it will be seen in table 5.4 that the majority of company-owned sites are in the highest category, 73% of their total number being in Class 5. In contrast, only 21% of the privately-owned outlets are in this group, thus again reiterating the feature established in the case of the filling stations where a majority of the better-located and -equipped stations are in company-ownership. As only 2 service stations are company-managed, it is the tenanted sites in this case that occupy the better sites.

Again, it is the companies of Group II rather than those of Group I which occupy a greater proportion of the better sites, the former having 66% of their total number allocated to Classes 5 and 6 in contrast to the 53% recorded for Group I brands. In this respect, it is also apparent that the Group III companies tend to occupy sites with low ratings, 71% of their number being in Class 8, the lowest category.

The distribution of service stations according to the above classification is represented in figures 5.22 and 5.23, and, here again, as in the case of the filling stations, the same features are displayed. It will be seen in figure 5.22 that Classes 5 and 6 tend to be within urban areas and on major roads, and in figure 5.23 that Classes 7 and 8 are widely distributed and particularly well-represented in rural districts. Again, company-tenanted sites are almost invariably either in areas of vehicle-concentration or on heavily-used roads.

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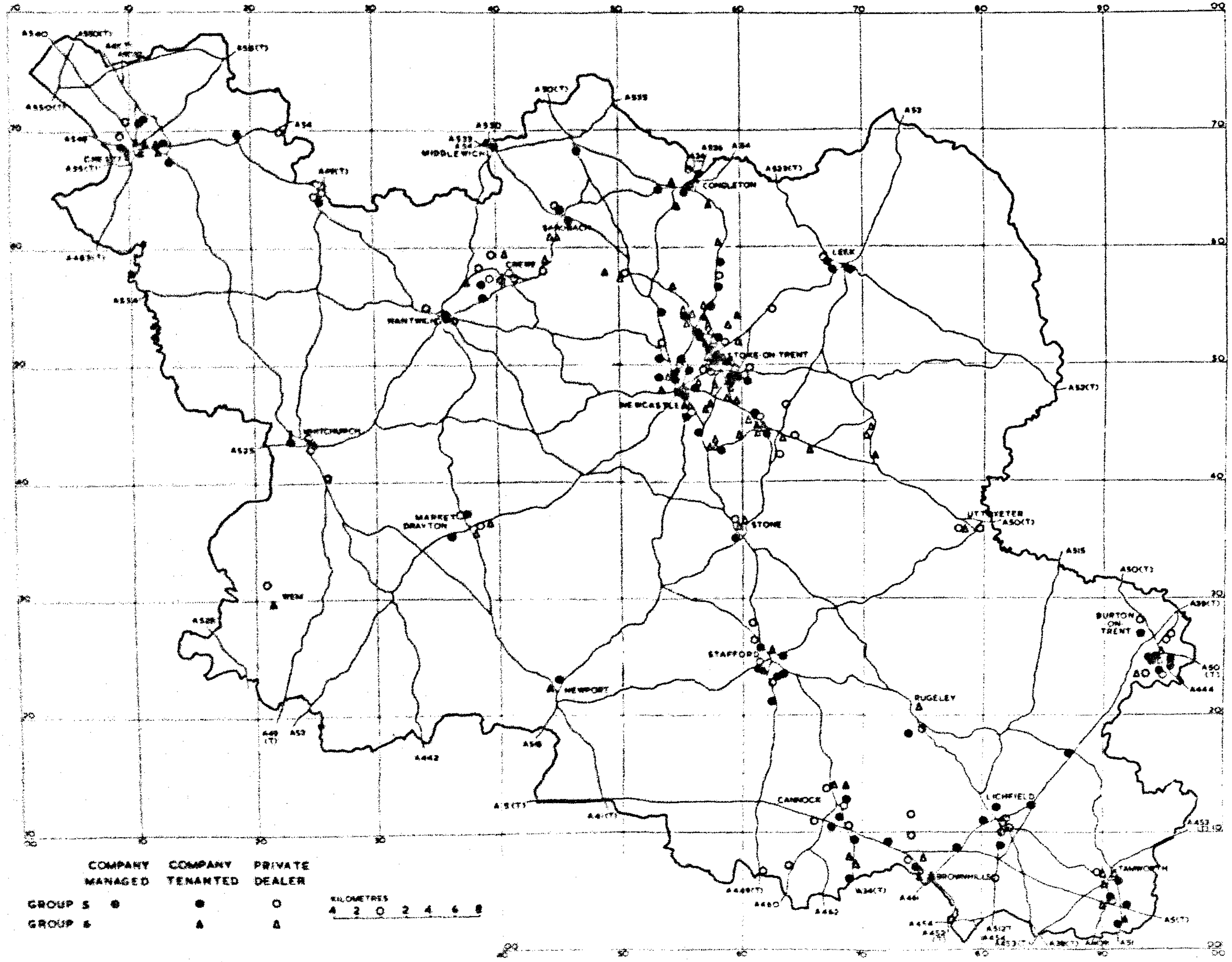
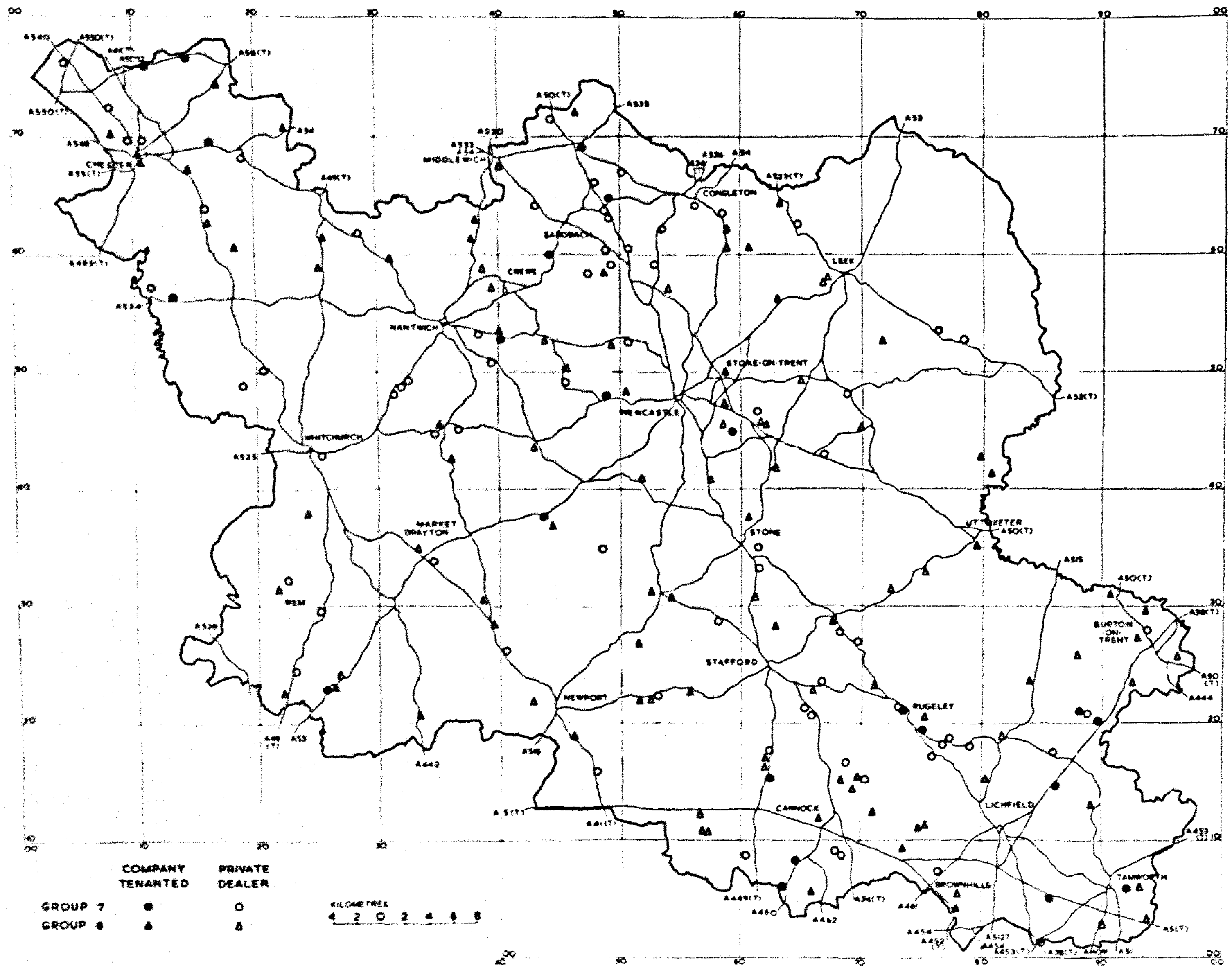
21. While it could be argued that Texaco, introduced in 1967, is a new brand, and should therefore be allocated to Group II, as it 'inherited' the bulk of the Regent network, a former major company with refineries in the U.K., without any fundamental change of ownership, it is correctly placed in Group I.

FIGURE 5.22 SERVICE STATIONS GROUPS 5 & 6



(Based on personal fieldwork)

FIGURE 5.23 SERVICE STATIONS GROUPS 7 & 8



(Based on personal fieldwork)

To conclude this section, it is perfectly clear in the light of the evidence presented that a very great range exists amongst outlets both in terms of locational factors and site-attributes, and that, as a result, it can be expected that actual sales performance will probably exhibit considerable variation. It is equally clear that individual thresholds will also vary, from the highest in the case of specialised filling stations to the lowest for a garage or village store, this forming the content of the subsequent chapter.

In summary, therefore, it can be concluded on the basis of the evidence produced in this chapter that the following expectations may be formulated :-

(a) that a hierarchical ordering of specialist outlets will exist, grading from Class 1 to Class 8, although probably not in complete numerical sequence ;

(b) that garages and other retail outlets will both individually and collectively sell very small amounts of petrol ;

(c) that stations retailing the brands of Group II companies will, individually, achieve higher sales figures than those Group I outlets having similar locational factors and site-attributes;

(d) that Group III stations will rank below those of Groups I and II in terms of sales ;

(e) that, within each class, company-owned stations will achieve levels of sales above those outlets in private ownership.

Chapter 6 : Threshold, Throughput and Commercial Viability.

The main theme and content of this chapter is a consideration of the threshold, sales performance and commercial viability of all outlets active at the end of 1977. Having already examined two forms of competition, namely those to do with location and site-attributes in Chapter 5, the third form of competition, price, as suggested by Berry, will also be considered.[1] Competition through differential pricing has been apparent throughout the period of study, 1973-1977, but has varied greatly in its intensity and effects as will be subsequently illustrated. Although succeeding in complicating the analysis of threshold, range and trade area as will be explained below, price-cutting has undoubtedly accelerated the termination rate of the less-successful stations.

It is first of all necessary to determine the thresholds of the different types of outlets so as to have some definite criteria with which to assess their varying degrees of commercial success or failure. This aspect has been briefly mentioned earlier, but with regard to specialised petrol retailers only, and even then only in a general sense. It is clear that threshold will vary not only between types of stations, namely filling stations, service stations, garages and other retail outlets, but also within each of these categories according to their individual locational costs particularly. In this sense, two otherwise similar establishments, the one located on a major road in a city centre and the other on a by-pass road in the suburbs would possess different requirements for the attainment of commercial viability. The former station would require a greater throughput and resultant income from petrol sales out of which its higher rental or rating costs could be met. Again, a specialised filling station which, by definition, possessed no other major source of income, would have a higher threshold in terms of petrol sales than a similarly-located service station, to whose total costs other activities such as vehicle repairs, would make a contribution. It is, therefore, very clear that the determining of required thresholds for different stations is quite a complex issue.

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1. see page 10.

However, whilst it is fairly certain that few outlets would possess exactly the same threshold requirement, it is possible to identify approximate values that may be applied to a number of stations. For this purpose, use will be made of the classification based on set-scores already made in the preceding chapter and recorded in Appendix A. Such a classification was made for specialist outlets only as it would be virtually impossible to ascertain petrol threshold for sites where such an activity was not very significant. Furthermore, such values would prove difficult to identify, as it is apparent that garages might be prepared to stand permanent losses on petrol sales, regarding the activity as a convenience for their customers. At present, as was explained on page 182, many such stations are increasingly abandoning this attitude and terminating petrol sales while continuing with their other activities. It is, therefore, of little purpose to attempt an analysis of threshold in the case of the non-specialist retailers of petrol, so that this examination will concern only the filling stations and service stations within the study-area.

It has been stated more than once in this study that a high gallonage or throughput is required to maintain a specialist petrol retailing outlet. Whilst this is so, it remains very difficult to establish actual values that would be applicable to all classes of filling stations and service stations. This is due to the many permutations in terms of location, facilities and ownership that characterise the specialist outlets. However, the analysis of costs experienced by actual stations should provide a fairly accurate indication of their required thresholds. This, in turn, should then provide the means to identify, at least approximately, the thresholds of all classes of specialist outlets.

Details of actual costs incurred have been obtained for 2 filling stations and 2 service stations as a result of much inquiry and not a little good fortune. Although 4 outlets form a small proportion of the total number, this is the best that could be achieved in view of the intensely competitive nature of the retail petrol market at present. Not surprisingly, the sources must remain anonymous, so that the actual stations cannot be specifically identified.

Station A : A specialist filling station allocated to Class 1 in the preceding chapter, possessing maximum scores in both Set 2 and Sets 4 and 5. The station is company-managed and is located on a busy urban major road, having been established in 1974 by one of the Group II companies.

Fixed costs -

purchase and development of a virgin site	-	£60,000
equipment, including installation	-	£50,000
sub-total, fixed costs	-	£110,000

Annual costs, at 1977 levels -

rates	-	£6,000
wages	-	£7,000
other, including maintenance, lighting, display, stationery, etc.	-	£8,000
sub-total, annual costs	-	£21,000

With regard, in the first place, to the annual costs of operating the station, a total gross profit margin of £21,000 must be realised in order to break-even. At a gross profit margin of 7p. per gallon, this being the level for this station at the end of 1977, a total of 300,000 gallons would therefore have had to be sold in order to reach this point. Secondly, in order to recover the fixed costs involved in the purchase and development of the station, it would be necessary to recoup this amount of £110,000 over a number of years, in this case the period being 30 years.[2] Thus, a further 3.33% of £110,000, viz. £3,666, had to be repaid annually. At a profit margin of 7p. per gallon, this would involve the sale of another 52,371 gallons, resulting in a total annual target of approximately 350,000 gallons. It must, however, be stressed that this total, large as it seems, would still only allow the attainment of a break-even financial situation.

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2. A period of 30 years seems to be the norm in the trade, and, in addition, there would be interest charges involved. However, no allowance has been made for the latter as it is clearly not possible to attain great accuracy in this type of estimate.

Station B : A specialist filling station allocated to Class 3 in the preceding chapter, possessing a score of 6 in Set 2 (out of a possible 12, locational factors) and 11 in Sets 4 and 5 (out of a possible 16, site-attributes). The station is located at a junction of two busy 'A' roads in a rural area, and is operated by a tenant of a Group II supplying company. It was established in 1968.

Fixed costs -

purchase and development of a virgin site	-	£25,000
equipment, including installation	-	£20,000
sub-total, fixed costs	-	£45,000

Annual costs, at 1977 levels -

rates	-	£1,000
labour costs (borne by tenant)	-	£5,000
other, including maintenance, lighting, display, stationery, etc.	-	£4,000
sub-total, annual costs	-	£10,000

Unlike the previous example, this station operated on a gross profit margin of 5p. per gallon, such variations being the product of different gallonage agreements made with the supplying companies as was originally explained on page 60. In order to cover the annual costs of operation, £10,000, a total sale of 200,000 gallons would be required. To repay the fixed costs at 3.33% per annum over 30 years a further £1,500 would be needed, this requiring the sale of another 30,000 gallons with a gross profit margin of 5p. per gallon. The threshold of this station, therefore, is approximately 230,000 gallons annually.

The above results will be taken to apply in a general sense to other filling stations of Classes 1 and 3. Further, as the differentiation in Chapter 5 was based on set-scores, and while it is certain that site costs incorporated into Set 2 were the principal variants in the assessment of fixed costs, stations of Class 2 and Class 4 will be assumed to possess similar fixed costs to those of Class 1 and Class 3 respectively. Thus, by interpolation, crude thresholds for filling stations will be approximately as follows :-

Class	Gallonage to recover - (a) Annual costs	(b) Fixed costs	Threshold
1.	300,000	50,000	350,000
2.	250,000	50,000	300,000
3.	200,000	30,000	230,000
4.	150,000	30,000	180,000

It is perfectly clear that these values are only approximations as substantial variations in threshold could exist even between quite similar stations. It is probable that the principal variant is the age of the station, as this would determine its fixed costs. In this sense, a filling station established more than 30 years ago would probably have repaid those costs, so that this factor will no longer apply at the older stations.[3] Thus, a station established prior to 1947, viz. more than 30 years ago, will be deemed to have as its threshold only the first value in the above table. Although this refinement can only be applied with certainty to those stations in the central sector of the study-area, their periods of origin being shown in the 'Age' column of Appendix A, sufficient information was obtained during data-collection to be able to identify at least the newer outlets located outside this sector.

This 30-year span, commencing in 1947, is sufficiently close to the start of the third temporal phase, 1945-1964, originally identified in Chapter 3. It is, therefore, proposed to regard those filling stations recording indices of 1, 2 or 3 in the 'Age' column of Appendix A as still being involved in the repayment of fixed costs, together with

3. Although an older site might have been re-furbished to some extent, no allowance will be made for this owing to the great variation involved.

those outlets recognised as being of fairly recent origin located outside the central sector. Thus, thresholds for filling stations will be regarded as follows :-

Class	Established pre-1947	Established post-1947
1.	300,000	350,000
2.	250,000	300,000
3.	200,000	230,000
4.	150,000	180,000

Before moving to a consideration of service stations, it must again be stressed that these values cannot be regarded as absolute, and it must be accepted that further divergence will occur. It will be realised, not only that it would have been impossible to have attempted to gather detailed financial information about each developed site due to the time factor involved, but that very few operators would have been prepared to provide such material about their own activities. In view of this, therefore, the above approximations are regarded as reasonable estimates of threshold for the purposes of this study. Also, as will be explained below, there was little to be gained in aiming for greater accuracy in terms of threshold as information about actual levels of sales could never hope to match this.

It should, however, be mentioned that few filling stations are entirely without some other source of income apart from that derived from the sale of petrol, as the sale of lubricating oil is a general feature. Others operate forecourt shops or automatic car-washes, for instance, but the introduction of this type of consideration would only involve a further sub-division of outlets into many more classes, so that such additional detail will not be incorporated.[4]

The service stations, by virtue of their participation in activities other than petrol retailing, possess more than one significant source of income. As already stated, they will engage in either or both of vehicle sales and vehicle repairs, so that their survival is not entirely dependent on petrol sales, in complete contrast to the filling stations. However, it is not their overall threshold that is to be

4. In actual fact, the possession of these facilities will have already entered into set-scores, so that in one sense their existence will have been recognised.

considered in this instance, but only their threshold in terms of petrol retailing. As many of their number can be regarded as specialist retailers of petrol, it is clear that they must view this function as being important, so that the viability of their forecourts may quite fairly be separately assessed from their other activities. Further, those forecourts that prove unviable can be closed without necessarily having to terminate other activities at such stations, many of the recorded closures in the study-area being of this nature.

However, one real difficulty remains the determination of the significance of each activity in the total business, so that reasonably accurate estimates may be made regarding the allocation of proportional shares of fixed costs to forecourt activities. It is clear that the capital investment involved in the development of a forecourt is much less than that required to install and equip a vehicle-repair facility, or, for that matter, premises and stock for car sales. As a result of consultations with a number of operators, it would appear that the establishment of a forecourt might account for some 5% - 10% of total fixed costs. It is, therefore, proposed to add a notional annual repayment towards fixed costs of some £1,000 at all service stations. In other words, at a gross profit margin of 5p. per gallon, a level seldom exceeded at service stations, a further 20,000 gallons will be added to the throughput required to repay annual costs. With regard to annual costs, these will be accounted as forming 50% of either rates or rental and 50% of the 'other' items, whilst the costs of the wages of forecourt staff will quite fairly be included in full.

As in the case of the filling stations, details of costs have been obtained for 2 service stations, as follows :-

Station C : A service station allocated to Class 5, recording a Set 2 score of 10 (out of 12) and an aggregate of 14 for Sets 4 and 5 (out of 16). Opened in 1966, the station is located on a busy urban major road, and operated by a tenant of a Group I company who also conducts vehicle repairs.

Notional contribution towards fixed costs	-	£1,000
Annual costs at 1977 levels, proportional share -		
rates	-	£3,000
wages	-	£6,000
other (as in stations A and B)	-	£3,000

In order to realise £12,000, the sub-total for annual costs, on a gross profit margin of 5p. per gallon, a throughput of 240,000 gallons would be required. To this must be added another 20,000 gallons to repay the notional contribution towards fixed costs, making a total target amount of some 260,000 gallons, this being the threshold.

<u>Station D</u> : A service station allocated to Class 7 in the preceding chapter, recording a Set 2 score of 6 (out of 12) and an aggregate of 8 in Sets 4 and 5 (out of 16). Owned and operated by a private individual who established the station in 1965, together with vehicle sales and repairs, it is located on a 'B' road on the outskirts of a small town. The station retails a Group II brand.

<u>Notional contribution towards fixed costs</u>	-	£1,000
<u>Annual costs at 1977 levels, proportional share</u> -		
rates	-	£1,000
wages	-	£4,000
other (as in stations A and B)	-	£1,500
<u>sub-total, annual costs</u>	-	<u>£6,500</u>

Operating on a gross profit margin of 5p. per gallon, a total amount of £6,500 would require the sale of some 130,000 gallons. In addition, a further 20,000 gallons must be sold in order to meet the contribution to fixed costs, thus resulting in a threshold of 150,000 gallons.

As was done in the case of the filling stations, the service stations of pre-1947 origin will not be allocated an extra gallonage towards the repayment of fixed costs, so that thresholds for the remaining two classes will be interpolated in a similar fashion. Respective thresholds for each class will be taken as follows :-

Class	Established pre-1947	Established post-1947
5.	240,000	260,000
6.	180,000	200,000
7.	130,000	150,000
8.	80,000	100,000

Having now identified the approximate thresholds of the specialist petrol retailing stations, mention must next be made of the effects of actual selling prices on these values. The material presented above refers specifically to 1977, this having been a year characterised by severe price-competition in which most of these stations participated to varying degrees. This will be subsequently considered in greater detail with regard to sample sectors of the study-area when it will be seen that the selling prices of petrol actually fell during the year at many stations, being lower in December than they had been in January of that year. Clearly, such a situation was in direct contrast to other sectors of the national economy as the Retail Price Index rose during the same period by 13%.[5]

However, the significant point to be stressed at this stage is that a great many stations involved in competitive marketing could only participate by reducing gross profit margins. That this might have been a recipe for eventual bankruptcy is evident, although it is known that the supplying companies aided their own branded outlets by an active policy of price-support, as was explained on pages 84-85. It would seem apparent that such companies provided greater support for their own stations, whether company-managed or -tenanted, than for privately-owned outlets, as the latter were rarely able to match the lower selling prices of the former group as will be subsequently shown.

It is clear that a reduction in selling price could only be achieved through a decrease in the profit margin, whether this was at the expense of the station operator, the supplying company, or both. The unavoidable corollary is that such a reduction in margin could only be offset by increased sales at that station, so that the total income could be maintained. In turn, any increase in sales at one station would certainly mean a decline elsewhere, especially as so many outlets were involved in this practice. This would be the case even in view of the fact that the total national sale of petrol was increasing during that time.

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5. Central Statistical Office. Monthly Digest of Statistics. H.M.S.O.

Thus, it is likely that some stations would record increased throughputs while others, perhaps less able to compete by discounting, would experience reductions. The sheer difficulty of surviving or maintaining viability while cutting the selling price is shown by the following example of an actual self-serve filling station in the London area during 1975 :-[6]

Selling price of 4-star petrol.	V.A.T.	Income.	Wholesale price.	Gross profit per gallon.	Weekly sale to break-even. (gallons)
72.4	14.8	57.6	52.2	5.4	5,074
70.0	14.0	56.0	52.2	3.8	7,210
69.0	13.8	55.2	52.2	3.0	9,133
68.0	13.6	54.4	52.2	2.2	12,454
67.0	13.4	53.6	52.2	1.4	19,571
66.0	13.2	52.8	52.2	0.6	45,667

The substantial increase in throughput required even to only maintain a break-even level indicates the problem that faced those stations opting for or being forced to follow such policies. In actual fact, as will be demonstrated below, the scale of price-cutting in this example was by no means uncommon in the study-area, although such reductions could not have been made without the support of the supplying companies. It is, therefore, clear that few participants could hope to maintaim their necessary incomes through this system of marketing. Further, those stations unable or unwilling to compete would suffer reduced income as they would almost certainly experience reductions in their throughputs due to the actions of the discounters.

It would also seem certain that one result would be to increase differential throughputs between outlets, as it is likely that those stations reducing prices by the greatest amounts would succeed in selling much higher gallonages than under normal conditions, that is to say when all stations retailed at virtually similar prices. Thus, as the present study of threshold and viability has been made for the particular year, 1977, it may be expected that throughputs will be found to range from very large amounts to those below the required levels.

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6. Frost, R.J. Going bust. Garage. 9.5.1975.

As the period of study commenced in late-1973, approximately contemporaneously with the advent of substantial price increases, reduced national sales and resultant price-discounting, it has not proved possible to review the market in its normal state as price-competition has characterised the whole period of time involved. In other words, as has been stated already, discounting has really been the normal situation in the petrol market since late-1973.

The following consideration of throughput and viability, therefore, can only be taken to apply to such a situation, as it is unlikely that all purchasers would necessarily continue to patronise the most active of the price-cutting stations once this advantage ended, unless those outlets were particularly convenient for their purposes. With the ending of discounting, many such customers would probably revert to their previous patterns of purchase, always assuming that those stations that did not compete had managed to survive such a lengthy period of intense price-cutting. The truth is, of course, that closures have been very great since 1973, and that this has been largely due to the severity and length of price-wars. The result, therefore, has been a reduction in the total number of stations retailing petrol, with the resultant reduction of choice for consumers. Thus, for most stations able to survive so many years in which the market has been dominated by discounting, any future return to uniform selling prices should herald a period of reasonable commercial stability as numbers of vehicles have increased whilst numbers of outlets have decreased.

A considerable amount of information relating to actual throughputs for the years 1976 and 1977 has been obtained, principally from two types of sources. In the first place, during this period, most of the operators were asked to approximately indicate their annual volumes of sales. A surprisingly large number were prepared to reveal their results, although not in great detail as is perfectly understandable. Many dealers were additionally ready to comment on their neighbours' results, at least in broad terms. Such approximations are, however, all that are really required for this study, as it would clearly be impossible to obtain detailed statistics for such a large number of stations. Even had this proved possible, it would be unjust to reveal such material in great detail. The other source of information could be regarded as a form of commercial espionage. This involved the reading of the automatic gallonage counters visible next to the display panels on petrol pumps during evenings when stations were closed for business, and subsequently making further visits to establish the amounts of sales made over periods of several months, this then being upgraded into an annual estimate.[7] While this is not illegal and is common practice in the trade, it seems to be the general method of discovering how other outlets are faring at any given time, and especially during periods of price-competition. Again, such detailed results have not been revealed in this dissertation, all material obtained from any source being recorded in the form of general amounts, as will be shown below.

One other method of checking claimed gallonages was developed and applied to selected stations within the study-area. This method was fairly straightforward and economic in its use of time, but was less-accurate possibly than those proposed by Claus & Hardwick.[8] Its great advantage over these was that a value could be obtained very quickly and involved basically a count of customers during a measured time-period, while observing the station, whereas these other methods required the statistical analysis of socio-economic factors in the trade-area. Thus, whilst similar to surveys made by supplier companies when considering the establishment of a new station or the purchase of an existing station, except that these would have involved actual 'field-study', they were not used for two reasons. First was the time factor involved, as these methods required very careful computing, and secondly, as actual values are not being used in this study, there seemed little purpose in aiming for this degree of accuracy.

The customer-count method, described in Appendix B, proved a sufficiently accurate indicator of sales as its results in each tested case were broadly in agreement with the throughputs supplied by station operators. This method was tested against the claimed gallonages of 50 stations and was found to yield results within some 10% of such amounts. It was then used to estimate approximate throughputs for those outlets for whom other sources were not forthcoming. Thus, approximate values have been compiled for each specialist outlet active at the end of 1977, results being recorded and presented in gallonage-bands, as follows :-

7. See Appendix B, item number 11.

8. Claus, R.J. & Hardwick, W.G. op cit.

Gallonage-bands are as follows :-

more than 500,000
400,000 - 500,000
350,000 - 400,000
300,000 - 350,000
250,000 - 300,000
200,000 - 250,000
150,000 - 200,000
100,000 - 150,000
50,000 - 100,000
less than 50,000

(all in gallons per annum, although many were supplied on a weekly or monthly basis)

The throughput of each of the specialist petrol retailing outlets has been recorded in Appendix C, together with postulated thresholds based on class and age. Thus, it is possible to identify those stations that are apparently viable and non-viable respectively, although it has to be realised that there is scope for error both in terms of claimed throughputs and in the allocation of threshold levels. However, the following table summarises the numbers of seemingly viable and non-viable stations :-

Table 6.1 : Viable and non-viable outlets by annual throughput.

Annual Throughputs.	Viable Outlets Filling Stations.	Viable Outlets Service Stations.	Non-viable Outlets Filling Stations.	Non-viable Outlets Service Stations.	Totals Viable	Totals Non-viable.	Totals All
more than 500,000	35	-	-	-	35	-	35
400,000-500,000	6	-	-	-	6	-	6
350,000-400,000	19	7	-	-	26	-	26
300,000-350,000	11	17	1	-	28	1	29
250,000-300,000	3	55	2	-	58	2	60
200,000-250,000	13	25	-	-	38	-	38
150,000-200,000	12	35	8	15	47	23	70
100,000-150,000	-	49	14	59	49	73	122
50,000-100,000	-	50	28	107	50	135	185
less than 50,000	-	-	1	27	-	28	28
Totals	99	238	54	208	337	262	599

Before attempting a consideration of the spatial distribution of viable and non-viable outlets, it is necessary to check these claimed gallonages against expectations. In the first place, an estimate of the size of the petrol market in the study-area can be made on the basis of the total number of resident vehicles, as it is known that the average annual consumption per vehicle in the U.K. in 1977 was some 345 gallons. This would produce an annual demand by multiplying this amount with the total number of cars in the study-area, viz. 345 x 258,460 = 89,168,700 gallons, or, for convenience, about 90 million gallons.

An approximate amount can be derived from table 6.1 by multiplying the numbers of stations in each gallonage-band by a value selected as representative of each category. If the minimum gallonage is used for the latter, together with a notional mean of 25,000 gallons for the lowest group, the following results are obtained :-

Table 6.2 : An Estimate of petrol consumption in the study-area, 1977.

Annual Throughputs.	Numbers of stations.	Estimated volumes.
more than 500,000	35	17,500,000
400,000 - 500,000	6	2,400,000
350,000 - 400,000	26	9,100,000
300,000 - 350,000	29	8,700,000
250,000 - 300,000	60	15,000,000
200,000 - 250,000	38	7,600,000
150,000 - 200,000	70	10,500,000
100,000 - 150,000	122	12,200,000
50,000 - 100,000	185	9,250,000
less than 50,000	28	700,000
Totals	599	92,950,000 gallons.

As this estimate relates to the filling stations and service stations only, it is necessary to add a further amount to represent the non-specialist petrol retailers. A reasonable estimate of their mean throughput would be some 10,000 gallons, and this, when multiplied by the 125 garages and other retail outlets would produce a further 1,250,000 gallons. Thus, the total amount sold in the study-area can be claimed, on the basis of recorded evidence, to be some 94,200,000 gallons.

While this is a greater amount than that derived from the use of national mean consumption per vehicle, there is a broad measure of approximate agreement between the two values. Although the accuracy of the recorded throughputs cannot be guaranteed, there are other means of explaining the deviation, in particular the sale of petrol to vehicles passing through, but not resident in, the study-area. However, it is probable that the size of the local market is in the vicinity of about 90 million gallons. It should be added at this point that each company supplying petrol for retail sale is required to report the size of its deliveries into delineated districts and that whilst it is possible to obtain this information, the cost involved is prohibitive.[9]

A recent report included an estimate of the relative proportions of outlets in the U.K. according to their annual throughputs.[10] This is reproduced as follows, together with a similar division for stations in the study-area :-

Annual Throughputs.	Proportions in (a) U.K. (1975)	(b) study-area (1977)
more than 500,000	4	5
200,000 - 500,000	18	22
100,000 - 200,000	33	27
less than 100,000	45	46

(this is based on the 724 outlets active in 1977, thus including non-specialist stations in the study-area)

It is clear that a broad agreement existed in terms of relative proportions even though the study-area contained only 2.46% of the national population of outlets. Further, as there was a 2-year interval between the two sets, characterised by severe price-competition, an exact correlation could hardly have been expected.

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9. The system, operated by the Department of the Environment, is known as PINGAR, standing for 'petrol into national grid area reporting'. The country is divided into blocks of 100 square kilometres, statistical information of the size of total petrol deliveries being available, but at a cost in 1976 of £75.00 per block.

10. Economist Intelligence Unit. op. cit.

With regard to viability, figure 6.1 indicates graphically the numbers of seemingly successful and unsuccessful stations respectively. It is clear that the level of sales alone is not a sufficiently accurate indicator of commercial viability as the station's individual threshold must also be considered. To illustrate this point, it is only necessary to realise that 3 filling stations with throughputs in excess of 250,000 gallons annually were not experiencing viability, while, in contrast, 12 with throughputs below 200,000 gallons were successful. Thus, the threshold must always be taken into account in any consideration concerning volumes of sales, although it can be claimed that the higher the annual gallonage, the greater the likelihood of achieving viability. The significance of the latter cannot be overstated as those stations experiencing losses over long periods of time can hardly be expected to survive indefinitely.

If the total annual sale in the study-area is assumed to be some 90 million gallons, then the mean annual throughput per outlet would be 124,000 gallons, well below the national average of 167,725 gallons. On the other hand, the mean sale of specialist outlets alone would be about 150,000 gallons, much closer to the national value. For the 337 viable stations, the mean sale would be almost 220,000 gallons. It may be expected that the stations with the higher throughputs will be those allocated to the higher classes on the basis of the categorisation made in the previous chapter. Table 6.3 summarises performance by classification while figure 6.2 presents the results in diagrammatic form, and it would appear that the expectation has been upheld.

Mean gallonages calculated for each class yield the following :-

Class	Mean Gallonage
1.	407,692
2.	192,857
3.	200,000
4.	104,651
5.	194,025
6.	97,753
7.	82,979
8.	62,019

FIGURE 6.1 VIABLE & NON-VIABLE OUTLETS

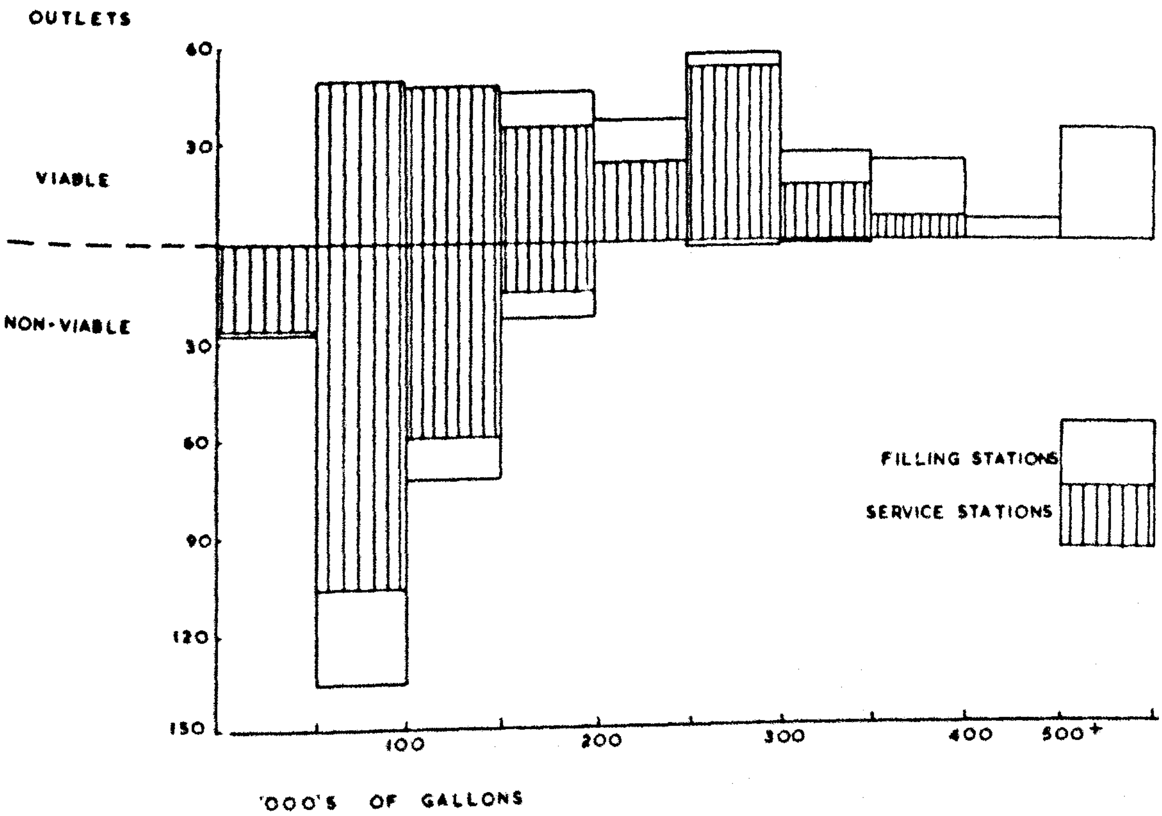
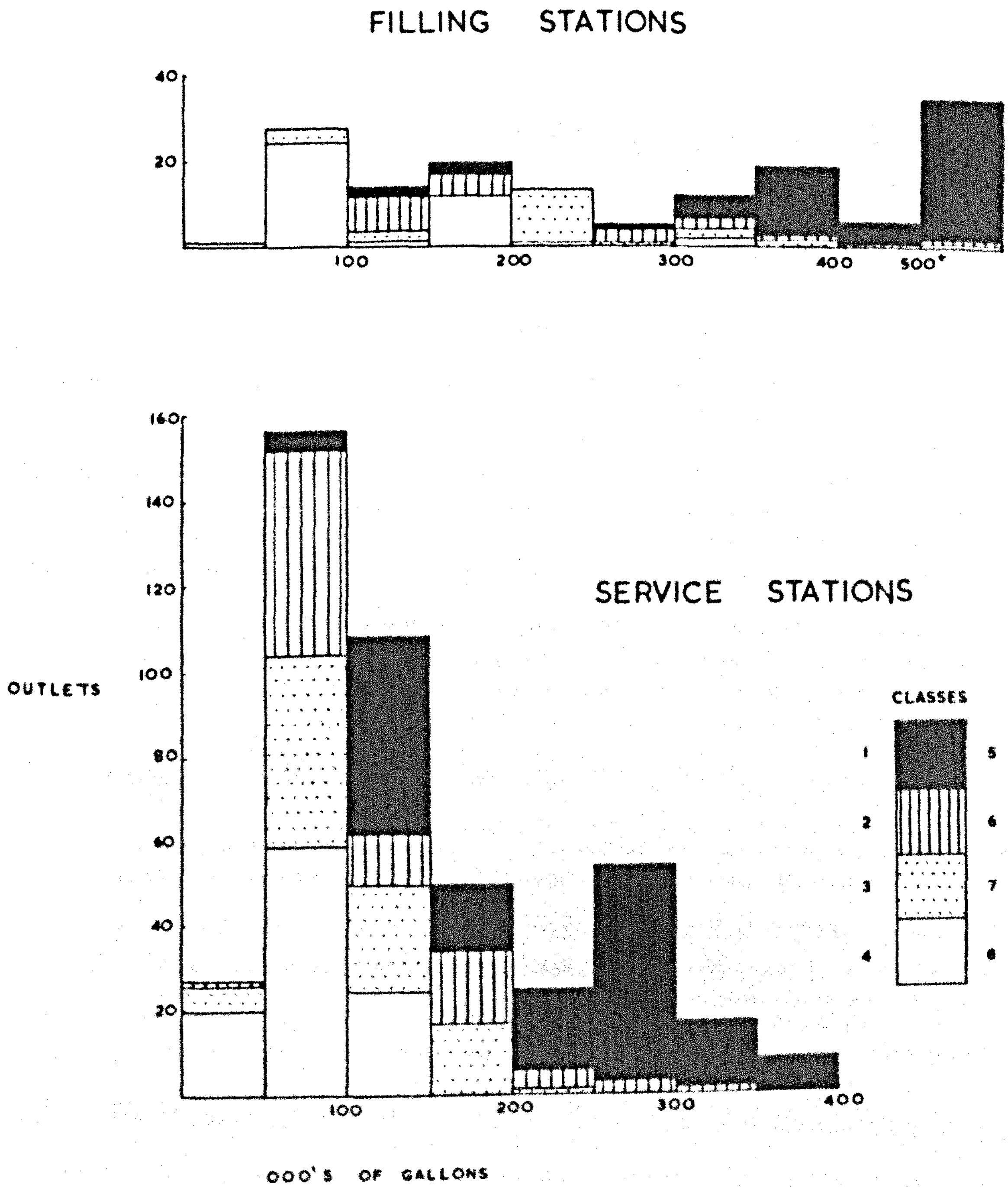


Table 6.3 : Specialist Outlets by Class and Throughput.

Annual Throughput.	Filling Stations				Service Stations				Totals.
	1.	2.	3.	4.	5.	6.	7.	8.	
more than 500,000	33	1	-	1	-	-	-	-	35
400,000 - 500,000	5	-	1	-	-	-	-	-	6
350,000 - 400,000	16	1	2	-	7	-	-	-	26
300,000 - 350,000	5	3	2	2	15	2	-	-	29
250,000 - 300,000	1	3	1	-	52	3	-	-	60
200,000 - 250,000	-	-	12	1	19	5	1	-	38
150,000 - 200,000	3	5	-	12	15	18	17	-	70
100,000 - 150,000	2	8	3	1	46	12	25	25	122
50,000 - 100,000	-	-	3	25	5	48	45	59	185
less than 50,000	-	-	-	1	-	1	6	20	28
Totals	65	21	24	43	159	89	94	104	599.

FIGURE 6.2 THROUGHPUT & CLASS



With the exception of the value for Class 3 which is surprisingly high, the rest conform to the expected pattern. This, as stated on page 229, suggested that a hierarchical ordering ranging from Class 1 to Class 8, although not in complete numerical sequence, would probably exist, this being shown above.

It was established in Chapter 5 that set-scores of company-owned stations were generally higher than those of privately-operated outlets, with the result that the higher classes contained a majority of the former. As their potential for sales was thus apparently greater it could be expected that their actual throughputs should be significantly greater. Table 6.4 on the following page summarises this aspect in the case of filling stations and table 6.5 on page 251 does the same for the service stations.

The information contained in these two tables is presented visually in figure 6.3 on page 252, serving to emphasise that company-owned stations generally outrank those in private ownership in terms of both annual throughput and viability. The following list is a summary of the performance of the specialist stations according to their ownership and operation, their potential having been assessed in the preceding chapter[11]:-

Suggested Hierarchy.	Category.	Total Number.	Number of viable stations.	Percentage of viable stations.	Mean Throughput.
1.	Company-managed filling stations	42	40	95	427,381
2.	Company-tenanted service stations	120	86	72	157,500
3.	Company-tenanted filling stations	64	46	72	124,218
4.	Privately-owned service stations	324	150	46	84,414
5.	Privately-owned filling stations	47	13	28	100,000

11. see page 212.

Table 6.4 : Filling Stations - by class, ownership/operation, throughput and viability.

Annual Throughputs.	Class 1			Class 2			Class 3			Class 4	
	*(2)	(1)	(0)	(2)	(1)	(0)	(2)	(1)	(0)	(1)	(0)
more than 500,000											
viable	27	5	1	-	1	-	-	-	-	1	-
non-viable	-	-	-	-	-	-	-	-	-	-	-
400,000 - 500,000											
viable	4	1	-	-	-	-	-	1	-	-	-
non-viable	-	-	-	-	-	-	-	-	-	-	-
350,000 - 400,000											
viable	6	10	-	-	1	-	1	1	-	-	-
non-viable	-	-	-	-	-	-	-	-	-	-	-
300,000 - 350,000											
viable	1	3	-	-	3	-	-	2	-	2	-
non-viable	1	-	-	-	-	-	-	-	-	-	-
250,000 - 300,000											
viable	-	-	-	-	-	2	-	1	-	-	-
non-viable	-	1	-	-	1	-	-	-	-	-	-
200,000 - 250,000											
viable	-	-	-	-	-	-	1	10	1	1	-
non-viable	-	-	-	-	-	-	-	-	-	-	-
150,000 - 200,000											
viable	-	-	-	-	-	-	-	-	-	3	9
non-viable	1	2	-	-	4	1	-	-	-	-	-
100,000 - 150,000											
viable	-	-	-	-	-	-	-	-	-	-	-
non-viable	-	1	1	-	5	3	-	1	2	-	1
50,000 - 100,000											
viable	-	-	-	-	-	-	-	-	-	-	-
non-viable	-	-	-	-	-	-	-	3	-	-	25
less than 50,000											
viable	-	-	-	-	-	-	-	-	-	-	-
non-viable	-	-	-	-	-	-	-	-	-	-	7

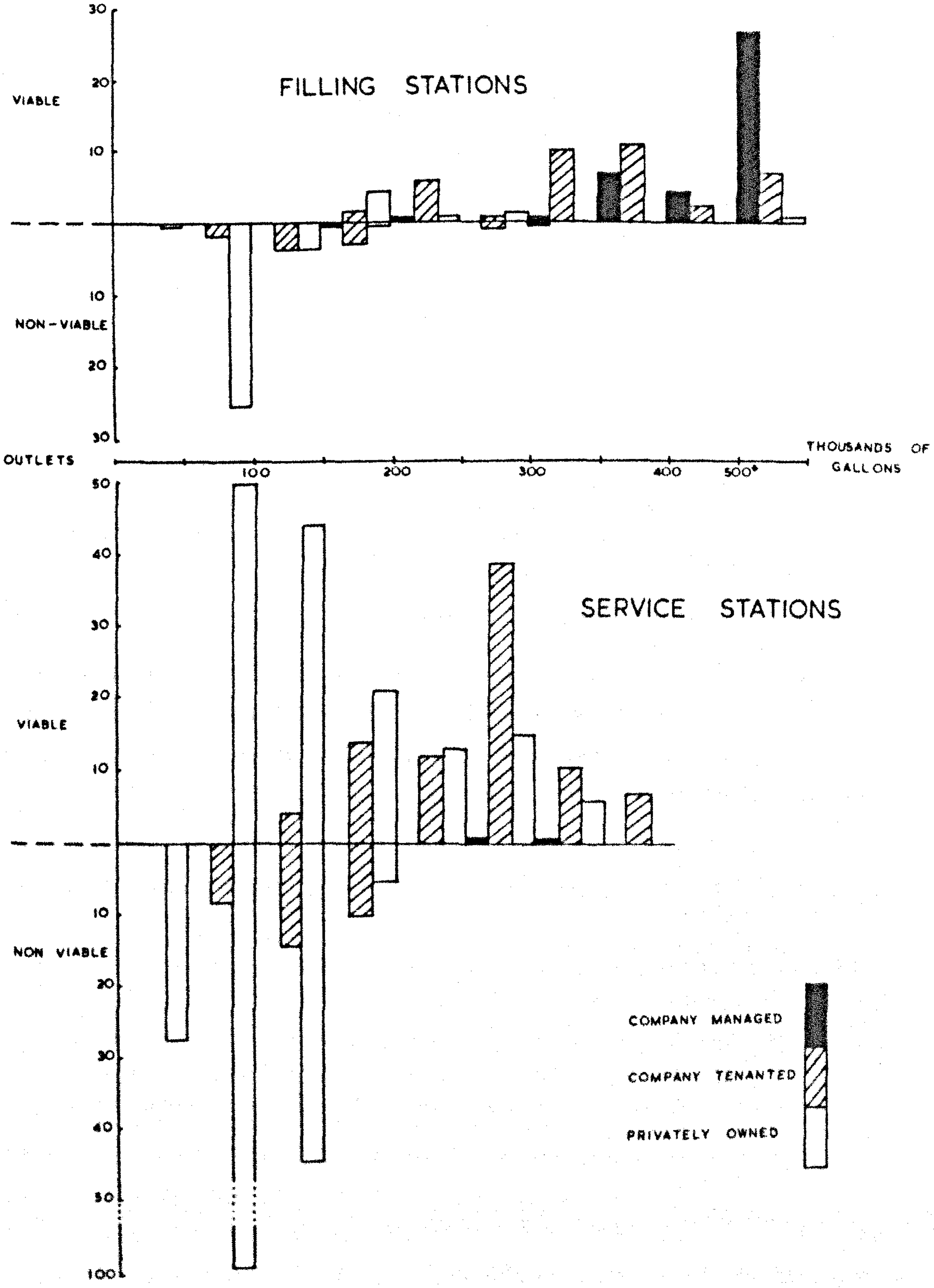
* (2) company managed
(1) company tenanted
(0) private

Table 6.5 : Service Stations - by class, ownership/operation, throughput and viability.

Annual Throughput.	Class 5 * (2)	Class 5 (1)	Class 5 (0)	Class 6 (1)	Class 6 (0)	Class 7 (1)	Class 7 (0)	Class 8 (1)	Class 8 (0)
350,000 - 400,000									
viable	-	7	-	-	-	-	-	-	-
non-viable	-	-	-	-	-	-	-	-	-
300,000 - 350,000									
viable	1	10	4	-	2	-	-	-	-
non-viable	-	-	-	-	-	-	-	-	-
250,000 - 300,000									
viable	1	37	14	2	1	-	-	-	-
non-viable	-	-	-	-	-	-	-	-	-
200,000 - 250,000									
viable	-	9	10	2	3	1	-	-	-
non-viable	-	-	-	-	-	-	-	-	-
150,000 - 200,000									
viable	-	-	-	1	17	13	4	-	-
non-viable	-	10	5	-	-	-	-	-	-
100,000 - 150,000									
viable	-	-	-	-	-	2	22	2	23
non-viable	-	11	35	3	9	-	1	-	-
50,000 - 100,000									
viable	-	-	-	-	-	-	-	-	50
non-viable	-	1	4	2	46	5	40	-	9
less than 50,000									
viable	-	-	-	-	-	-	-	-	-
non-viable	-	-	-	-	1	-	6	-	20

* (2) company managed
(1) company tenanted
(0) private

FIGURE 6.3 THROUGHPUT & OWNERSHIP



The outstanding success of the company-managed filling stations is clearly apparent, thus, as a group, realising the potential indicated by their high mean set-scores as shown on page 190. It was stated at that stage that the difference in scores between the next two categories was fairly small, this being borne out by the achievement of the same proportion of viable stations by both groups. However, the slightly higher set-scores of the company-tenanted service stations is reflected by a mean throughput substantially in excess of that achieved by company-tenanted filling stations. These categories stand well ahead of the privately-owned stations in terms of both viability and annual throughput, thus substantiating the ordering of the suggested group hierarchy. However, the situation in relation to the privately-owned outlets is less distinct, as the service stations have achieved a higher proportion of viable units whilst the filling stations experience a greater mean annual throughput. As the latter have no other major form of income apart from that accruing from petrol sales, it is not surprising that a greater proportion of their number were apparently unsuccessful. At the same time, the service stations with their additional sources of revenue were able to achieve viability with lower annual sales.

The spatial distribution of viable and non-viable specialist stations in the study-area is illustrated in figures 6.4 and 6.5. The former, in particular, reveals very clearly that most non-viable filling stations are located outside urban areas, and when compared with figure 4.10 are seen to be largely in areas having very small numbers of resident vehicles. However, the distribution of non-viable service stations is much less obvious as they occupy both urban and rural sites in substantial numbers. Many of the former sites are on minor urban roads certainly, but most rural stations are on 'A' roads.

It can be claimed that the non-viable filling stations, as a group, had low mean set-scores, these being :-

Set 2 - 6 (out of 12)   Sets 4 and 5 - 8 (out of 16).

Clearly, as shown on page 221, such an aggregate was typical of a Class 4 station, so that most of these outlets, at any rate, did not possess high site and facility ratings. Similarly, in the case of the non-viable

FIGURE 64 FILLING STATIONS - VIABILITY

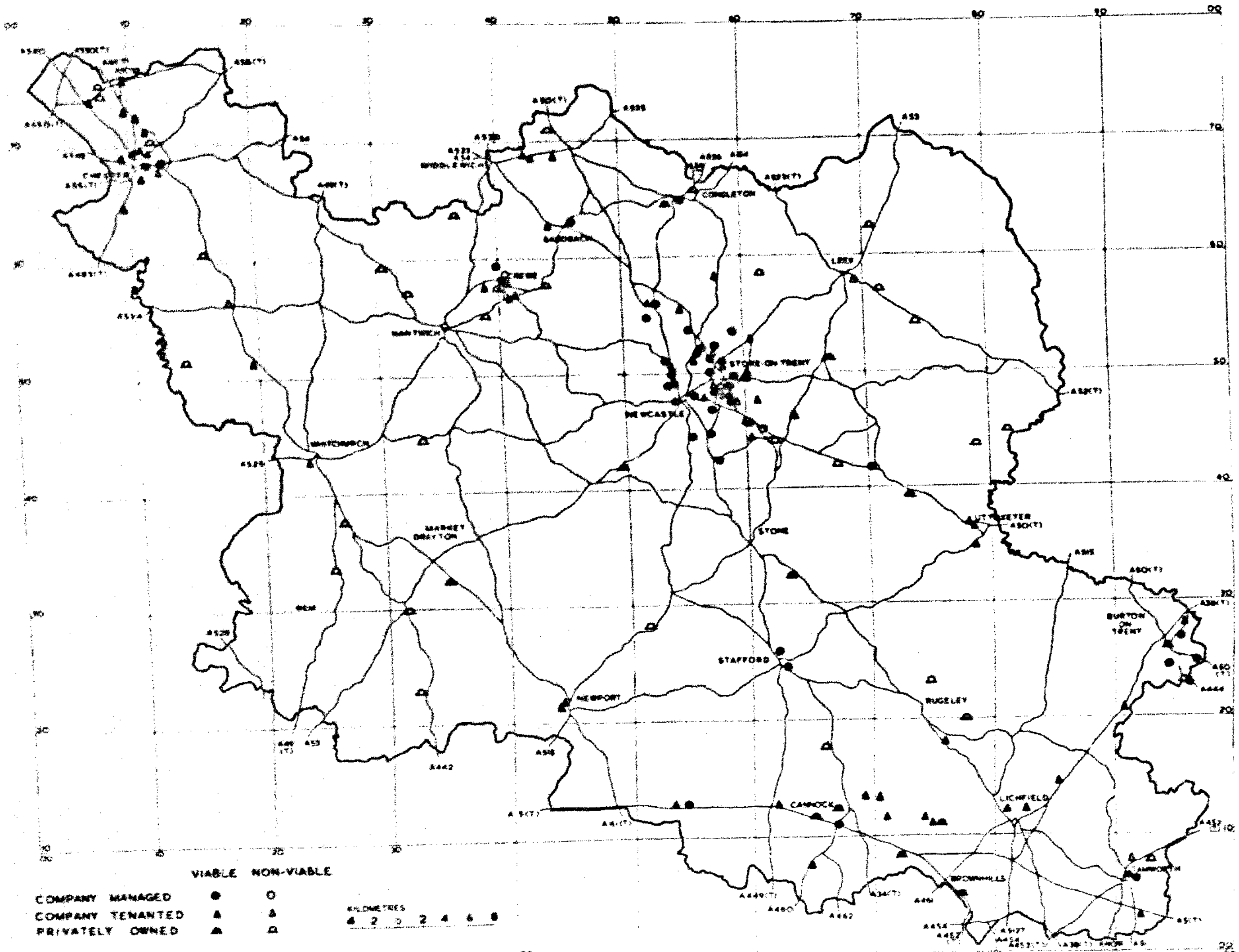
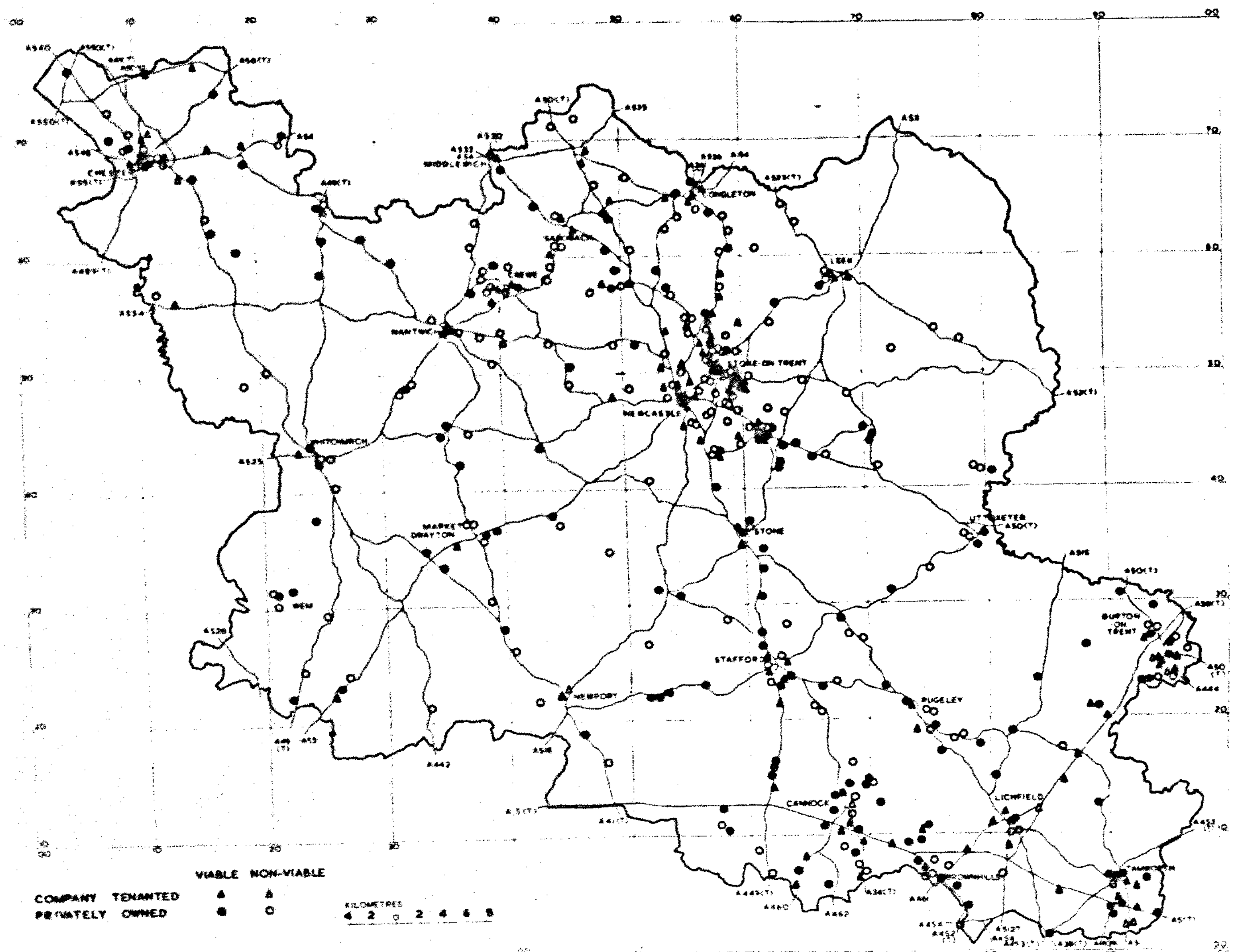


FIGURE 6.5 SERVICE STATIONS - VIABILITY



service stations, low mean set-scores characterised the 208 outlets involved, the actual values being :-

Set 2 - 6 (out of 12) Sets 4 and 5 - 7 (out of 16).

Again, this would approximate most closely to the mean set-scores of the lowest category of service stations, namely Class 8. Thus, at least in average terms, the non-viable outlets did not possess high ratings, so that, as a group, they were neither well-located nor well-equipped when compared with the whole population of outlets.

With regard to the spacing of outlets as considered on pages 162 and 163, it is not the case that many viable stations have achieved this status by being located at substantial distances from their nearest competitors. In fact, only 31 viable outlets were situated more than 1.92 kilometres from their nearest neighbour. As there were 110 such stations in all, this factor can hardly be deemed as being of great significance in the achievement of viability.

The locations of both viable and non-viable stations in the principal urban areas are shown in greater detail in figures 6.6 and 6.7. With regard, in the first place, to figure 6.6, it is apparent that only 5 out of the viable filling stations in the Stoke-on-Trent and Newcastle areas are not located on 'A' roads, and, of these, 3 are hypermarket sites. The remaining 2 (reference numbers 279 and 432), are both on heavily-used 'B' roads so that every viable filling station is located on a busy roadway. Only 4 of the viable service stations are not on 'A' roads while 22 of those that are non-viable are on minor roads. Figure 6.7 presents a broadly-similar pattern with regard to both filling stations and service stations in four of the towns having populations of about 50,000 each.

Turning now to the most successful stations in the study-area, figure 6.8 shows the location of each station that was retailing petrol at a rate in excess of 300,000 gallons annually. There are 96 such outlets altogether including 35 who enjoyed throughputs of over 500,000 gallons. Mean set-scores were as follows :-

Annual Throughput.	Set 2	Sets 4 and 5
more than 500,000	10.31	14.20
400,000 - 500,000	9.00	14.00
350,000 - 400,000	9.96	13.00
300,000 - 350,000	9.00	10.93

FIGURE 6.6 VIABLE & NON-VIABLE OUTLETS

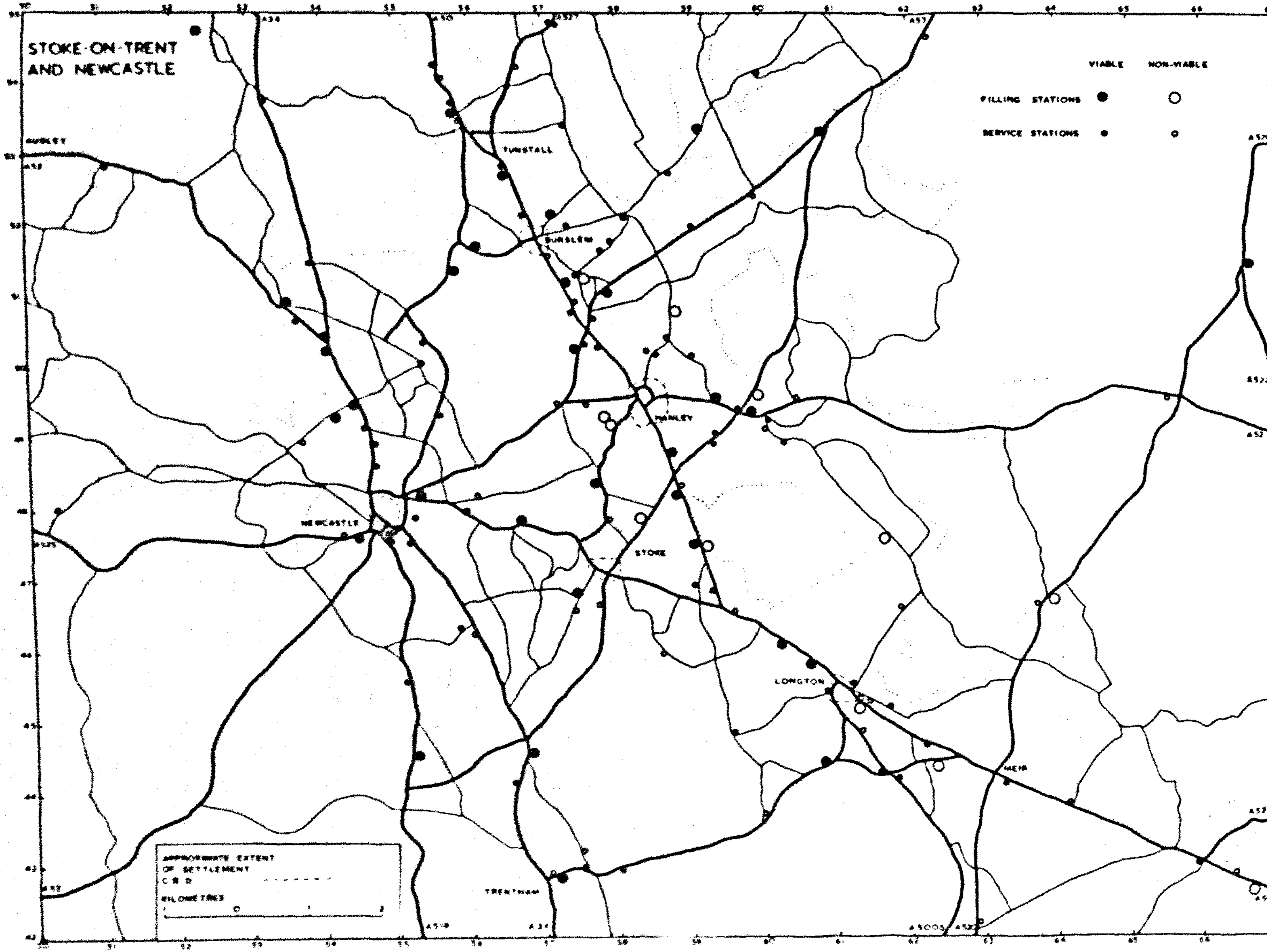


FIGURE 6.7 VIABLE & NON-VIABLE OUTLETS

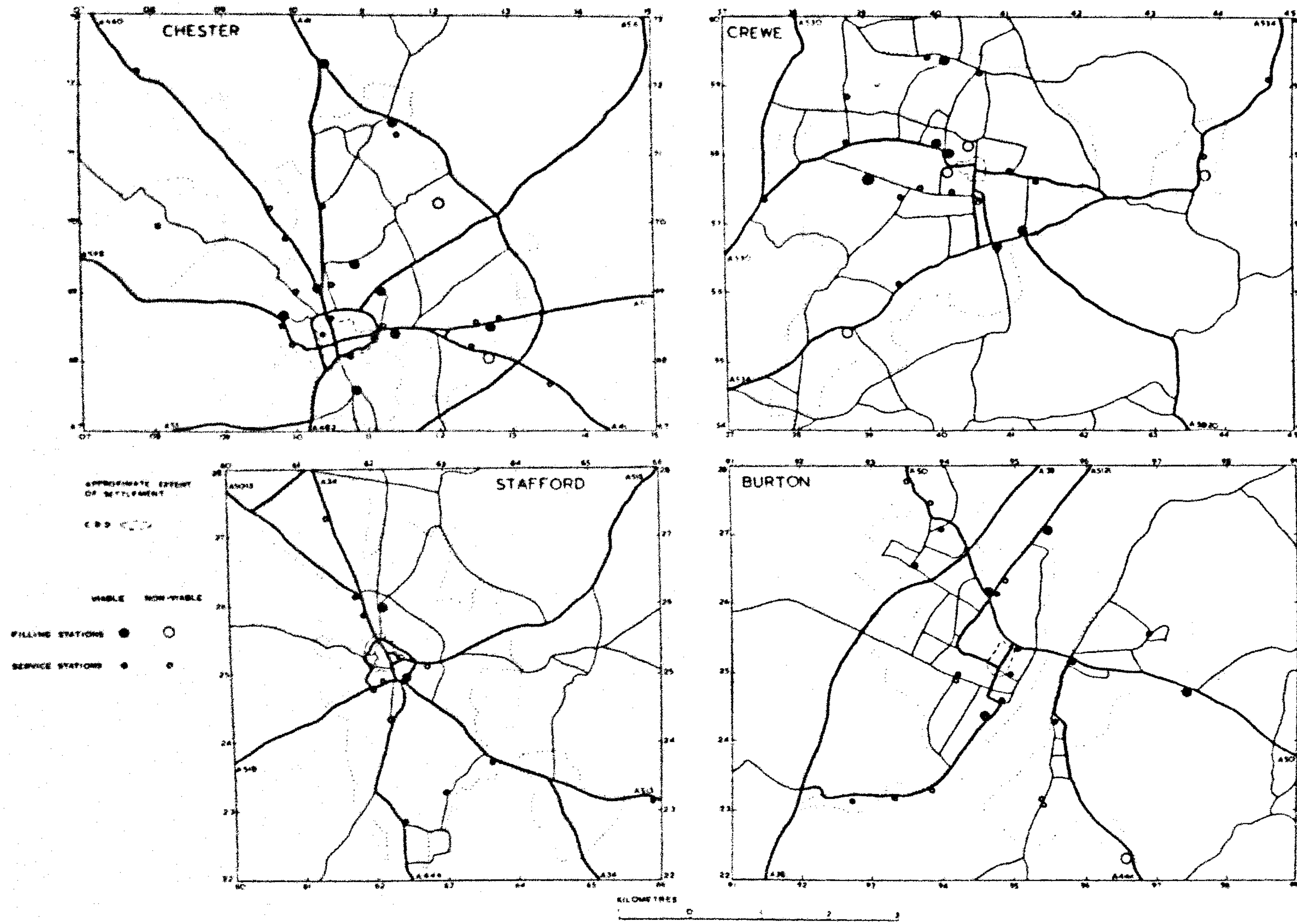
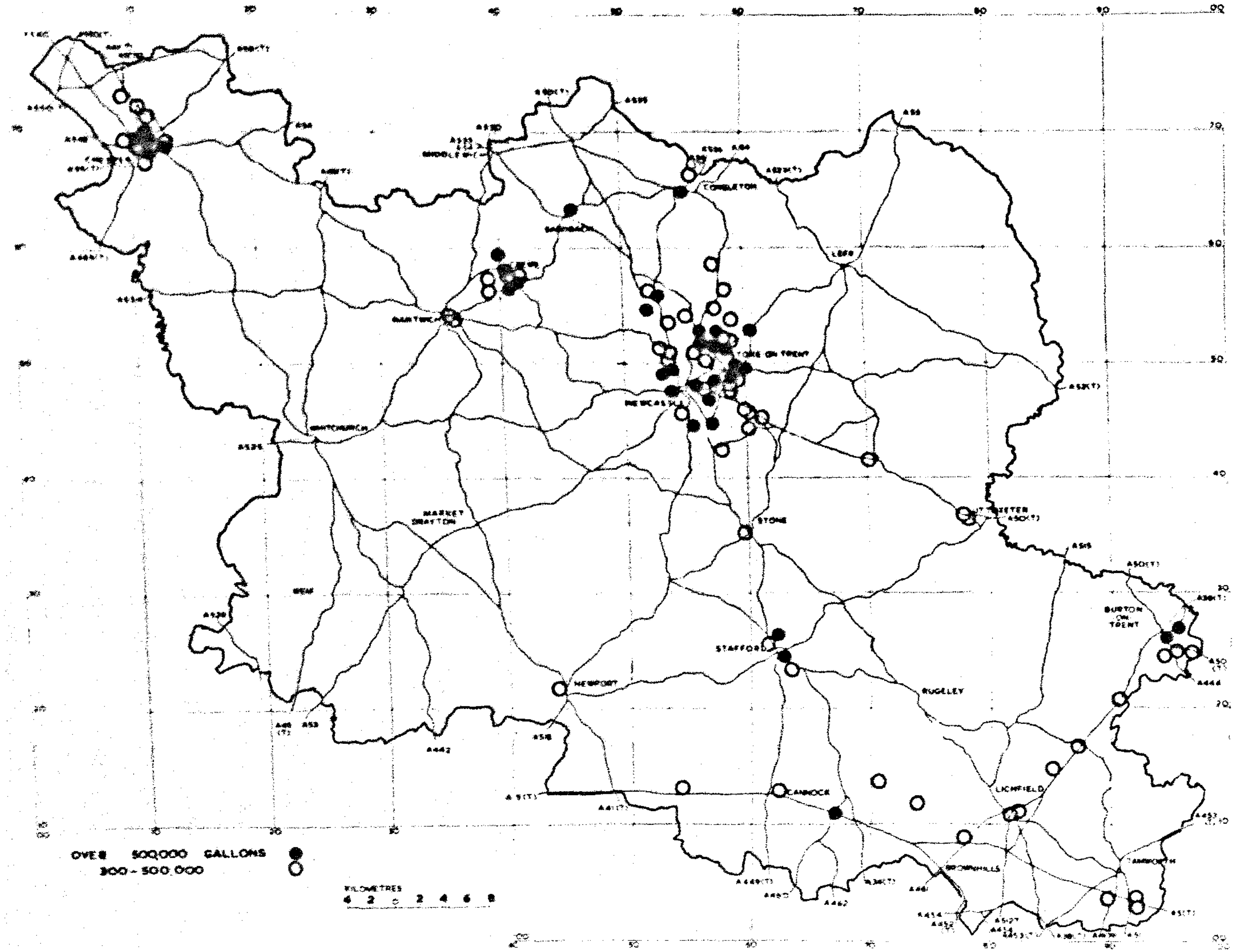


FIGURE 6.8 HIGH THROUGHPUT STATIONS



(Based on personal fieldwork)

Clearly, apart from being well above average even for the highest classes of specialist stations, the gradation is of interest in that it rises approximately as gallonage totals increase. In terms of site-attribute ratings particularly, the correlation with throughput must be extremely close, so that it would seem that investment in such facilities would be worthwhile.[12]

The 35 filling stations that sold over 500,000 gallons annually were all situated within areas of high vehicle population, each one having more than 500 cars within a radius of 0.92 kilometres. All, apart from one, were located on roads that carried more than 10,000 petrol-using vehicles per day, thus occupying sites on major roads within urban areas. Each station was sited on a road subject to statutory speed limits, and 25 were within 300 metres of a main road junction or roundabout as is evident in Appendix A. Thus, there were factors, external to the stations, that induced vehicles to reduce their speed of travel, so that they might more readily stop in order to buy petrol. In addition, only one station had a visibility-rating of less than 100 metres from its nearside approach road, while 20 were visible from more than 300 metres.

A mean score of 14.20 in Sets 4 and 5 (site-attributes) out of a possible 16 emphasises the high standard of these stations. All, apart from 2, were self-serve stations, and with one exception all were in company-ownership, as many as 27 being operated by managers. The majority were new establishments, with 16 of the 25 for which periods of origin are shown in Appendix A having been opened since 1965.

It is clearly evident in figure 6.8 that these high-gallonage outlets were located in the principal urban areas within the study-area, these also being the areas of greatest vehicle concentration and containing the busiest roads. Thus, without doubt, for a station to enjoy a really large throughput, it would be essential for it to occupy this type of location.[13]

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12. A statistical correlation could not really be conducted to test the extent of this claimed relationship as only 4 categories of annual throughput had been utilised.

13. A number of outlets recorded as having throughputs in excess of 500,000 gallons annually were claimed to be retailing at about twice this amount.

With regard to the brands retailed at these outlets, 20 sold Group I and 15 sold Group II products. This obviously meant that the latter's proportional share, 43%, was greatly in excess of their representation amongst all stations in the study-area, this being only 24%. This serves to emphasise the attitude of the newer supplying companies, as has already been explained. In contrast, as only 4 out of the 24 service stations retailing in excess of 300,000 gallons annually sold Group II brands, their marketing policies are clearly revealed as being concerned with the sale of petrol rather than with other activities related to vehicles in general. Of particular interest is the role of Texaco amongst the leading sites, this being the brand sold by 11 of the 35 stations selling more than 500,000 gallons annually, including 2 of the 3 hypermarket sites. The marketing policy of this firm was discussed on pages 78-80 when it was recognised as the most progressive of the older major companies, this being substantiated by its leading position amongst the high-throughput outlets.

Reference to figures 6.9 and 6.10 will further emphasise the concentration of the high-gallonage outlets in the principal urban areas, these containing 32 of these stations. The great majority are situated on the major roads leading into the towns, although one of the widely-held beliefs within the trade does not seem to be fully substantiated. This is the view that the most successful stations will occupy the first sites to be encountered on the left-hand side of roads leading out of town centres, on the grounds that customers are more likely to buy petrol on their return journeys. A check of the high-gallonage sites in figures 6.9 and 6.10 reveals that only 13 of the 35 in this category occupy such locations, although the feature is particularly well-illustrated in the case of Newcastle where 4 such outlets are apparent. Although the claim can neither be confirmed nor dismissed, it does appear to possess a certain logic, so that while it is possible that it contains an element of truth, there is insufficient evidence to regard the case as proven.

(Based on personal fieldwork)

FIGURE 6.9 ANNUAL THROUGHPUTS

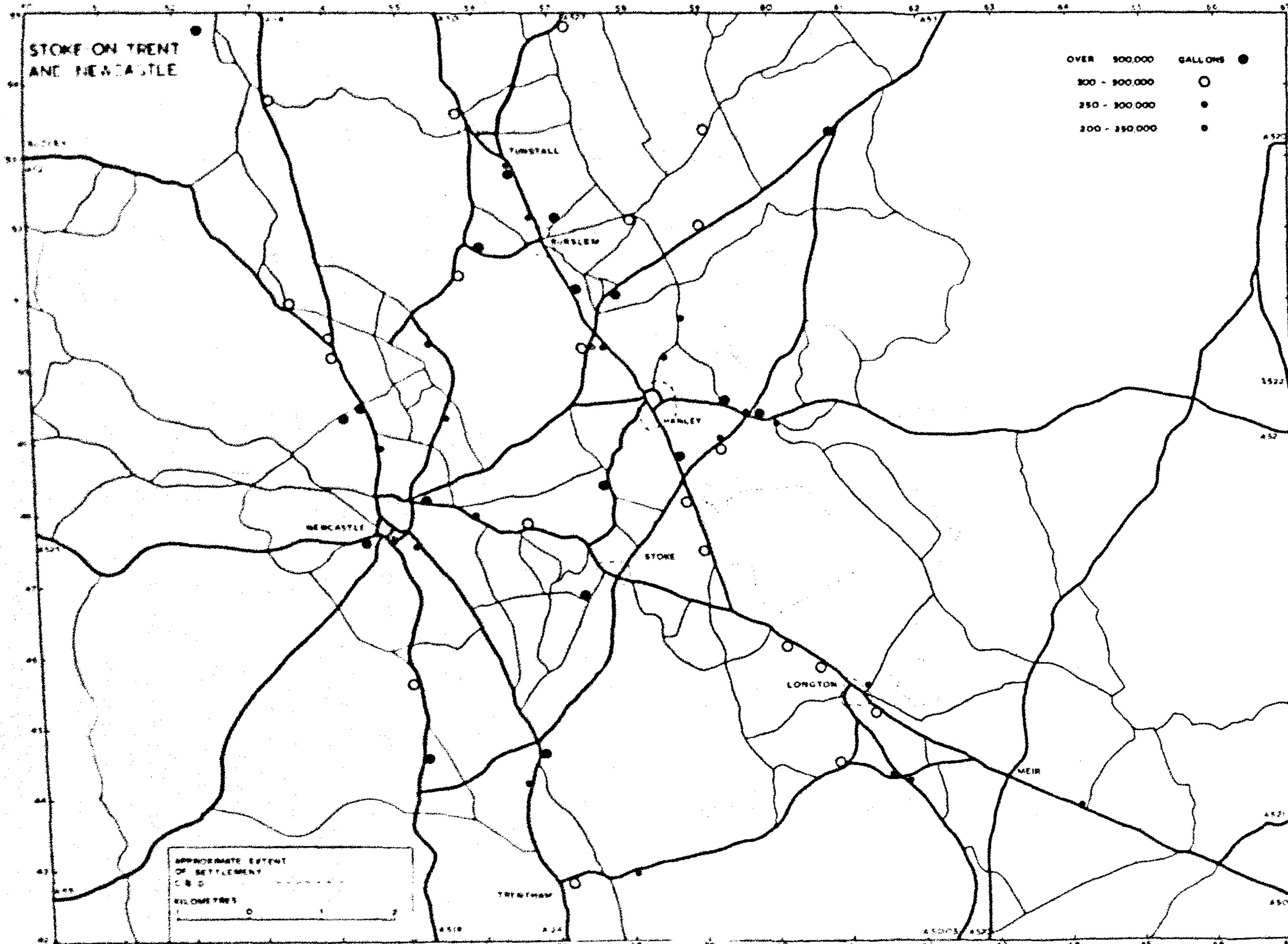
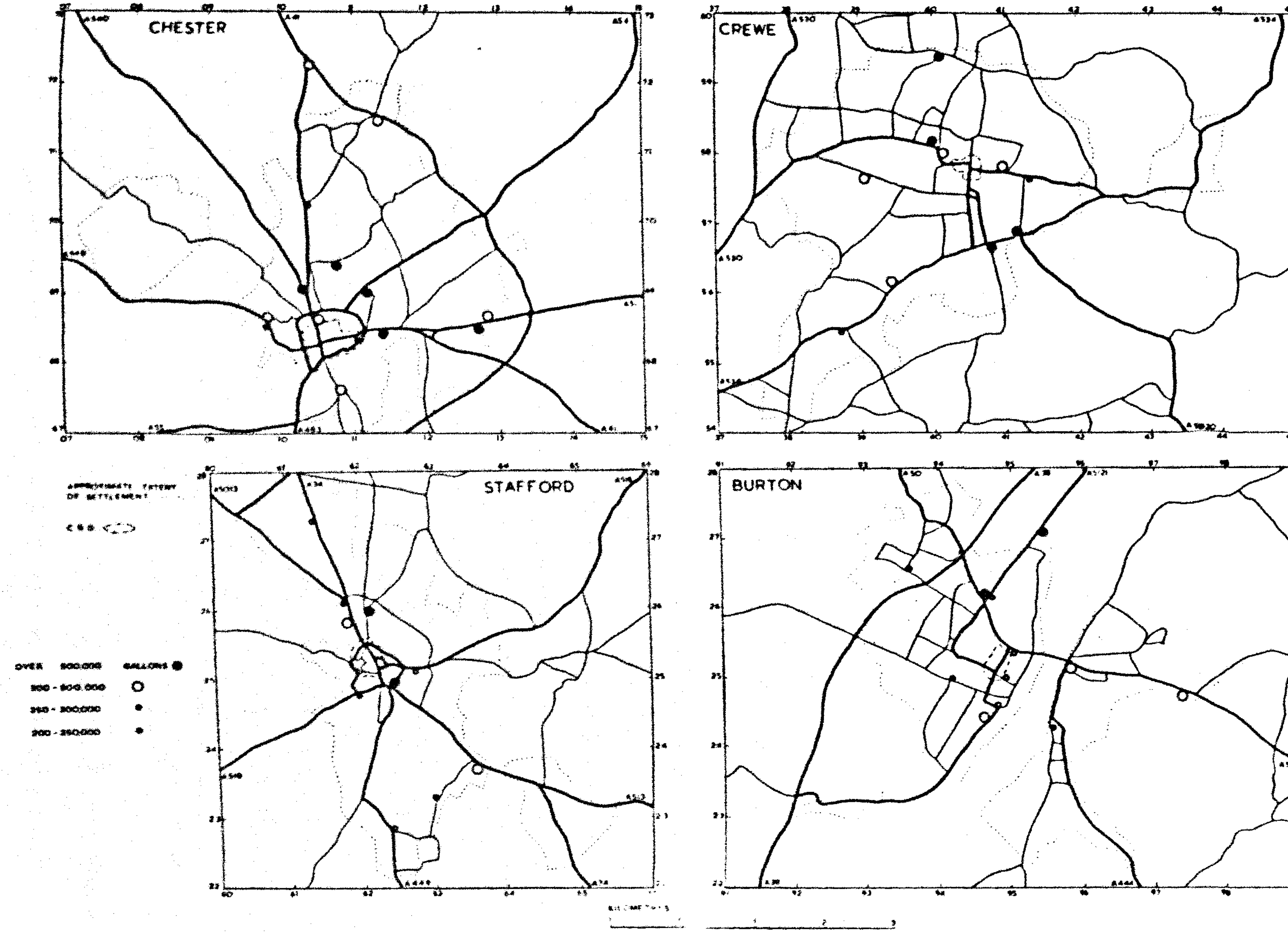


FIGURE 6.10 ANNUAL THROUGHPUTS



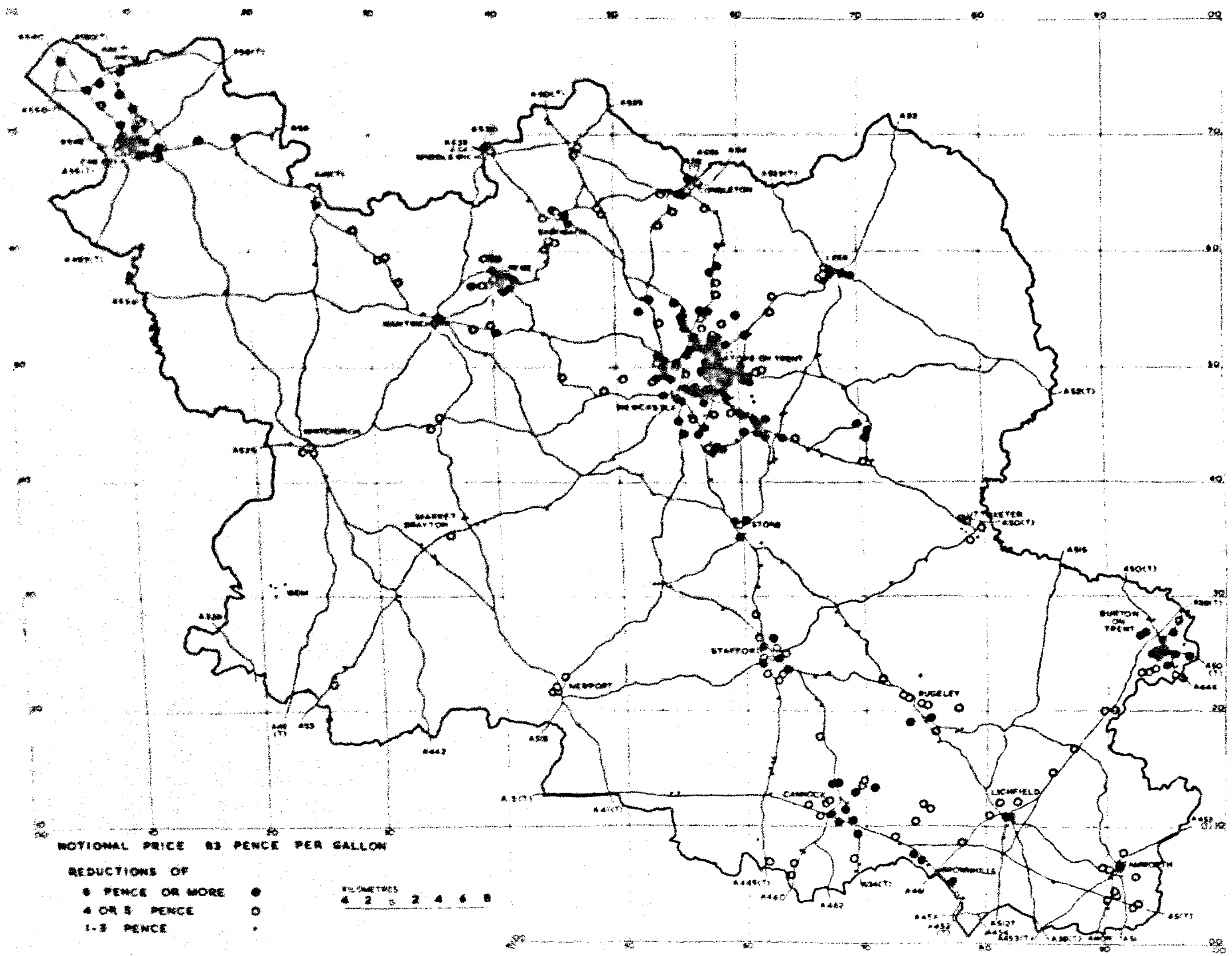
(Based on personal fieldwork)

Having considered the locations and attributes of all the specialist outlets, these being the means whereby stations were able to compete with each other, there remains the third form of competition, namely price. This form of competition has been very prominent in recent years both in terms of duration and severity. Figure 6.11 has been constructed to illustrate the form and extent of price-competition during August 1977, this having been, in retrospect, a fairly typical month. It will be seen that price-cutting was most widespread and severe in urban areas, these being the principal markets for petrol and also, as outlets were more concentrated, the areas where customers could most readily 'shop around' without consuming too much petrol in the process. In the rural areas and in the smaller towns, the degree of reductions was much less, in all probability due to the impossibility of selling much more petrol owing to the relatively small numbers of vehicles in such areas. Also, such outlets had access to a type of captive market, as it would not pay a motorist to drive great distances in order to buy cheaper petrol as the saving might be consumed in the process. This feature is particularly well-illustrated in the cases of Market Drayton and Wem, both of which are located at substantial distances from larger towns. In other words, as Shrewsbury is the nearest large town in each case and it lies 16 and 25 kilometres from Wem and Market Drayton respectively, the conclusion to be drawn is that such distances act as a barrier to the spread of price-cutting. In this sense, these towns are too far from other centres for their residents to drive such distances just to buy cheaper petrol, while the size of their respective markets is too small to justify the decision by any station operator to substantially reduce the selling price.

The great majority of those stations offering reductions of 6p. per gallon or more were company-sites, and thus, in all probability, were receiving substantial price support. Again, a majority of those reducing prices by 4p. or 5p. were in the same category, whilst those stations offering lesser reductions, or none at all, were invariably in private ownership. This can be clarified by reference to an actual example which may be regarded as typical of the areas where competition was at its most fierce, in other words, one of the larger towns.

(Based on personal fieldwork)

FIGURE 6.11 PRICE COMPETITION AUGUST 1977



The situation in Crewe at this time was that, out of a total number of 22 petrol retail outlets, 15 were engaged in price competition. As the following list shows the market was dominated by 7 company-owned stations who were discounting at 6p. or more per gallon. These 7 in fact, accounted for some 60% of total sales in the local market, their only substantial opposition coming from one privately-owned discounter. However, the latter's throughput was considerably less than those of the leading retailers.

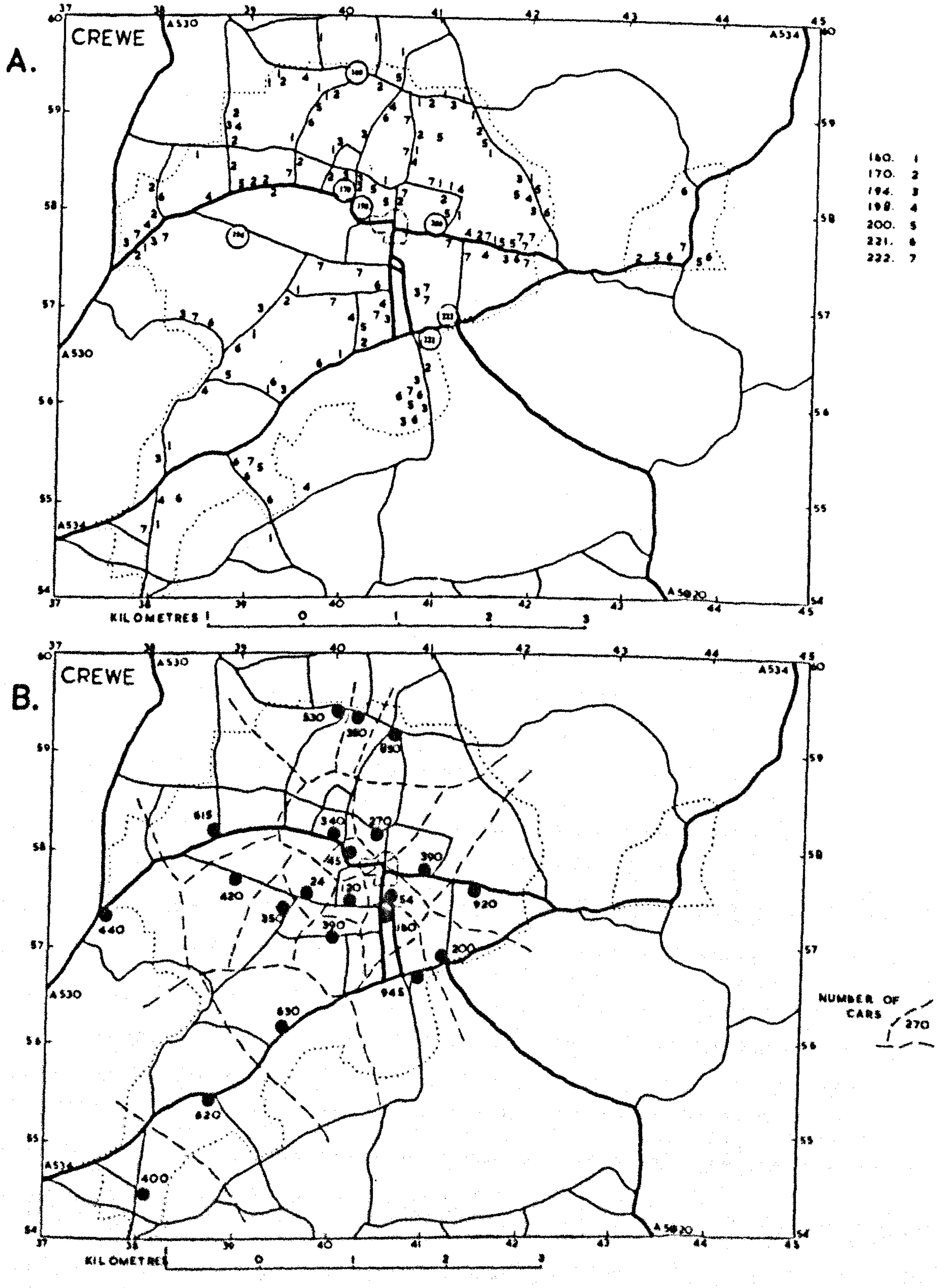
Table 6.6 : Price competition in Crewe, August 1977.

Annual Throughput.	Number of stations.	Ownership.	Price reduction.
more than 500,000	4	company	6 +
400,000 - 500,000	1	company	6 +
350,000 - 400,000	1	company	6 +
300,000 - 350,000	2	company	6 + ; 3
250,000 - 300,000	1	private	6 +
150,000 - 200,000	4	company - 2 private - 2	4 ; full price both at full price
100,000 - 150,000	7	private	6 + ; three at 4 ; one at 3 ; two at full price
less than 100,000	8	private	all at full price.

The locations of the 7 company-owned discounters are shown in figure 6.12A together with the points of origin of their locally-based customers during a 2-hour period on one weekday morning in August 1977. The initial impression is that customers were distributed throughout the town, fairly indiscriminately, but further study will reveal that a substantial number actually favoured their nearest outlet. Out of the 153 customers marked on the map, 46 made purchases at their local stations. Of the rest, none admitted to making a special journey for the purchase of petrol at a more distant station. Each of these customers claimed that the particular outlet visited was on a route that they frequently used. All of the customers from the local area regarded themselves as regular customers, visiting the station at least once a week.[14] Clearly, in such a situation, the actual location of a

14. It is extremely difficult to define a 'regular customer' either according to frequency of visit or by size of purchase. It will range down from the person who buys all his petrol at that station to someone who makes a purchase once a month or so.

FIGURE 6.12 TRADE AREAS



(Based on personal fieldwork)

station had to be a significant factor influencing customer-choice, but only 24% gave this as the principal reason for their visit. In contrast, 80% claimed that the selling price of petrol was the major reason for patronising a particular station, but in view of the fact that a number of outlets gave the same discount, this factor only served to explain the higher throughputs of the price-cutters. The brand of petrol had little or no significance as only 5% of the 153 motorists even mentioned this as a reason to explain their choice of station.[15]

This type of situation could not have developed if each customer patronised only the station nearest to home. If this were the case, that each purchaser made use of the nearest station only, the petrol market in Crewe, and by implication in other towns, would have been sub-divided very differently. Figure 6.12B shows the theoretical hinterlands of the stations active in the town in August 1977, with the numbers of cars and vans in each unit marked.[16] Thus, potential throughputs for each station could be calculated by multiplying these numbers by the average annual petrol consumption per vehicle, viz. 345 gallons. In table 6.7, stations have been listed in the first column in order of potential throughputs, but a brief consideration is enough to reveal that there is little relationship with actual sales.

The high-gallonage outlets of figure 6.12A are marked with asterisks in table 6.7 on page 269, and it will be seen that 6 of their number had potential throughputs of below 150,000 gallons annually. In other words, these 6 would not have been viable units had they relied on custom only from their own hinterlands, that is to say from those motorists for whom they were the nearest outlets. It is perfectly clear that these stations attracted custom from every part of the town, and in so doing drew prospective purchasers away from other outlets. Clearly, therefore, hexagonal trade areas did not exist in this case, although it is a fact that marketing conditions must have been influenced by differential selling prices. However, it is highly unlikely that discounting was the sole reason for the non-existence of such patterns as the quality of the leading retailers, in terms of sites and attributes, were superior to those of the other outlets.

15. Several customers were unable to correctly name the brand of petrol that they had just bought.

16. This is the number of vehicles for which a particular station is the nearest site.

Table 6.7 : Potential and actual throughputs of outlets in Crewe.

Reference Numbers.	Potential custom - number of cars.	Potential annual throughput.	Actual annual throughput.
221.*	945	326,000	more than 500,000
206.	920	317,000	250,000-300,000
161.	850	290,000	100,000-150,000
220.	630	217,000	300,000-350,000
236.	620	214,000	150,000-200,000
168.	615	212,000	100,000-150,000
159.	530	183,000	100,000-150,000
193.	440	152,000	150,000-200,000
194. *	420	145,000	300,000-350,000
253.	400	138,000	less than 50,000
197.	390	134,000	less than 50,000
200. *	390	134,000	350,000-400,000
160. *	350	120,000	more than 500,000
196.	350	120,000	50,000-100,000
170. *	340	117,000	more than 500,000
171.	270	93,000	150,000-200,000
222. *	200	69,000	more than 500,000
205.	180	62,000	100,000-150,000
203.	120	41,000	150,000-200,000
204.	54	18,000	less than 50,000
198. *	45	15,000	400,000-500,000
195.	24	8,000	100,000-150,000

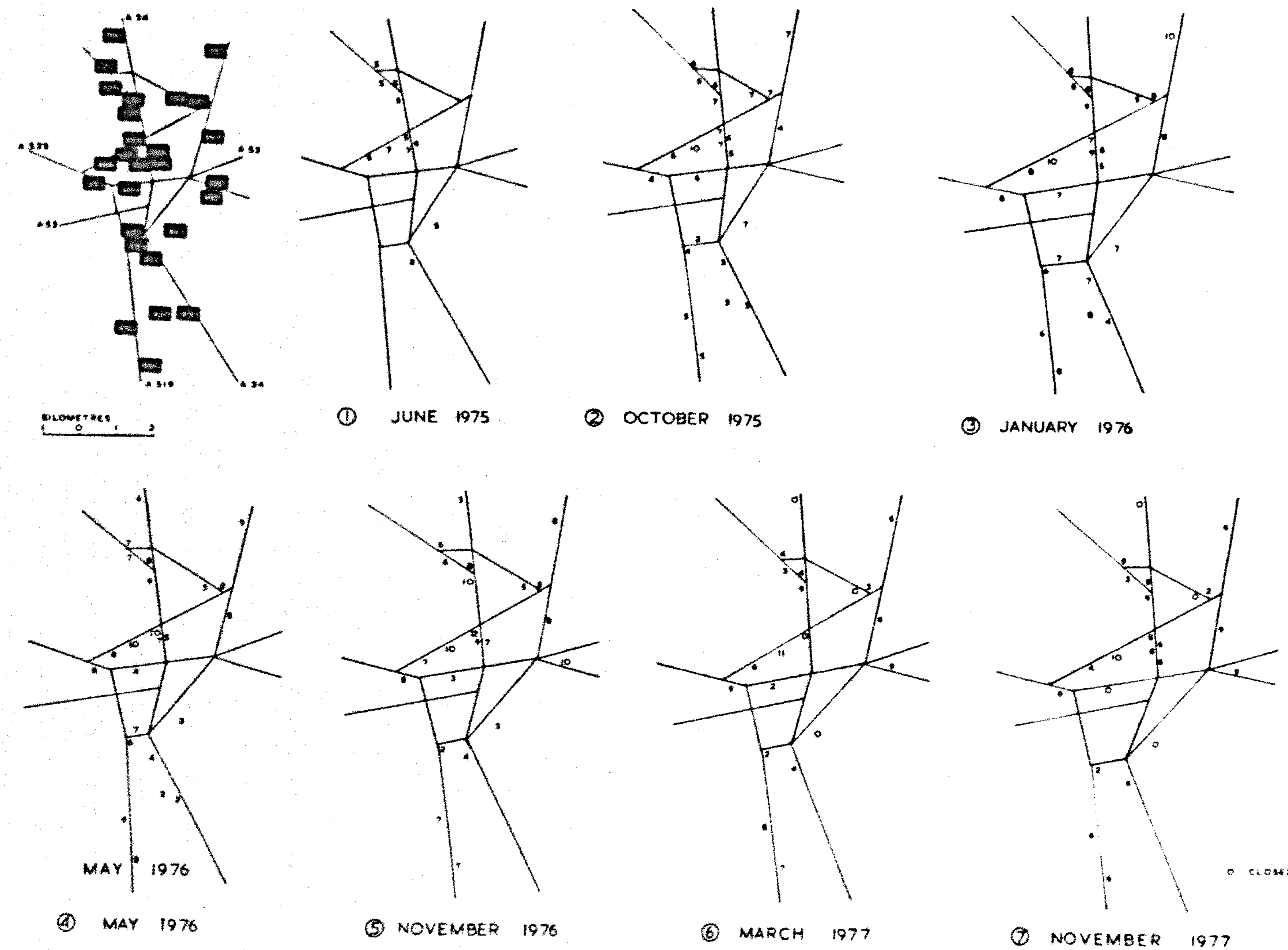
The significance of a site on a major road near the town centre, and having access to heavy volumes of traffic, is highlighted by stations 170 and 198 in particular. Neither of these had sufficient potential for viability in their own hinterlands, but their commercial success has obviously been built on the attraction of both regular customers from other parts of the town and on casual passing trade. Station number 222, likewise, possessed a sparse catchment area, but has obviously drawn from much farther afield in order to sustain its role as a 500,000 + gallon site. Its actual location at the junction of 2 'A' roads on the edge of the urban area has clearly been its great advantage. With regard to station number 160, it is not even on a heavily-used road, so that access to large volumes of traffic is not essential in achieving a high throughput.

Whilst there are great difficulties involved in attempting to assess the influence of differential discounting policies on trade areas, the actual commencement and development of a price-war has been traced within the study-area. Although selling prices were observed and recorded at intervals between late-1973 and the end of 1977 for the whole of the study-area, a complete and detailed record was kept for the whole period in the case of Newcastle. Apart from being the nearest and most-accessible town, Newcastle is also the second largest urban area. Due to the configuration of the road-pattern, it is very much a linear area with competition being diffused over considerable distances by the busiest road, the A34, in particular. Also, this was an area where price-competition increased in its severity due to the establishment of a hypermarket cut-price outlet.

Figure 6.13 illustrates the sequence that took place between June 1975 and November 1977 as competition varied in its extent and intensity during this time. Although moderate price reductions of 2p. or 3p. per gallon had been offered by a few stations along the A34 through-route since the end of 1974, it was the establishment in February 1975 of a large hypermarket with an associated petrol forecourt that stimulated severe discounting. That this outlet was originally supplied by ICI meant that the wholesale price of its petrol was less than those of other brands, as explained on page 83, with the result that

(Based on personal fieldwork)

FIGURE 6.13 PRICE COMPETITION



it initially offered a discount of 7p. per gallon. The hypermarket, located almost 2 kilometres from the town centre, relied on car-borne shoppers who would then purchase this cheaper fuel during their visit. As a result, stations in its immediate vicinity were the first to suffer, and they responded by reducing their own selling prices, although seldom by as much as the hypermarket was able to sustain.

This might be termed 'the first ripple in the pool of competition', when stations 354, 356, 386 and 388 entered the activity. As 3 of these outlets were situated on the A34, the effect was to extend competition outwards from the hypermarket and on to this busy roadway. Thus, the practice of discounting spread northwards to include stations 328, 329, 330 and 331, and southwards as far as station 416, as is shown in 6.13-1. A consequence of the latter's participation was the response of station 414, located near to station 416 but on a town centre side road, by undercutting the latter. In this way it was attempting to compensate for its poorer relative location. It will be seen in 6.13-2 and 6.13-3 that station 414 continued to sell at a lower price than station 416 until early-1976, by which time it seemed to be losing its enthusiasm for the contest. Eventually, as is shown in 6.13-6, it was closed, in all probability due to the income lost as a result of reducing its profit margin over a period of about eighteen months.[17]

The effect of discounting along the A34 was to transfer competition to all parts of the town as is shown in 6.13-2. By this time in October 1975 the hypermarket was selling at 10p. per gallon below the notional price of petrol which meant that those stations wishing to seriously challenge its supremacy in the local market had to cut their prices by similarly large amounts. This was becoming apparent at that time, although no other station was reducing its price by more than 7p. Then, by January 1976, as is shown in 6.13-3, the first competitor to match the hypermarket's reduction, station 333, made its attempt and continued with a price just above the former's until November 1976. Others followed this system, probably out of necessity as they were all losing custom. These included stations 331 and 354 during the first half of 1976, the latter eventually going much further by undercutting the hypermarket in November of that year, this being shown in 6.13-5.

---

17. Station 414 closed its forecourt only and continued as a vehicle-dealership. It will be seen in Appendix C to have been non-viable.

That this was an unwise move is shown in 6.13-6 when the outlet is seen to have been terminated, although it has since re-opened. It will be seen that 4 outlets were closed during 1977, these being permanent terminations, and as each had participated in discounting, it is not difficult to suggest a reason for their withdrawal.

By the middle of 1976, following a very successful year's activity when it sold about one million gallons of petrol, the hypermarket changed its supplier from ICI to Texaco. However, its sales were so large that it was able to obtain very substantial rebates on the wholesale price and was able to continue to sell at 10p. per gallon below the notional level.[18] At this time, station 390 was opened on a virgin site by the Mobil company and it immediately matched the hypermarket's selling price, as is shown in 6.13-5. Subsequently, it found that its town-centre major road location allowed it to compete with the hypermarket without having to sell its petrol quite as cheaply, as can be seen in 6.13-6 and 6.13-7.

By the end of 1977, with no immediate prospect of an end to severe discounting, it will be seen that there were 9 major competitors, each one offering a reduction in price of at least 8p. per gallon. Reference to Appendix A will reveal that 8 of these stations were company-owned and were therefore in receipt of support in order to maintain such low prices, while Appendix C suggests that each one was a viable entity. The exception, station 356, withdrew from petrol retailing early in 1978, this move again, in all probability, being due to losses sustained in price-cutting.

The Newcastle market is now dominated by a small number of high-gallonage company-owned outlets, consisting of stations 331, 354, 390 and 411. The hypermarket, station 355, does not belong to a petrol supplier but to the North Midlands Co-operative Society. It has, therefore, the financial backing of a large company to sustain its price-cutting activities which, in effect, were designed mainly to attract customers to the store itself rather than to the forecourt. As a result, the forecourt's lack of profitability due to the discounting policy is probably of little consequence.

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18. The irony of this type of situation is exemplified just to the north of Newcastle where another Normid hypermarket, station 255, was able to retail Shell petrol at a price below the wholesale price charged to one of Shell'stenants at the nearby station 238.

Each of the outlets referred to above maintained a price-cutting policy of at least 8p. per gallon while selling more than 500,000 gallons annually. Reference to page 239 will reveal that such a practice almost certainly involved a financial loss for each outlet. In spite of this, an integrated company with its own refinery must sell its resultant petrol, even at a loss.[19] Further, as privately-owned stations could not compete at this level, many would lose custom and be forced to terminate their activities, thus effecting a reduction in the numbers of retailers in the market and thereby improving the long-term prospects for company-owned stations.

While it is clear that it is the company-owned sites that are best-able to offer cheaper petrol to the motorist, it is the privately-owned outlets that are closing as a result of failing to match these price-cuts. Those most at risk are clearly the filling stations, as they lack other sources of income. Already, the situation is that the market is becoming increasingly dominated by the large volume company outlets, so that future prospects must imply a smaller number of stations in all with very few remaining in private ownership.

Assuming the total sale of petrol in the study-area to have been 90 million gallons in 1977, about 65% of this amount passed through company-owned forecourts. That was the extent of the control of the market held by the suppliers at that time, and there is little doubt that such a proportion will have increased since then.

As it seems likely, therefore, that the total number of outlets will continue to fall, this chapter will end with a consideration of the approximate number required to supply the needs of the study-area. Clearly, as the spatial distribution of outlets is certainly as significant as their total number, both of these aspects will have to be considered.

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19. The process of refining petroleum results in the unavoidable production of petrol, this accounting for between 12% and 18% of the original crude, depending on its chemical composition. Such a product must therefore be disposed of in some way, the actual disposal being in a sense more important than the realisation of a profit on the petrol itself as the cost-structure of an integrated company is based on all its many products.

The first task is the identification of the number of outlets required, bearing in mind that they must all have a reasonable chance of attaining viability. In view of this, it is necessary to set parameters in order to arrive at a reasonable number, or it could be claimed that the only requirement was to have a small number of very large stations, in terms of their throughputs, but occupying widely dispersed sites. Ideally, there should be sufficient stations so that no prospective customer need travel very far for petrol, so that the problem is essentially to obtain a balance between this requirement and that of station viability.

In terms of table 6.1, it would seem logical to select values of 200,000 and 300,000 gallons as the thresholds for service stations and filling stations respectively. This, in turn, based on the average annual consumption per vehicle of 345 gallons would imply that they would require to supply 580 and 870 cars, or their equivalent, respectively, so that thresholds may more usefully be expressed in this form.[20]

The ideal provision in any locality would be to have a mix of each type, as the service station performs activities other than petrol retailing, in particular vehicle repairs and sales. There were in the study-area in 1977, 153 filling stations and 446 service stations, making a total of 599 specialist petrol retailers. In other words, there were three times as many service stations as there were filling stations, so that this ratio should be maintained in deciding the ideal number for the whole area. One further factor should be applied in a consideration of the distribution of outlets, namely the type of location best suited to each category of outlet, as follows :-

(a) a filling station, as it has no other source of income, should only be sited on heavily-used major roads preferably in urban and suburban areas ;

(b) a service station may be sited as in (a) or in any other location where its threshold requirements can be met.

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20. In view of the partial reliance of some outlets on casual custom, the threshold could be met by a lower number of regular cars (or customers) making all their purchases at that station as long as the difference was made up by supplying petrol to occasional callers.

This consideration will only involve the specialist type of outlet as the garages are in effect relics of a past era in terms of their petrol retailing activities, and are unlikely to continue to participate for many more years. Their present insignificance can be demonstrated by the fact that the 125 non-specialist outlets in total sold only 3% of the entire amount of petrol supplied in the study-area in 1977.

Thresholds were expressed above in terms of vehicle numbers, with 580 and 870 cars being required for a service station and a filling station respectively. As there were in the study-area in 1977 a total of 258,460 petrol-using vehicles, it is now possible to calculate the numbers of outlets required for such a population. As it was decided to retain the 3 : 1 ratio, the following should give the required answer :-

$$\frac{258{,}460}{(3 \times 580) + (1 \times 870)} = \text{the number of sets of 3 service stations and 1 filling station.}$$

The number of sets is found to be 99, which means that the requirement is for 99 filling stations and 297 (= 3 x 99) service stations. These values imply a degree of accuracy that cannot be sustained in this type of allocation, so that actual numbers will be taken as 100 filling stations and 300 service stations.

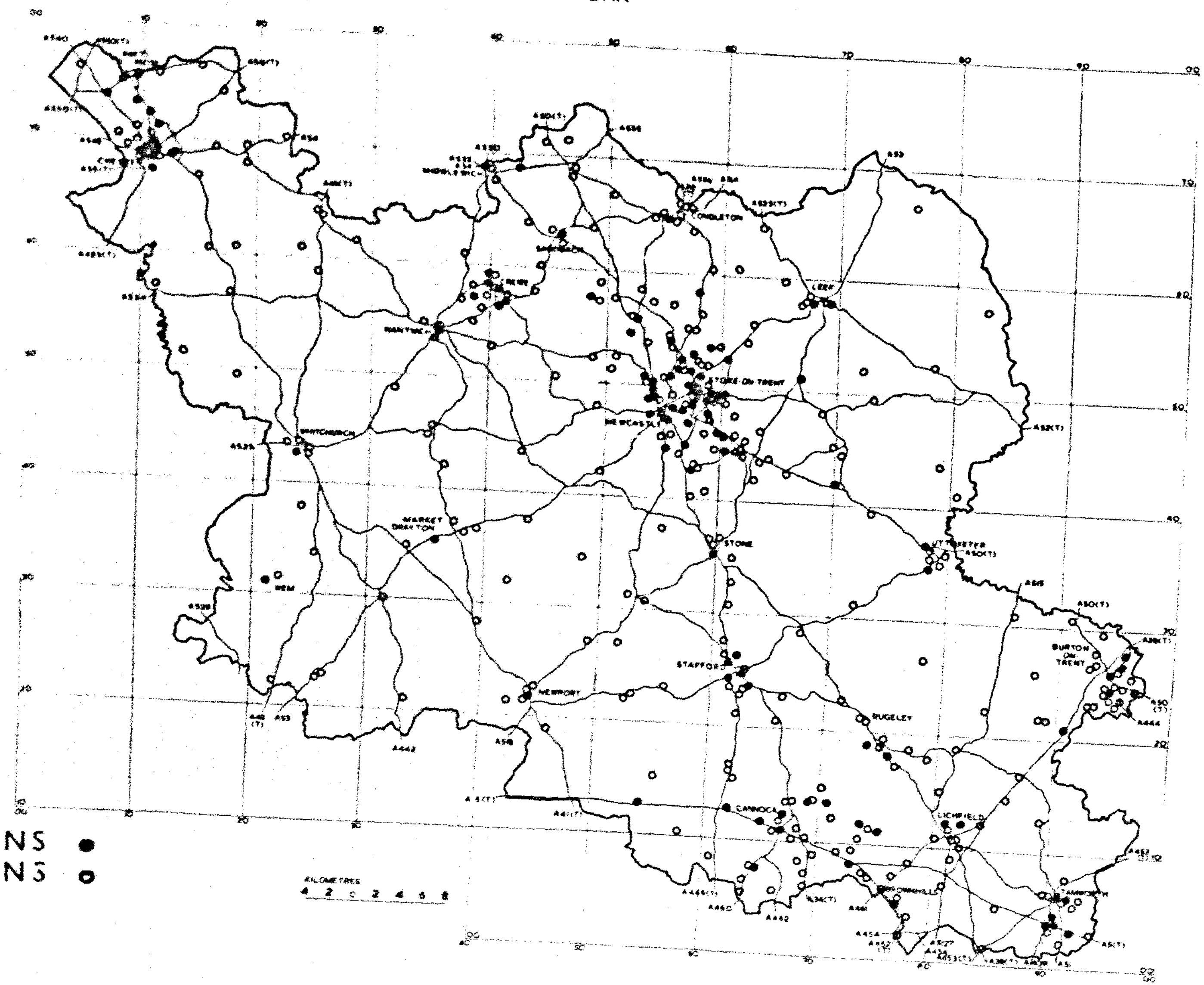
A distribution of the 400 specialist petrol retailers has been constructed in figure 6.14 and this will serve as a summary of one possible pattern. Clearly, the area could manage with many fewer sites, and might have to do so in a situation where some stations greatly exceeded their sales-threshold, thus causing others to become non-viable and eventually being terminated. There are, of course, many permutations that could be suggested, but this particular example would seem to be logical as it is based on actual criteria, as follows :-

(a) it is related to threshold levels ;

(b) it retains the ratio between filling stations and service stations as actually existed in 1977 ;

(c) it makes use of existing sites.

FIGURE 6.14 A THEORETICAL NETWORK



FILLING STATIONS ●
SERVICE STATIONS ○

With regard to the 100 filling stations, they have been allocated, where possible, to existing viable sites. Notice has been taken of throughputs, so that in general the selected filling stations are those that were viable and experienced substantial gallonages in 1977. It will be seen that very few have been placed outside urban and suburban areas, but, where this has occurred, such stations are on particularly busy roads such as the A5 or A38.

The task of allocating the 300 service stations to particular sites followed the same principle as above, so that attention was paid to both gallonage and required threshold. However, a comparison between figure 6.14 and 6.5 will reveal that a number of non-viable stations have been retained in the reduced network. This is quite deliberate and is based on the likelihood that some of the present non-viable stations could exceed their thresholds if some of their neighbours were to close. As an example, Tarporley,on the A51 between Chester and Nantwich, has retained one of its two non-viable outlets on the grounds that one could survive where two could not. Again, some of the selected sites were garages in 1977, but would in future be able to serve a dispersed rural population assuming that other neighbouring garages had withdrawn from petrol retailing.

In summary, figure 6.14 illustrates a situation in which filling stations are located on major arteries that carry heavy volumes of traffic, and, in all probability, not being unduly reliant on local custom as was demonstrated in figure 6.12 in the case of Crewe. The service stations, in contrast, are neighbourhood sites that fulfil a number of needs for locally-based custom, so that the only requirement for their siting is that there should exist a sufficient number of vehicles to provide the required threshold for their petrol forecourts.

Conclusion :

It was stated at the outset that the period of study, 1973-1977, spanned a time of turmoil and change in petrol retailing. Clearly, this was a complete coincidence as the study had been commenced before the 1973 Arab-Israeli War which set off a chain of reactions in the supply and pricing of petroleum. Petrol retailing was to experience severe marketing conditions due essentially to the rapid increase in the costs of crude, which led, in turn, to the advent of ever-higher selling prices for petrol.

The severity was heightened, not just by the two-year fall in sales which characterised part of the period, but by the fact that in 1973 there had been far too many outlets in the retail petrol market. The results were to put great pressure on these, and particularly on the weakest amongst them, namely those with low throughputs and little opportunity to follow the policy of discounting. In the event, terminations amongst such outlets have been very great, almost all the closed sites having been privately-owned. In contrast, managed and tenanted stations in receipt of financial support from their owners, the petrol suppliers, have largely survived.

One overall result has been to expedite the concentration of sales at company-owned stations. By 1977, with some 30% of all outlets in company control, at least 65% of all petrol sold passed through their forecourts. The trend towards the domination of the market by the petrol suppliers has been apparent for a long time, starting from the introduction of solus agreements in 1950 and continuing through the establishment of the first company-managed stations in 1955. However, the severe pressures since 1973 have accelerated this process and ensured the concentration of sales at the company sites, this having been made possible through discounting on a scale which few private dealers could emulate. Many of the latter have been forced to withdraw from the activity, thus ensuring an increasing concentration of sales at company stations with an overall reduction in the total population of outlets.

Thus, the period 1973-1977 has witnessed events which, in different circumstances, might have taken until the end of the century to be achieved. The future of the activity, in all probability, involves a further diminution in the number of outlets, possibly to a total within the study-area of about 400, as is suggested on pages 276-277. This would imply some 16,000 outlets for the whole of the U.K. as compared with about 29,000 at the end of 1977. Such a projection might well be exaggerating the scale of reductions, but it is certain that this number would be adequate to meet the demands of the market. Further, the decrease would certainly be within the private sector, where many existing outlets will close their petrol forecourts whilst probably continuing with other activities such as vehicle repairs.

As a concomitant to the decreasing number of outlets would be the increasing domination of the market by managed and tenanted stations. These, as has been demonstrated, are usually well-located to serve their customers, and also possess an impressive range of facilities, so that the average motorist need not despair at future prospects in petrol retailing. The one actual disadvantage will be that many motorists will have to drive further in order to visit their nearest stations, but, on the positive side, there will be no room for the sub-standard forecourt. It may well also mean that most purchases will be made at specialist retailing stations, with fewer customers being able to buy petrol at the stations where their cars are serviced and repaired.

Already the stage has been reached where the oil companies own the high-gallonage outlets, so that, in effect, they will exercise control over the whole means of distributing petrol. This is the new development that has been expedited since the traumas of 1973 and 1974, and it is this change from an activity characterised by large numbers of small, privately-owned outlets indulging in a multitude of activities, to one based on fewer, more efficient, company-owned specialist stations that has taken place during the period of study. Such a change has been paralleled in other sectors of the economy where mergers and take-overs have reduced the numbers of participants in most sectors of industry, and the amalgamation of farms which has led to fewer, larger and more-efficient units in agriculture.

In petrol retailing, it is not the numbers of competing suppliers that has fallen, but the numbers of actual outlets. Thus, the parallel is to be found in both industry and agriculture, and, for that matter, in other sectors of the retail trade, where the numbers of producing or retailing units has decreased due to merger activity. The difference is probably that the diminution in petrol retailing outlets has been achieved by intense competition, with resultant bankruptcies, as the successful outlet does not need to purchase the unsuccessful, as customers of the latter must unavoidably take their patronage to surviving outlets.

The eventual result will be to concentrate petrol retailing in the urban and suburban areas of customer residence, with its increasing withdrawal from districts of sparse population and villages. The effect on the spatial distribution of outlets will be similar to the developments in the grocery trade, for instance, where such concentration has already taken place. Thus, from its foundation during the 1920's and 1930's, when outlets were opened almost indiscriminately by private dealers, petrol retailing will operate through a reduced and more efficient network, but very much in the control of the large international oil companies. Thus, the 1970's have provided the conditions for such a rationalisation to take place much more rapidly than would otherwise have been the case.

A concluding section would be incomplete without some reference to the concern expressed in this dissertation for the need to examine the commercial viability of outlets. It is clear that this is the way to relate the required number of outlets to demand for their product, so that more attention should be devoted to such considerations in spatial studies of retailing. Admittedly, there are not many categories of retailing where the range of products are as limited as in petrol retailing, nor where conditions throughout the country are as uniform, but it is possible that the licensed trade might lend itself to such a study. Again, while it is possible that similar studies could be attempted for any type of low-order activity, very few have been attempted. Finally, it remains to be stressed that, in any such study, the essential requirement is to establish threshold levels, so that a theoretical network of outlets, or stores, may be based on realistic conditions.

Appendix A : Outlet indices and scores.

Key to Appendix A :

Set 1 : major activities other than petrol retailing

1 if present, 0 if not :-

column 1 - vehicle repairs and maintenance.

column 2 - vehicle sales (new cars, used cars or both).

column 3 - vehicle rental.

column 4 - a retail outlet not necessarily related specifically either to vehicles or to motorists, e.g. ironmongery, grocer, post office, public house, etc.

Set 2 : locational factors I

entries may be 2 or 1 or 0 - see pages 176-178 :-

column 5 - general location.

column 6 - numbers of vehicles within 0.96 kilometres.

column 7 - weekday traffic volume.

column 8 - actual location of site.

column 9 - statutory speed restrictions.

column 10 - visibility of station.

Set 3 : locational factors II

entries may be 2 or 1 or 0 - see page 178 :-

column 11 - distance to nearest neighbour.

column 12 - other outlets within 1.92 kilometres.

Set 4 : site-attributes I

entries may be 2 or 1 or 0 - see pages 179-183 :-

column 13 - nature of access and exit.

column 14 - width and depth of forecourt.

column 15 - pumps and pump stands.

column 16 - nature of service offered.

column 17 - availability of purchases by credit card.

column 18 - ownership and operation.

Set 5 : site-attributes II

1 if present, 0 if not - see pages 184-185 :-

column 19 - a shop, as a subsidiary activity, selling 'convenience' items.

column 20 - a canopy over the pump stands.

column 21 - toilets for customers.

column 22 - a car-wash.

Sub-totals : these are shown for each of Sets 2 to 5 inclusive :- maximum scores are as follows :-

Set 2 - 12 ; Set 3 - 4 ; Set 4 - 12 ; Set 5 - 4.

F = Functional type :

F. Filling station. G. Garage.
S. Service station. R. Other retail outlet.

Gp = Class : Classes 1 to 8 - see pages 220-221.

Age = period of establishment : - see page 186 :-

5. pre-1928
4. 1929-1939
3. 1945-1964
2. 1965-1973
1. post-1973

Brand : an index in brackets denotes a terminated site.

1.1 Shell
1.2 Esso
1.3 Texaco
1.4 B.P.
1.5 National
1.6 Fina

2.1 Mobil
2.2 Jet
2.3 Elf
2.4 Total
2.5 Amoco
2.6 Burmah
2.7 Apex
2.8 Chevron
2.9 Gulf
2.10 Murco

3.1 ICI
3.2 Globe
3.3 Sotro
3.4 MP
3.5 EP
3.6 Tops
3.7 Dragon
3.8 Enerco
3.9 Freedom
3.10 Nafta
3.11 Pure
3.12 Sheaf
3.13 Summit
3.14 Thames
3.15 U.K.
3.16 Ultramar.

Appendix A

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age. Brand
1.	1000	102201	22	220120	0010	6	4	7	1	S	7	1.3
2.	1000	101101	11	120121	1110	4	2	7	3	S	7	1.1
3.	1000	101011	22	220221	1110	4	4	9	3	S	7	1.1
4.	0000	101002	00	221220	1110	4	0	9	3	F	3	2.2
5.	0000	101201	10	220121	1110	5	1	8	3	F	3	2.6
6.	0000	101002	00	221120	1010	4	0	8	3	F	3	1.2
7.	1000	111012	11	110120	1010	6	2	5	2	S	8	1.1
8.	0000	101202	11	220121	1110	6	2	8	3	F	3	2.6
9.	0000	112012	11	222221	1110	7	2	11	3	F	3	2.4
10.	1000	101001	11	120020	1010	3	2	5	2	G		2.3
11.	1001	010011	11	000000	0000	3	2	0	0	R		(3.7)
12.	1100	111001	10	210120	1110	4	1	6	3	S	7	1.2
13.	0000	122212	10	220221	1111	10	1	9	4	F	1	1.4
14.	1000	010011	22	110020	0000	3	4	4	0	G		1.1
15.	1100	100001	00	220100	0010	2	0	5	1	S		(1.3)
16.	1000	000001	00	110020	1110	1	0	4	3	G		3.5
17.	1100	020011	01	221100	0000	4	1	6	0	S	8	1.5
18.	1000	020011	01	210000	1110	4	1	3	3	G		1.1
19.	0000	222012	00	222121	1110	9	0	10	3	F	1	1.1
20.	1000	121021	00	220121	1010	7	0	8	2	S	5	1.5
21.	1000	100002	01	220120	1100	3	1	7	2	S	7	2.2
22.	0000	100002	01	220120	1000	3	1	7	1	F	4	1.2
23.	1100	120021	10	110120	1000	6	1	5	1	S	8	2.1
24.	1100	121012	00	210120	1010	7	0	6	2	S	5	2.3
25.	1000	222021	00	211121	1010	9	0	8	2	S	5	1.1
26.	0000	121021	00	000120	1000	7	0	3	1	F	4	1.6
27.	1000	102021	01	010120	1000	6	1	4	1	S	8	1.1
28.	1000	102022	01	010220	1111	7	1	5	4	S	5	1.1
29.	0000	100001	22	000100	1000	2	4	1	1	F		(1.2)
30.	1000	121011	00	210120	1110	6	0	6	3	S	7	1.2
31.	1100	121022	00	211120	0110	7	0	7	2	S	5	2.9
32.	0000	222221	00	111121	1010	7	0	7	2	F	4	1.1
33.	1110	120021	00	210120	0111	6	0	6	3	S	7	2.6
34.	0000	122021	00	210121	1011	8	0	7	3	F	2	2.4
35.	1100	020020	00	000000	0100	4	0	0	1	G		3.4
36.	0000	222122	00	222221	1110	11	0	11	3	F	1	2.4
37.	1100	120120	00	000000	0000	6	0	0	0	G		(3.4)
38.	1000	020020	00	000000	0000	4	0	0	0	G		3.7
39.	1000	020021	00	100020	1011	5	0	3	3	G		1.6
40.	1000	102012	22	222221	1110	6	4	11	4	S	7	1.4
41.	1100	000010	02	110020	1000	1	2	4	1	G		(2.3)
42.	1000	112012	01	221121	1110	7	1	9	3	S	5	2.5
43.	1000	102021	01	000000	0000	6	1	0	0	G		(1.2)
44.	0000	101001	00	211121	1110	3	0	8	3	F		(1.4)
45.	0000	111001	10	211121	1011	4	1	8	3	F	3	2.8
46.	1000	120021	01	210121	1010	6	1	7	2	S	7	2.3
47.	1000	111012	10	210100	0000	6	1	4	0	S		(1.2)
48.	0000	222222	00	222221	1111	12	0	11	4	F	1	2.6
49.	1100	222222	00	211121	1010	12	0	8	2	S	5	2.1
50.	1100	222221	00	210120	0010	11	0	6	1	S		(1.2)

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age	Brand
51.	1110	222021	00	110110	1010	9	0	4	2	S	6		1.1
52.	1100	120021	00	110020	0000	6	0	4	0	G			1.2
53.	1100	122121	00	000120	0100	9	0	3	1	S	6		3.1
54.	0000	121121	00	000120	0110	8	0	3	2	F			(1.2)
55.	1100	120020	00	010121	1010	5	0	5	2	S	8		2.6
56.	1000	020020	00	000000	0000	4	0	0	0	G			(1.4)
57.	1100	020121	00	000120	0110	6	0	3	2	S	8		1.1
58.	1100	020020	00	000020	0000	4	0	2	0	G			(1.4)
59.	1100	020120	00	010000	0000	5	0	1	0	G			(1.4)
60.	1100	222221	00	000120	0000	11	0	3	0	S	6		1.1
61.	1000	222220	00	110121	1000	10	0	6	1	S	6		2.9
62.	0000	222122	00	222222	1110	11	0	12	3	F	1		1.3
63.	1100	222021	00	211221	1110	9	0	9	3	S	5		1.1
64.	1100	222021	00	000120	1110	9	0	3	3	S	6		2.6
65.	0000	222022	00	222222	1110	10	0	12	3	F	1		1.3
66.	1100	222221	00	000000	0000	11	0	0	0	G			(1.2)
67.	1000	221121	00	110120	0100	9	0	5	1	S	6		1.5
68.	0000	221021	00	210121	1011	8	0	7	3	F	2		1.2
69.	1100	111012	01	210120	1110	6	1	6	3	S	7		1.1
70.	1100	221120	01	100100	1100	8	1	2	2	S	6		2.1
71.	1100	221121	01	220121	1010	9	1	8	2	S	5		2.5
72.	0000	101001	01	212221	1110	3	1	10	3	F	3		2.6
73.	0000	101001	01	211221	1110	3	1	9	3	F	3		2.6
74.	1100	221121	01	210121	1110	9	1	7	3	S	5		2.5
75.	1100	020021	20	000020	0000	5	2	2	0	G			1.1
76.	1100	020020	00	000000	0000	4	0	0	0	G			1.2
77.	0000	121021	00	222221	1111	7	0	11	4	F	3		1.4
78.	1100	121021	10	210121	1100	7	1	7	2	S	5		1.4
79.	1000	020021	01	000100	1000	5	1	1	1	S	8		1.2
80.	1100	121011	11	210100	1110	6	2	4	3	S	8		1.3
81.	0000	101001	22	110120	1010	3	4	5	2	F			(1.2)
82.	1000	100201	21	210120	0110	4	3	6	2	S	7		1.2
83.	1000	100000	22	220120	1010	1	4	7	2	S	7		1.4
84.	1000	221111	00	221120	1010	8	0	8	2	S	5		1.3
85.	1000	000001	22	100000	1010	1	4	1	2	G			1.6
86.	0001	000021	22	000000	0000	1	3	0	0	R			(1.1)
87.	1000	121121	00	210121	1111	8	0	7	4	S	5		2.4
88.	1100	222221	00	000120	0000	11	0	3	0	S	6		1.1
89.	0000	120021	00	000100	1000	6	0	1	1	F	4		1.6
90.	1100	221120	00	100121	1111	8	0	5	4	S	5		1.2
91.	1000	222222	00	222221	1111	12	0	11	4	S	5		2.2
92.	1100	221021	00	110121	0010	8	0	6	1	S	6		1.2
93.	1100	121120	00	000000	0000	7	0	0	0	G			(1.2)
94.	1000	010001	10	110000	1000	2	1	2	1	G			1.4
95.	0000	100001	22	210100	1110	2	4	4	3	F			(1.2)
96.	0000	100002	22	211121	1110	3	4	8	3	F	3		1.1
97.	1000	121021	01	210120	1010	7	1	6	2	S	5		1.5
98.	1000	121021	01	111120	1010	7	1	6	2	S	5		2.1
99.	1100	121021	01	222221	1110	7	1	11	3	S	5		2.6
100.	1000	111012	10	211120	1100	6	1	7	2	S	7		2.1

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age.	Brand
101.	0100	100201	00	221121	1010	4	0	9	2	S	7		2.8
102.	1100	100101	00	221120	1010	3	0	8	2	S	7		2.2
103.	0000	120011	00	210110	1110	5	0	5	3	F	4		1.1
104.	0000	112012	00	211121	1010	7	0	8	2	F			(1.3)
105.	0000	222121	00	111222	1111	10	0	9	4	F	1		1.3
106.	1000	222120	00	110121	1010	9	0	6	2	S	5		1.1
107.	1000	020020	00	000020	0000	4	0	2	0	G			3.5
108.	1100	020021	00	210120	1110	5	0	6	3	S	7		2.1
109.	1000	121021	10	110120	1100	7	1	5	2	S	6		2.2
110.	1100	100011	21	010120	1000	3	3	4	1	S	8		2.1
111.	1100	100011	01	000120	0010	3	1	3	1	S			(2.3)
112.	1100	101002	01	210120	1010	4	1	6	2	S	7		1.1
113.	1000	000021	22	000000	0000	3	4	0	0	G			(1.2)
114.	0000	000001	22	210100	1110	1	4	4	3	F	4		1.1
115.	1000	000001	22	210100	1110	1	4	4	3	S	8		1.4
116.	1000	120120	00	000000	1000	6	0	0	1	G			1.2
117.	1100	121120	00	221120	1100	7	0	8	2	S	5		1.5
118.	1100	121121	00	221221	0110	8	0	10	2	S	5		1.4
119.	0000	222121	00	222222	1111	10	0	12	4	F	1		1.3
120.	1000	111101	00	010010	1000	5	0	2	1	G			1.5
121.	1000	100101	00	220120	1010	3	0	7	2	S	7		3.1
122.	1010	112012	11	000120	1000	7	2	3	1	S	6		3.2
123.	0100	121011	11	210120	1010	6	2	6	2	S	7		1.4
124.	1100	101001	01	110120	0000	3	1	5	0	S	8		1.2
125.	1000	000021	00	010000	0000	3	0	1	0	G			1.2
126.	0001	000011	11	000000	0000	2	2	0	0	R			(1.2)
127.	1000	020021	00	210000	0000	5	0	3	0	G			1.4
128.	0000	121121	00	211221	1110	8	0	9	3	F	1		2.8
129.	1100	222120	00	000000	0000	9	0	0	0	G			1.1
130.	1100	222120	00	010020	1000	9	0	3	1	G			1.6
131.	1000	020021	00	000000	0000	5	0	0	0	G			1.2
132.	1000	222021	00	222221	1110	9	0	11	3	S	5		1.3
133.	1000	100001	10	210000	1000	2	1	3	1	G			1.3
134.	1000	102001	11	210120	1010	4	2	6	2	S	7		1.6
135.	1000	111001	11	111100	1110	4	2	4	3	S	8		1.3
136.	1000	100001	21	210120	1010	2	3	6	2	S	7		1.2
137.	0000	100002	22	200100	1000	3	4	3	1	F	4		1.5
138.	1100	100021	00	211120	0000	4	0	7	0	S	8		2.1
139.	1100	101021	22	211120	1010	5	4	7	2	S	7		3.1
140.	1000	222020	00	110120	1010	8	0	5	2	S	6		2.10
141.	1010	222021	00	110100	1000	9	0	3	1	S	6		2.6
142.	1000	100001	00	210120	1010	2	0	6	2	S			(1.4)
143.	0000	101001	22	211120	1010	3	4	7	2	F	4		1.1
144.	1100	000021	22	210100	1110	3	4	4	3	S	8		1.5
145.	1000	000021	01	000000	0000	3	1	0	0	G			(1.2)
146.	1000	000021	11	010000	1000	3	2	1	1	G			1.5
147.	1000	000020	11	000000	1000	2	2	0	1	G			1.2
148.	1100	100011	21	211100	0010	3	3	5	1	S	8		1.1
149.	1100	202011	10	210121	1110	4	3	7	3	S	7		1.1
150.	1000	100001	10	211120	0010	2	1	7	1	S	7		1.2

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age	Brand
151.	1100	100001	10	220120	1010	2	1	7	2	S	7		1.5
152.	1100	121011	00	100120	1010	6	0	4	2	S	8		3.1
153.	1100	121021	00	110100	1100	7	0	3	2	S	6		1.2
154.	1000	000021	11	000100	1000	3	2	1	1	S	8		3.2
155.	0000	100002	10	210100	1010	3	1	4	2	F			(1.2)
156.	0001	000020	22	000000	0000	2	4	0	0	R			1.1
157.	0000	101002	01	211120	1010	4	1	7	2	F	4	5	1.1
158.	1100	101002	01	210120	1000	4	1	6	1	S	8	4	1.4
159.	1100	121022	00	211120	1110	8	0	7	3	S	8	4	1.1
160.	0000	222120	00	222222	1110	9	0	12	3	F	1	1	2.3
161.	1100	222220	00	111120	0000	10	0	6	0	S	6	4	2.6
162.	1000	222011	10	200100	1000	8	1	3	1	S	6	3	1.6
163.	1000	020011	01	010000	1000	4	1	1	1	G		5	(1.4)
164.	1000	020011	01	000000	0000	4	1	0	0	G		3	(3.2)
165.	1000	000021	22	100000	1000	3	4	1	1	G		5	1.3
166.	1000	000021	11	211100	1010	3	2	5	2	S	8	4	1.1
167.	1000	020021	00	110100	1000	5	0	3	1	S	8	3	1.1
168.	1000	222021	00	210120	0110	9	0	6	2	S	5	3	2.4
169.	1000	020020	00	000000	0000	4	0	0	0	G		4	(1.3)
170.	0000	222122	00	222222	1110	11	0	12	3	F	1	2	2.2
171.	0000	222121	00	222122	1010	10	0	11	2	F	1	3	1.3
172.	1100	122011	00	210120	1010	7	0	6	2	S	5	4	1.3
173.	1100	111012	10	220120	0010	6	1	7	1	S	7	2	2.4
174.	1100	112011	11	210120	1010	6	2	6	2	S	7	5	1.6
175.	0000	221021	00	210121	1010	8	0	7	2	F	2	2	1.1
176.	1100	221021	00	110121	1110	8	0	6	3	S	5	2	2.4
177.	1000	000011	10	010000	0000	2	1	1	0	G		3	(1.2)
178.	0000	000001	11	210100	1110	1	2	4	3	F	4	2	1.4
179.	1100	221022	00	121120	1010	9	0	7	2	S	5	3	1.1
180.	0100	221021	00	211121	1110	8	0	8	3	S	5	2	2.4
181.	1000	020020	00	010010	0010	4	0	2	1	G		2	2.3
182.	1100	020021	00	000120	0000	5	0	3	0	S	8	4	1.1
183.	1100	020020	00	000020	1010	4	0	2	2	G		4	3.1
184.	1100	020021	00	100100	1100	5	0	2	2	S	8	3	1.2
185.	1100	222121	00	111121	1111	10	0	7	4	S	5	3	2.1
186.	1100	221021	00	110000	1000	8	0	2	1	G		5	1.2
187.	1000	020020	00	000000	0000	4	0	0	0	G		3	1.4
188.	1100	221121	00	211121	1010	9	0	8	2	S	5	5	1.1
189.	0001	222120	00	000000	0000	9	0	0	0	R		5	(3.13)
190.	1000	020121	00	010020	0000	6	0	3	0	G		3	1.2
191.	0000	221121	00	211211	1010	9	0	8	2	F	2	2	1.6
192.	0000	101001	11	110120	1010	3	2	5	2	F	4	3	1.3
193.	1100	211222	10	210120	0010	10	1	6	1	S	6	5	1.2
194.	0000	221021	00	210121	0100	8	0	7	1	F	2	3	2.4
195.	1100	221022	00	210120	1010	9	0	6	2	S	5	2	1.6
196.	1100	020021	00	000120	1110	5	0	3	3	S	8	3	1.2
197.	0001	020021	00	000000	0000	5	0	0	0	R		4	3.1
198.	0000	222120	00	111221	1110	9	0	8	3	F	1	5	1.2
199.	1100	122121	00	110120	1110	9	0	5	3	S		4	(1.2)
200.	1100	222021	00	211121	0010	9	0	8	1	S	5	3	1.6

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age	Brad
201.	0000	121120	00	100120	0000	7	0	4	0	F.	4	3	1.1
202.	1100	020020	00	000000	0000	4	0	0	0	G		5	(2.3)
203.	1010	221122	00	210221	1110	10	0	8	3	S	5	5	2.7
204.	1100	121120	00	010020	0000	7	0	3	0	G		3	1.1
205.	1110	222120	00	011120	1011	9	0	5	3	S	5	5	1.1
206.	1100	222021	00	111220	1110	9	0	7	3	S	5	5	2.4
207.	0000	122021	01	210110	1000	8	1	5	1	F	2	5	1.1
208.	1000	121021	00	100121	1010	7	0	5	2	S	6	5	2.5
209.	1100	121021	00	110120	0000	6	0	5	0	S	8	5	2.3
210.	1000	111212	00	211220	1110	8	0	8	3	S	5	5	1.2
211.	1100	121021	00	100120	1000	7	0	4	1	S	6	5	1.2
212.	1100	121021	00	222120	0110	7	0	9	2	S	5	3	1.2
213.	0000	221011	00	221111	1010	7	0	8	2	F		3	(2.5)
214.	0001	000020	22	000000	0000	2	4	0	0	R			1.1
215.	1000	010021	01	210120	1100	4	1	6	2	S	7		1.5
216.	0001	110020	01	110000	0000	4	1	2	0	R			1.2
217.	1100	100002	21	221121	1010	3	3	9	2	S	7		1.1
218.	0000	101202	22	221121	1110	6	4	9	3	F	3		2.6
219.	1000	100201	22	100000	1000	4	4	1	1	G		5	1.2
220.	1100	222012	10	222221	1110	9	1	11	3	S	5	3	1.4
221.	0000	222121	00	112221	1111	10	0	9	4	F	1	5	1.4
222.	0000	222222	02	222221	1111	12	2	11	4	F	1	5	2.4
223.	1100	121101	10	210120	1110	6	1	6	3	S	7	3	1.6
224.	1000	020202	00	000000	0000	6	0	0	0	G		4	1.6
225.	1100	122202	00	010120	1000	9	0	4	1	S		3	(3.2)
226.	1000	122212	00	110100	0000	10	0	3	0	S		3	(3.13
227.	1100	020202	00	100100	1010	6	0	2	2	S.	8	3	2.4
228.	1000	122202	00	110120	1000	9	0	5	1	S	6	4	1.2
229.	1100	000021	10	110000	0000	3	1	2	0	G		3	2.1
230.	1000	010021	10	000000	0000	4	1	0	0	G		3	1.5
231.	1100	121012	00	221221	1111	7	0	10	4	S	5	2	2.1
232.	1000	111012	11	110120	1010	6	2	5	2	S	8	3	1.5
233.	0001	000000	22	000000	0000	0	4	0	0	R		4	(1.5)
234.	0000	100001	22	220120	1010	2	4	7	2	F	4	2	2.2
235.	0001	000001	12	000000	0000	1	3	0	0	R		5	3.4
236.	0000	222021	10	210110	0000	9	1	5	0	F	2	4	1.1
237.	1100	021021	00	110120	0000	6	0	5	0	S		3	(2.1)
238.	0000	222222	00	211121	0000	12	0	8	0	F	2	5	1.1
239.	0000	222222	00	222222	1111	12	0	12	4	F	1	1	2.4
240.	0000	222022	10	122221	1110	10	1	10	3	F	1	2	2.1
241.	1000	000001	10	100000	1000	1	1	1	1	G		3	(1.2)
242.	1000	110012	21	110020	1000	5	3	4	1	G		2	1.3
243.	1100	100011	22	210020	0000	3	4	5	0	G		2	1.5
244.	1000	000000	11	110000	0000	0	2	2	0	G		4	(3.9)
245.	0000	111001	00	220100	0000	4	0	5	0	F		4	(1.6)
246.	1100	222021	10	211120	0010	9	1	7	1	S	5	5	2.6
247.	1000	222021	00	210120	0010	9	0	6	1	S		4	(1.1)
248.	1000	222121	00	000000	0000	10	0	0	0	G		5	1.6
249.	1100	122020	00	000000	0000	7	0	0	0	G		5	1.1
250.	1100	222222	00	121121	0110	12	0	8	2	S	5	5	1.1

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age	Brand
251.	1100	222220	00	110120	0010	10	0	5	1	S	6	5	2.1
252.	1110	222222	00	121221	0111	12	0	9	3	S	5	5	1.4
253.	1000	020021	10	010000	0000	5	1	1	0	G		4	3.2
254.	1100	000021	11	100000	0000	3	2	1	0	G		3	3.3
255.	0000	222022	10	222222	1100	10	1	12	2	F	1	1	1.1
256.	1100	222021	00	110120	0000	9	0	5	0	S	6	4	1.4
257.	1000	222021	00	110120	0000	9	0	5	0	S	6	4	1.2
258.	1000	222022	00	110121	0000	10	0	6	0	S	6	2	2.1
259.	1000	222021	00	110110	1000	9	0	4	1	S	6	5	3.1
260.	1000	222021	00	220222	0000	9	0	10	0	S	5	2	2.10
261.	1000	121022	00	210111	1000	8	0	6	1	S	6	2	2.1
262.	1000	122022	11	221120	1110	9	2	8	3	S	5	3	2.1
263.	0000	100001	12	000100	0100	2	3	1	1	F	4	3	1.6
264.	1000	000010	22	000020	1000	1	4	2	1	G			3.4
265.	1110	211211	02	210120	1110	8	2	6	3	S	5	4	1.1
266.	1100	111012	10	110120	1110	6	1	5	3	S	7	5	2.2
267.	1110	111012	00	000120	1000	6	0	3	1	S	8	4	1.5
268.	1100	111012	00	220121	1110	6	0	8	3	S	7	3	1.6
269.	1100	100010	10	120000	0000	2	1	3	0	G		3	1.6
270.	1000	110021	00	000000	1000	5	0	0	1	G		5	1.4
271.	1100	100212	00	220120	1000	6	0	7	1	S		3	(1.3)
272.	1000	000021	00	100000	0000	3	0	1	0	G		3	(1.4)
273.	1000	102212	11	221121	1010	8	2	9	2	S	5	5	1.4
274.	1000	222021	00	112121	1000	9	0	8	1	S	5	4	1.2
275.	0000	222122	00	221222	1111	11	0	11	4	F	1	1	2.4
276.	1100	222021	00	110120	0000	9	0	5	0	S	6	5	1.5
277.	1100	122022	00	110120	0000	9	0	5	0	S	6	4	1.1
278.	1000	121021	00	000010	1000	7	0	1	1	G		3	1.2
279.	0000	222022	00	222222	1111	10	0	12	4	F	1	1	1.1
280.	0000	222222	00	222221	1110	12	0	11	3	F	1	1	2.5
281.	1000	222221	00	000000	0000	11	0	0	0	G		3	1.6
282.	1000	110021	22	100000	0000	5	4	1	0	G		4	1.5
283.	1000	100001	01	000000	0000	2	1	0	0	G		3	(2.1)
284.	1100	100001	11	210120	1010	2	2	6	2	S	7	3	1.2
285.	1000	000021	01	000000	0000	3	1	0	0	G			(1.1)
286.	0001	000020	22	000100	0000	2	4	1	0	R			1.4
287.	1000	100101	12	220120	0000	3	3	7	0	S	8	4	1.1
288.	1000	120021	00	000000	1000	6	0	0	1	G		5	3.2
289.	1000	120021	00	000100	1100	6	0	1	2	S	8	3	1.2
290.	1000	111021	10	210120	1100	6	1	6	2	S	7	4	2.10
291.	0100	222121	00	222221	1111	10	0	11	4	S	5	5	1.1
292.	0000	222122	00	211222	1100	11	0	10	2	F	1	2	2.7
293.	1000	222121	00	121121	1010	10	0	8	2	S	5	4	1.3
294.	0000	222021	00	222222	1000	9	0	12	1	F	1	1	1.3
295.	1000	222022	00	220100	0100	10	0	5	1	S	6	4	2.4
296.	1100	222221	00	222221	1100	11	0	11	2	S	5	4	1.4
297.	1100	122022	00	210120	0000	9	0	6	0	S	6	4	3.2
298.	1000	010021	10	100020	0000	4	1	3	0	G		3	1.3
299.	1000	100011	11	220120	1000	3	2	7	1	S	7	3	3.2
300.	1100	100011	01	210120	0000	3	1	6	0	S		3	(1.5)

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age	Brand
301.	0000	000021	22	110100	1000	3	4	3	1	F	4		1.4
302.	0000	101001	11	220121	1111	3	2	8	4	F	3		1.1
303.	1000	100001	22	000000	1000	2	4	0	1	G		5	3.4
304.	1000	000021	00	000000	1100	3	0	0	2	G		4	3.3
305.	1000	000021	00	000000	0000	3	0	0	0	G		3	(1.3)
306.	1100	100001	00	220120	1110	2	0	7	3	S	7	5	1.1
307.	1000	020011	10	110000	1100	4	1	2	2	G		5	1.4
308.	1100	222012	00	210120	1010	9	0	6	2	S	5	4	1.1
309.	1000	222121	00	110120	0000	10	0	5	0	S		3	(2.8)
310.	0000	222222	00	222221	1111	12	0	11	4	F	1	1	2.1
311.	1100	020020	00	010000	0000	4	0	1	0	G		3	(3.2)
312.	0000	222122	00	222222	1111	11	0	12	4	F	1	2	1.3
313.	1000	222021	00	010100	0000	9	0	2	0	S		4	(1.3)
314.	1000	222122	00	110120	1000	11	0	5	1	S	6	4	1.2
315.	1100	220022	00	220120	1000	8	0	7	1	S	5	3	1.2
316.	0100	222122	00	110121	0010	11	0	6	1	S	6	4	2.9
317.	1000	121021	00	000120	0000	7	0	3	0	S	6	4	1.2
318.	1100	120022	00	210120	0101	7	0	6	2	S	5	1	1.2
319.	0000	121022	00	120221	1100	8	0	8	2	F	2	1	1.2
320.	0000	222022	00	222222	1111	10	0	12	4	F	1	1	1.5
321.	0000	222122	00	222222	1111	11	0	12	4	F	1	2	2.2
322.	1100	222022	00	222220	1110	10	0	10	3	S	5	4	1.1
323.	0000	100222	22	100120	1110	7	4	4	3	F	4	4	1.2
324.	1000	000011	22	210100	1000	2	4	4	1	S	8	4	1.2
325.	1100	101002	11	220120	1110	4	2	7	3	S	7	4	1.2
326.	1000	100021	01	000000	1000	4	1	0	1	G		5	1.2
327.	1000	100021	01	110120	1000	4	1	5	1	S	8	5	1.3
328.	0000	221121	00	222222	1111	9	0	12	4	F	1	4	2.3
329.	1100	221021	00	210221	1111	8	0	8	4	S	5	3	2.1
330.	0000	222222	00	222221	1111	12	0	11	4	F	1	4	1.2
331.	0000	222122	00	222222	1111	11	0	12	4	F	1	1	1.3
332.	0000	222122	00	210120	0011	11	0	6	2	F		3	(1.2)
333.	1100	222021	00	221221	1110	9	0	10	3	S	5	4	1.1
334.	1000	121021	00	111220	1110	7	0	7	3	S		4	(2.4)
335.	1100	121021	00	222220	1111	7	0	10	4	S	5	3	1.5
336.	1100	222022	00	211121	1110	10	0	8	3	S	5	3	1.2
337.	1100	222122	00	010120	1110	11	0	4	3	S	6	5	1.2
338.	1100	222121	00	210121	1010	10	0	7	2	S	5	4	1.2
339.	0000	222122	00	221222	1110	11	0	11	3	F	1	3	2.7
340.	1100	222121	00	220100	0000	10	0	5	0	S	6	3	2.4
341.	1110	222122	00	122221	1111	11	0	10	4	S	5	3	1.5
342.	1000	020021	00	010000	1000	5	0	1	1	G		3	1.2
343.	1100	020021	00	120000	0000	5	0	3	0	G		4	3.1
344.	0000	222021	00	222221	1110	9	0	11	3	F	1	4	2.2
345.	1100	222020	00	011120	0010	8	0	5	1	S	6	4	1.1
346.	1000	020020	00	000000	0000	4	0	0	0	G		4	(3.2)
347.	1000	121020	00	110120	0100	6	0	5	1	S	8	4	1.2
348.	1100	222021	00	220121	1110	9	0	8	3	S	5	2	1.2
349.	1000	121021	00	000100	1100	7	0	1	2	S	6	5	1.2
350.	1000	000021	22	210120	1100	3	4	6	2	S	7		1.4

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age	Brand
351.	0001	000021	22	000000	0000	3	4	0	0	R		4	1.1
352.	1100	100011	01	110120	1110	3	1	5	3	S	7	3	1.5
353.	1100	100011	01	210120	1010	3	1	6	2	S	7	4	1.1
354.	0000	222221	00	112222	1110	11	0	10	3	F	1	3	2.5
355.	0000	222021	00	222222	1100	9	0	12	2	F	1	1	1.3
356.	1100	222121	00	110120	1010	10	0	5	2	S	6	3	2.4
357.	1000	222022	00	111111	1110	10	0	6	3	S	5	4	2.10
358.	1000	222021	00	110100	0000	9	0	3	0	S		5	(1.2)
359.	1000	222222	00	221220	1110	12	0	9	3	S	5	3	1.5
360.	1000	222122	00	211120	1000	11	0	7	1	S	5	4	1.2
361.	1100	222022	00	000020	0000	10	0	2	0	G		3	1.1
362.	0000	221022	00	221221	1111	9	0	10	4	F	1	2	2.1
363.	0000	222021	00	221120	1011	9	0	8	3	F	1	4	1.1
364.	1000	222021	00	000020	0000	9	0	2	0	G		4	(1.6)
365.	1000	020021	00	000020	1000	5	0	2	1	G		5	1.2
366.	1100	020021	00	000000	0000	5	0	0	0	G		4	1.1
367.	0000	222222	00	222222	1111	12	0	12	4	F	1	4	1.3
368.	0000	222121	00	110111	1000	10	0	5	1	F	2	2	2.9
369.	1100	222021	00	110120	0000	9	0	5	0	S		3	(2.4)
370.	1100	222222	00	211220	0000	12	0	8	0	S	5	4	1.4
371.	0000	222121	00	211222	1110	10	0	10	3	F	1	1	2.7
372.	1000	222222	00	221120	1010	12	0	8	2	S	5	3	1.2
373.	0100	222022	00	221221	1111	10	0	10	4	S	5	2	1.2
374.	1110	222022	00	110020	0000	10	0	4	0	G		5	1.2
375.	1100	222022	00	210121	1000	10	0	7	1	S	5	3	1.2
376.	1100	222022	00	210120	1010	10	0	6	2	S	5	4	1.1
377.	1100	020021	00	100020	0000	5	0	3	0	G		4	3.2
378.	1100	222022	00	110120	1000	10	0	5	1	S		3	(2.4)
379.	1100	122022	11	110120	1010	9	2	5	2	S		4	(3.2)
380.	1000	101112	01	210120	0010	6	1	6	1	S	8	3	1.1
381.	1000	100011	01	210020	0000	3	1	5	0	G		3	1.4
382.	1000	100020	22	210000	1100	3	4	3	2	G		3	1.4
383.	1100	100011	11	210120	1010	3	2	6	2	S	7	4	1.3
384.	1100	101020	11	210120	1010	4	2	6	2	S	7	3	1.4
385.	1100	010011	11	110100	0010	3	2	3	1	S	8	2	2.6
386.	1000	222022	00	210221	1110	10	0	8	3	S	5	2	2.1
387.	1000	221022	00	220000	0000	9	0	4	0	G		3	3.6
388.	0010	222122	00	211221	1010	11	0	9	2	S	5	5	2.1
389.	1000	222021	00	111121	1010	9	0	7	2	S	5	2	1.2
390.	0000	222122	00	222222	1111	11	0	12	4	F	1	1	2.1
391.	1000	020020	00	000000	0000	4	0	0	0	G		5	(1.5)
392.	1100	020020	00	000000	0000	4	0	0	0	G		4	(1.1)
393.	1100	222022	00	110120	0000	10	0	5	0	S	6	3	1.2
394.	1100	222022	00	000120	0000	10	0	3	0	S		3	(2.1)
395.	1100	222022	00	110120	1000	10	0	5	1	S		4	(1.6)
396.	0000	222021	00	222222	1111	9	0	12	4	F	1	2	2.4
397.	0000	222122	00	212222	1111	11	0	11	4	F	1	1	1.4
398.	1100	222112	00	110120	0000	10	0	5	0	S	6	4	1.1
399.	1000	020021	00	000000	0000	5	0	0	0	G		4	(1.1)
400.	0000	222112	00	211222	1101	10	0	10	3	F	1	2	2.2

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age	Brand
401.	0100	222022	00	211121	0000	10	0	8	0	S	5	3	1.1
402.	0100	020020	00	000000	0000	4	0	0	0	G		3	(3.4)
403.	0100	222022	00	211121	1010	10	0	8	2	S	5	3	1.3
404.	1100	100201	22	210120	1010	4	4	6	2	S	7	5	1.1
405.	1000	100020	21	110000	0000	3	3	2	0	G		5	(3.2)
406.	1000	000011	22	000000	1000	2	4	0	1	G			1.1
407.	1000	100011	21	110000	0000	3	3	2	0	G		5	1.1
408.	1100	111001	11	222121	1110	4	2	10	3	S	7	4	1.2
409.	1000	222120	00	000100	1000	9	0	1	1	S		5	(1.5)
410.	1100	222021	00	010120	1000	9	0	4	1	S	6	3	1.1
411.	0000	222121	00	211221	1110	10	0	9	3	F	1	5	1.1
412.	1100	222121	00	210121	0010	10	0	7	1	S	5	2	1.4
413.	1000	222222	00	010120	1010	12	0	4	2	S	6	5	1.1
414.	1100	121021	00	000120	0000	7	0	3	0	S	6	3	1.3
415.	0110	222122	00	222221	1111	11	0	11	4	S	5	3	1.2
416.	1100	222012	00	222221	1111	9	0	11	4	S	5	4	1.5
417.	0000	222021	00	211221	1111	9	0	9	4	F	1	4	1.2
418.	1000	020021	00	000000	0000	5	0	0	0	G		5	3.3
419.	0100	222120	00	010120	0000	9	0	4	0	S	6	5	1.2
420.	1100	121022	00	110120	0000	8	0	5	0	S		4	(1.3)
421.	0100	222121	00	111121	1000	10	0	7	1	S		3	(1.6)
422.	1000	020020	00	000000	0000	4	0	0	0	G		4	1.2
423.	0000	222012	00	210121	0110	9	0	7	2	F	2	2	1.2
424.	0000	222012	00	222222	0110	9	0	12	2	F	1	5	2.7
425.	1100	121021	00	111120	0000	7	0	6	0	S		5	(2.4)
426.	0000	222012	00	110121	1110	9	0	6	3	F	2	3	1.2
427.	0000	222012	10	210111	1110	9	1	6	3	F	2	3	1.1
428.	1000	000020	22	000000	0000	2	4	0	0	G			(1.4)
429.	1001	120020	22	000000	0100	5	4	0	1	G		4	1.1
430.	1100	221112	00	111120	1000	9	0	6	1	S	6	3	2.1
431.	1100	222012	00	220120	1000	9	0	7	1	S	5	3	1.1
432.	0000	222022	00	122222	1111	10	0	11	4	F	1	3	1.3
433.	1100	221021	00	000020	0000	8	0	2	0	G		4	(1.4)
434.	0100	221021	00	110120	0000	8	0	5	0	S	6	3	3.2
435.	0100	222022	00	110120	0000	10	0	5	0	S	6	4	1.2
436.	1000	020020	00	000020	0000	4	0	2	0	G		4	1.4
437.	1000	021020	00	000120	0000	5	0	3	0	S	8	5	1.1
438.	1100	222121	00	000120	0000	10	0	3	0	S	6	4	1.1
439.	1100	222122	00	111120	0100	11	0	6	1	S	6	5	1.1
440.	1100	020021	00	110020	1110	5	0	4	3	G		3	3.2
441.	0000	222022	00	112221	1111	10	0	9	4	F	1	3	1.5
442.	1000	121011	10	110120	1110	6	1	5	3	S	7	3	1.2
443.	0000	222011	01	110121	0000	8	1	6	0	F	2	2	2.1
444.	1000	222011	01	211110	1110	8	1	6	3	S	5	3	1.2
445.	1000	000021	22	000000	0000	3	4	0	0	G		4	1.2
446.	1000	101011	22	210100	1010	4	4	4	2	S		4	(3.2)
447.	1000	100121	01	210100	1000	5	1	4	1	S	8	5	3.1
448.	1100	100020	01	210120	1010	3	1	6	2	S	7	4	1.2
449.	1000	102011	11	210120	1010	5	2	6	2	S	7	4	1.2
450.	1000	222011	10	211221	1110	8	1	9	3	S	5	3	1.2

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age	Brand
451.	0100	221021	00	110120	0000	8	0	5	0	S		3	(1.1)
452.	1100	020012	10	120120	0100	5	1	6	1	S	8	4	1.1
453.	0000	222021	00	111121	1110	9	0	7	3	F	2	3	1.2
454.	1110	222021	00	210020	0000	9	0	5	0	G		5	1.1
455.	1100	222020	00	000120	0000	8	0	3	0	S	6	5	2.1
456.	1100	222021	00	010120	0000	9	0	4	0	S		4	(1.5)
457.	1000	222020	00	211121	1110	8	0	8	3	S	5	4	1.2
458.	1000	020021	00	000000	0000	5	0	0	0	G		5	(3.2)
459.	1100	222021	00	111120	1100	9	0	6	2	S	5	3	2.4
460.	0000	222022	00	121222	1110	10	0	10	3	F	1	2	2.7
461.	1100	020021	00	110120	0000	5	0	5	0	S	8	3	1.1
462.	1000	020022	00	211120	0000	6	0	7	0	S	8	3	3.1
463.	1000	110121	00	000000	0000	6	0	0	0	G		2	(2.2)
464.	1000	110021	01	110100	0100	5	1	3	1	S	8	3	3.1
465.	0000	100001	22	210100	1010	2	4	4	2	F	4	4	1.2
466.	0001	100121	01	000000	0000	5	1	0	0	R		5	1.1
467.	1000	100121	01	110100	0000	5	1	3	0	S		4	(1.4)
468.	1000	100121	01	100100	1010	5	1	2	2	S	8	4	1.4
469.	0000	222112	10	222222	1110	10	1	12	3	F	1	1	1.5
470.	0000	222221	00	210120	1010	11	0	6	2	F		5	(1.1)
471.	0000	222222	00	212222	1110	12	0	11	3	F	1	5	2.4
472.	1100	222012	00	111121	1110	9	0	7	3	S	5	3	1.2
473.	1000	021021	10	221221	1010	6	1	10	2	S	7	3	2.1
474.	0000	222121	00	211221	1100	10	0	9	2	F	1	5	2.1
475.	0001	222021	00	000000	0000	9	0	0	0	R		5	(1.1)
476.	1100	222021	00	000120	0110	9	0	3	2	S	6	5	1.3
477.	1100	222222	00	111120	0100	12	0	6	1	S	6	4	2.2
478.	1100	222122	00	221121	0000	11	0	9	0	S	5	5	2.5
479.	1000	020021	00	000000	0000	5	0	0	0	G		4	(1.6)
480.	1000	222021	00	000110	1000	9	0	2	1	S	6	4	1.1
481.	1100	222021	00	210020	0001	9	0	5	1	G		3	(1.4)
482.	0000	222021	00	211120	1010	9	0	7	2	F	2	3	1.4
483.	1100	222122	00	110100	0000	11	0	3	0	S	6	5	2.6
484.	1100	220021	01	100100	0000	7	1	2	0	S	6	4	3.2
485.	1000	220021	01	110100	0110	7	1	3	2	S	6	4	1.1
486.	1000	000021	22	000000	0000	3	4	0	0	G		3	2.2
487.	0000	000021	22	210100	1010	3	4	4	2	F	4		1.4
488.	1100	220021	00	210121	1110	7	0	7	3	S	5	5	2.3
489.	0001	120021	00	000000	0000	6	0	0	0	R		5	(3.4)
490.	1100	221121	00	211120	0010	9	0	7	1	S	5	5	1.1
491.	1100	221021	00	000000	0000	8	0	0	0	G		5	1.1
492.	1000	220121	00	110120	1000	8	0	5	1	S	6	4	1.1
493.	1100	222122	00	110120	0010	11	0	5	1	S		5	(1.2)
494.	0000	221021	00	210121	1110	8	0	7	3	F	2	3	1.2
495.	1100	222121	00	121120	1011	10	0	7	3	S	5	4	2.1
496.	1100	110011	00	210120	1010	4	0	6	2	S	7	4	1.4
497.	1000	121012	00	210120	1000	7	0	6	1	S	6	3	1.3
498.	1000	222011	00	000100	1000	8	0	1	1	S	6	4	3.8
499.	1000	222012	00	121210	1101	9	0	7	3	S	5	3	1.5
500.	1000	121221	00	000100	1000	9	0	1	1	S	6	5	3.14

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age	Brand
501.	1000	100011	22	110100	1000	3	4	3	1	S	8	4	1.2
502.	0000	110021	22	110120	1100	5	4	5	2	F	4	4	2.4
503.	1100	222120	00	110120	0000	9	0	5	0	S	6	5	1.4
504.	1100	222021	00	110120	0110	9	0	5	2	S	6	4	1.2
505.	0000	222122	00	222222	1100	11	0	12	2	F	1	3	2.5
506.	1000	222021	00	211121	1110	9	0	8	3	S	5	5	1.2
507.	1000	121111	00	210120	1010	7	0	6	2	S	5	2	1.3
508.	1000	121011	01	210120	1110	6	1	6	3	S	7	2	1.4
509.	0000	111011	01	210100	0010	5	1	4	1	F	4	3	1.2
510.	0000	000021	01	001100	1000	3	1	2	1	F	4	4	1.2
511.	1000	000020	01	210100	1000	2	1	4	1	S	8	5	1.1
512.	0000	102011	10	100120	1010	5	1	4	2	F	4	4	1.1
513.	1100	111011	01	211120	0000	5	1	7	0	S	8	4	2.4
514.	1000	101111	01	210120	1100	5	1	6	2	S		3	(1.2)
515.	0000	221121	01	112222	1111	9	1	10	4	F	1	2	1.3
516.	1000	120121	01	110100	1110	7	1	3	3	S	6	4	1.2
517.	1100	000020	21	110100	1010	2	3	3	2	S	8		1.6
518.	0100	102012	01	211100	1000	6	1	5	1	S		4	(1.1)
519.	1000	102112	10	220120	1110	7	1	7	3	S	5	5	1.4
520.	0001	000021	22	000000	0000	3	4	0	0	R		3	1.2
521.	0001	100201	22	210000	0000	4	4	3	0	R		4	1.1
522.	1000	100002	22	210100	0000	3	4	4	0	S	8	4	1.1
523.	1010	102011	11	110120	0000	5	2	5	0	S	8	4	2.2
524.	1100	010021	11	010020	0010	4	2	3	1	G		4	2.1
525.	1000	000010	11	110000	0000	1	2	2	0	G		4	(1.1)
526.	1000	000021	22	000000	0000	3	4	0	0	G		4	(1.2)
527.	1100	101001	01	220120	0000	3	1	7	0	S		3	(1.3)
528.	0000	101001	21	220120	1010	3	3	7	2	F	4	4	1.5
529.	1000	000010	22	000000	0000	1	4	0	0	G		4	1.2
530.	1000	100001	22	210120	1000	2	4	6	1	S	8	4	1.2
531.	0000	101001	22	110100	0010	3	4	3	1	F		3	(1.2)
532.	1000	000000	10	000000	0000	0	1	0	0	G		3	(1.4)
533.	0000	101011	22	110120	1010	4	4	5	2	F	4	4	1.3
534.	0000	101111	01	220100	1010	5	1	5	2	F		3	(1.1)
535.	1100	110211	01	220121	1011	6	1	8	3	S	7	2	2.9
536.	1000	010011	01	210120	1000	3	1	6	1	S	8	3	3.3
537.	1000	000020	22	000000	1000	2	4	0	1	G		3	1.5
538.	1000	000021	10	210000	1000	3	1	3	1	G		3	1.1
539.	1000	000020	22	000000	0000	2	4	0	0	G		4	1.6
540.	1010	000020	00	000000	0000	2	0	0	0	G		4	(1.3)
541.	0001	000001	12	000000	0000	1	3	0	0	R			(1.1)
542.	1000	000001	12	100000	0000	1	3	1	0	G		4	(2.2)
543.	1100	221021	00	111220	1111	8	0	7	4	S	5	4	1.4
544.	1100	221021	00	210121	1110	8	0	7	3	S	5	3	1.3
545.	1100	121021	00	000020	0000	7	0	2	0	G		4	1.1
546.	0001	121121	00	010000	0000	8	0	1	0	R		4	1.5
547.	1100	221121	00	110120	1110	9	0	5	3	S	5	3	1.2
548.	1000	121120	00	010100	1000	7	0	2	1	S	6	5	1.5
549.	1000	121021	00	000100	1010	7	0	1	2	S	6	5	1.4
550.	1100	212222	00	111120	1010	11	0	6	2	S	5	4	2.6

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age	Brand
551.	1100	221022	00	000120	1010	9	0	3	2	S	6	5	1.2
552.	1000	021021	00	110100	1110	6	0	3	3	S	8	4	1.2
553.	1000	221020	00	000120	1000	7	0	3	1	S	6	3	2.2
554.	0001	000020	22	000000	0000	2	4	0	0	R		4	(1.6)
555.	0000	221212	00	222221	1010	10	0	11	2	F	1	2	1.1
556.	0000	221122	00	211121	1110	10	0	8	3	F	1	2	2.5
557.	1100	020020	00	000000	0000	4	0	0	0	G		5	1.2
558.	1000	100002	11	210000	0000	3	2	3	0	G		3	1.3
559.	1000	110021	22	100020	1000	5	4	3	1	G		4	1.1
560.	1000	110021	01	000000	0000	5	1	0	0	G		5	(1.1)
561.	1000	110021	01	000000	0000	5	1	0	0	G		5	(3.11)
562.	1100	221021	00	210120	1110	8	0	6	3	S		4	(1.3)
563.	1100	221022	10	221221	1111	9	1	10	4	S	5	5	1.1
564.	0001	100001	22	200100	0000	2	4	3	0	R		3	(1.1)
565.	1100	222222	10	222221	1110	12	1	11	3	S	5	4	1.1
566.	0100	221021	00	210120	1110	8	0	6	3	S	5	3	1.5
567.	1100	221021	00	211120	0010	8	0	7	1	S	5	4	2.2
568.	1100	221121	00	000120	1100	9	0	3	2	S	6	5	1.5
569.	1100	020120	00	010120	0000	5	0	4	0	S	8	4	1.6
570.	0001	121020	00	000000	0000	6	0	0	0	R		4	(2.4)
571.	1000	000000	11	000000	1000	0	2	0	1	G		4	1.1
572.	1000	101101	11	210120	0000	4	2	6	0	S	8	4	1.2
573.	1000	000021	22	210120	1110	3	4	6	3	S	7	4	1.2
574.	1000	000021	22	110000	1000	3	4	2	1	G		4	1.2
575.	1000	110011	10	210120	1010	4	1	6	2	S	7	4	1.2
576.	1000	000010	22	000000	1110	1	4	0	3	G		4	1.2
577.	0000	211011	10	210121	1010	6	1	7	2	F	4	2	1.1
578.	0000	100001	11	110120	1000	2	2	5	1	F	4	3	1.2
579.	1000	100001	11	000000	1000	2	2	0	1	G		3	3.2
580.	1000	101112	11	220120	1010	6	4	7	2	S	7	4	1.5
581.	1100	102002	11	210120	1110	5	2	6	3	S	7	4	1.1
582.	1000	100000	22	210100	1010	1	4	4	2	S	8	4	1.5
583.	0000	101001	01	220100	0010	3	1	5	1	F		4	(1.2)
584.	0000	101001	11	220100	0010	3	2	5	1	F	4	4	2.2
585.	1000	100001	22	210000	0101	2	4	3	2	G		3	1.5
586.	0000	100002	11	210120	1110	3	2	6	3	F	4	5	1.2
587.	1100	120021	00	110120	1011	6	0	5	3	S	7	5	1.1
588.	1000	101011	01	110000	0000	4	1	2	0	G		4	(1.4)
589.	1000	000021	22	110000	0000	3	4	2	0	G		4	1.3
590.	1000	000021	11	000000	0000	3	2	0	0	G		3	(1.1)
591.	1000	000020	22	000000	1000	2	4	0	1	G		4	3.3
592.	0001	120021	01	000020	0000	6	1	2	0	R		5	1.2
593.	1100	120021	01	000120	1000	6	1	3	1	S	8	5	1.1
594.	1000	100002	22	110100	1110	3	4	3	3	S	8	4	1.1
595.	0000	100011	12	211100	1010	3	3	5	2	F			(2.1)
596.	1100	121021	00	210120	1010	7	0	6	2	S	5	4	1.4
597.	1100	121020	00	000120	0100	6	0	3	1	S	8	4	1.2
598.	1000	021021	00	000000	0000	6	0	0	0	G		4	(3.6)
599.	1000	121021	00	110120	1010	7	0	5	2	S	6	4	1.5
600.	1000	101220	01	010000	1000	6	1	1	1	G		4	(3.2)

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age	Brand
601.	1000	000021	01	010000	1000	3	1	1	1	G		3	1.5
602.	0000	101021	01	100100	0000	5	1	2	0	F	4	5	1.2
603.	1000	101011	01	000000	0000	4	1	0	0	G		3	(1.2)
604.	1000	100011	21	210100	0000	3	3	4	0	S	8	3	1.4
605.	1100	120011	01	210120	1000	5	1	6	1	S	8	3	1.2
606.	1100	102001	22	110120	1000	4	4	5	1	S	8	4	1.2
607.	0001	000000	22	000000	0000	0	4	0	0	R		4	(2.3)
608.	0001	100011	22	210000	0010	3	4	3	1	R			1.1
609.	1000	020021	22	010100	1000	5	4	2	1	S	8		1.1
610.	1000	100001	22	210120	1010	2	4	6	2	S	7	5	1.6
611.	1100	120021	21	210100	1000	6	3	4	1	S	8		1.3
612.	1000	100110	01	000000	0000	3	1	0	0	G		3	(1.2)
613.	1000	101112	01	000000	1000	6	1	0	1	G		4	(2.3)
614.	1100	101011	22	210120	1000	4	4	6	1	S	8	4	1.1
615.	0000	100002	11	010100	1000	3	2	2	1	F	4	4	1.2
616.	1000	100021	22	210120	1110	4	4	6	3	S	7	4	1.1
617.	1100	110021	11	210100	1010	5	2	4	2	S	8	2	1.4
618.	1100	100111	11	110120	1010	4	2	5	2	S	8	4	1.1
619.	0000	111011	10	210121	1110	5	1	7	3	F	4	4	1.1
620.	1000	000020	22	000000	0000	2	4	0	0	G		5	1.1
621.	0001	100021	00	000000	0000	4	0	0	0	R		4	(1.5)
622.	1000	100021	11	010000	1000	4	2	1	1	G		4	1.2
623.	1100	222012	00	111120	1110	9	0	6	3	S	5	5	1.5
624.	1100	100001	11	120120	1010	2	2	6	2	S	7	4	1.3
625.	1100	120022	00	210120	1010	7	0	6	2	S	5		1.6
626.	1000	120021	00	010120	1111	6	0	4	4	S	7		1.4
627.	0100	020021	00	100100	1000	5	0	2	1	S	8		3.1
628.	1100	221012	10	221120	1010	8	1	8	2	S			(2.1)
629.	0000	221012	00	222222	1111	8	0	12	4	F	1		1.3
630.	1000	000020	22	100000	0000	2	4	1	0	G		3	1.1
631.	1000	000020	22	000000	0000	2	4	0	0	G		4	(1.1)
632.	1100	100002	22	000000	1000	3	4	0	1	G		3	1.1
633.	1110	000001	11	210120	0010	1	2	6	1	S	8	4	2.2
634.	1100	020021	00	000000	0000	5	0	0	0	G		3	(1.4)
635.	1100	222221	00	211120	0010	11	0	7	1	S	5	5	2.5
636.	1100	222221	00	110120	1111	11	0	5	4	S		5	(2.5)
637.	1000	020020	00	000000	0000	4	0	0	0	G		4	(1.3)
638.	0001	020020	00	000000	0000	4	0	0	0	R		5	(1.4)
639.	1000	100002	11	220120	1110	3	2	7	3	S	7	3	1.5
640.	0001	000021	22	000100	0000	3	4	1	0	R		4	1.2
641.	1000	000001	22	210100	1110	1	4	4	3	S	8		1.1
642.	1000	020021	00	000100	1000	5	0	1	1	S			(1.5)
643.	1100	121021	00	211221	1110	7	0	9	3	S	5		1.1
644.	0000	222221	00	212220	1110	11	0	9	3	F	1		1.5
645.	1110	222121	00	210120	1100	10	0	6	2	S	5		1.4
646.	1100	222021	00	210120	1110	9	0	6	3	S	5		1.3
647.	1000	100011	22	110000	1110	3	4	2	3	G			1.3
648.	1000	100001	22	210120	1110	2	4	6	3	S	7	4	1.2
649.	1100	222121	00	222221	1110	10	0	11	3	S	5	2	1.1
650.	0000	222021	00	212222	1110	9	0	11	3	F	1	5	1.3

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age	Brand
651.	1100	121221	00	000100	0000	9	0	1	0	S	6	4	1.5
652.	1000	121121	00	212121	1110	8	0	9	3	S	5	3	1.2
653.	1000	000001	22	110020	0000	1	4	4	0	G			2.3
654.	1000	020020	00	000000	0000	4	0	0	0	G			(1.1)
655.	1000	020020	00	000000	0000	4	0	0	0	G			(1.5)
656.	1000	020020	00	110000	0000	4	0	2	0	G			(1.3)
657.	1100	020020	00	000000	0000	4	0	0	0	G			(1.1)
658.	1000	221021	00	222121	1100	8	0	10	2	S	5		1.2
659.	1100	222121	00	210120	1000	10	0	6	1	S	6		2.4
660.	1100	222221	00	210121	1110	11	0	7	3	S	5		1.4
661.	1000	020021	00	010120	1000	5	0	4	1	S	8		1.2
662.	1100	100012	22	221120	1010	4	4	8	2	S	7	4	1.4
663.	1000	221121	00	200120	1110	9	0	5	3	S	5	5	1.3
664.	0000	222221	00	222222	1110	11	0	12	3	F	1	5	2.2
665.	1000	221222	00	221121	1110	11	0	9	3	S	5	5	2.1
666.	1100	020021	00	100000	0000	5	0	1	0	G		4	1.1
667.	1100	222121	00	100120	0000	10	0	4	0	S		5	(1.1)
668.	1100	221020	00	100120	0100	7	0	4	1	S	6	3	1.2
669.	1100	121021	00	220121	0000	7	0	8	0	S	5		1.1
670.	1100	222021	00	110101	1010	9	0	4	2	S	6		2.9
671.	1100	221121	00	210121	0100	9	0	7	1	S	5		1.2
672.	1000	020020	00	000000	0000	4	0	0	0	G			(1.2)
673.	0000	222021	00	222222	1110	9	0	12	3	F	1		2.3
674.	1000	020020	00	110000	0000	4	0	2	0	G			(1.2)
675.	1100	121021	00	211222	1100	7	0	10	2	S	5		2.7
676.	0000	221012	00	222222	1110	8	0	12	3	F	1		1.3
677.	1000	111020	01	110120	1010	5	1	5	2	S	8	4	2.2
678.	1100	111021	01	210221	1010	6	1	8	2	S	7	3	2.3
679.	1000	101011	11	210100	0000	4	2	4	0	S	8	3	1.2
680.	0000	100001	22	221120	1010	2	4	8	2	F	4	3	1.5
681.	1100	121022	00	222221	1111	8	0	11	4	S	5	4	1.6
682.	1100	222022	00	211221	1110	10	0	9	3	S	5	4	1.1
683.	1000	222022	00	110000	1110	10	0	2	3	G		5	1.2
684.	1100	111011	10	000120	1010	5	1	3	2	S	8	5	1.1
685.	1100	100011	10	110120	1110	3	1	5	3	S	7	3	1.5
686.	1100	010021	12	210000	0000	4	3	3	0	G		4	(1.4)
687.	1100	100011	22	210100	1100	3	4	4	2	S	8		1.5
688.	1100	011021	00	220100	1010	5	0	5	2	S	8		2.2
689.	1000	221021	00	110120	1100	8	0	5	2	S	6		1.4
690.	1100	221021	00	210220	1110	8	0	7	3	S	5		1.5
691.	1100	020021	00	110020	0000	5	0	4	0	G			1.2
692.	1000	020020	00	000000	1100	4	0	0	2	G			3.12
693.	1000	121021	00	111221	1110	7	0	8	3	S	5		1.1
694.	1000	121021	00	210120	1100	7	0	6	2	S	5		1.6
695.	1000	100011	22	210120	1000	3	4	6	1	S	8	4	1.2
696.	0001	000010	22	000000	0000	1	4	0	0	R		4	3.3
697.	1100	220021	00	210121	1010	7	0	7	2	S	5	3	2.1
698.	0010	120021	00	010000	0000	6	0	1	0	G		4	3.3
699.	1100	120021	00	110100	1000	6	0	3	1	S	8	5	1.2
700.	1100	120021	00	110120	1010	6	0	5	2	S	8	4	2.1

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age	Brand
701.	1100	120021	00	110120	1110	6	0	5	3	S	7	4	1.1
702.	1100	100021	22	000100	0000	4	4	1	0	S	8	4	2.2
703.	1000	221022	00	211120	1010	9	0	7	2	S	5	4	1.2
704.	1000	110112	20	210120	1000	6	2	6	1	S	8	3	1.5
705.	0000	000021	10	220100	1010	3	1	5	2	F	4	3	1.1
706.	0000	121022	10	100100	1001	8	1	2	2	F	2		2.10
707.	0001	000020	01	110000	0000	2	1	2	0	R		4	(1.5)
708.	1000	100021	22	210100	1000	4	4	4	1	S	8	5	3.3
709.	1000	010020	11	000100	1010	3	2	1	1	S	8	4	1.1
710.	1000	221120	00	210101	1100	8	0	5	2	S	6	4	2.2
711.	0000	221121	00	221121	1110	9	0	9	3	F	1	5	1.1
712.	0000	020020	00	210121	1111	4	0	7	4	F	3	4	1.4
713.	1100	221021	00	000000	1000	8	0	0	1	G		5	(3.3)
714.	0001	221220	00	000000	0000	9	0	0	0	R		4	(1.6)
715.	1100	211112	11	222121	1110	8	2	10	3	S	5	4	1.4
716.	1000	101012	01	220120	1110	5	1	7	3	S	7	3	2.8
717.	1100	211011	00	220120	1010	6	0	7	2	S	7	5	2.3
718.	1100	211011	00	222221	1110	6	0	11	3	S	7	3	1.3
719.	1000	121121	00	000000	0000	8	0	0	0	G		4	(1.1)
720.	1000	121021	10	000020	1000	7	1	2	1	G		4	1.5
721.	1000	101012	01	110120	1110	5	1	5	3	S	7	4	1.5
722.	1000	121021	00	110120	1000	7	0	5	1	S	6	3	2.1
723.	1100	020021	00	000120	0000	5	0	3	0	S		5	(3.15)
724.	1100	120021	00	110120	1010	6	0	5	2	S	8	5	1.2
725.	1100	100121	22	000000	1000	5	4	0	1	G			1.1
726.	1100	020021	01	210121	1110	5	1	7	3	S	7		2.4
727.	1100	020020	00	220120	1110	4	0	7	3	S	7		1.2
728.	1000	111012	10	221121	1010	6	1	9	2	S	7		1.2
729.	0000	111011	11	221121	1010	5	2	9	2	F	3		1.3
730.	1000	000010	22	000000	0000	1	4	0	0	G			(1.3)
731.	1100	221122	00	210120	1111	10	0	6	4	S	5		1.1
732.	1100	221022	00	222221	1110	9	0	11	3	S	5		2.4
733.	1100	210021	00	220120	0010	6	0	7	1	S	7		1.3
734.	1100	210021	00	222221	1110	6	0	11	3	S			(1.4)
735.	0000	000011	10	110120	1000	2	1	5	1	F	4		2.2
736.	1000	101001	21	000100	1110	3	3	1	3	S	8		2.3
737.	0000	101001	22	210120	1110	3	4	6	3	F	4		2.2
738.	0000	211021	10	220121	1110	7	1	8	3	F	3		1.5
739.	0100	100011	00	220120	1010	3	0	7	2	S	7		2.3
740.	1100	100011	00	110120	1110	3	0	5	3	S	7		1.2
741.	1100	100121	22	110120	1000	5	4	5	1	S	8		1.3
742.	1000	101002	10	210120	1110	4	1	6	3	S	7		1.5
743.	1000	100011	11	221120	1010	3	2	8	2	S	7		1.2
744.	1000	110021	11	220120	0100	5	2	7	1	S	7		1.2
745.	1100	101001	22	221120	1010	3	4	8	2	S	7		2.2
746.	1000	101011	00	210110	1110	4	0	5	3	S	7		1.5
747.	1100	111012	00	200110	1010	6	0	4	2	S	8		3.1
748.	1100	111012	00	200120	1010	6	0	5	2	S	8		1.1
749.	1100	010012	11	110120	1110	4	2	5	3	S	7		1.2
750.	0001	110021	01	000000	0000	5	1	0	0	R			(1.6)

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age	Brand
751.	1100	111222	11	221121	1010	9	2	9	2	S	5		2.3
752.	1100	111012	10	211121	1010	6	1	8	2	S	7		1.2
753.	1000	100001	22	210100	1010	2	4	4	2	S	8		1.6
754.	1000	000020	22	000000	1000	2	4	0	1	G			1.1
755.	1000	010021	10	110120	1100	4	1	5	2	S	8		1.1
756.	1000	021021	00	110100	1000	6	0	3	1	S	8		1.2
757.	1000	020021	00	110120	0000	5	0	5	0	S	8		2.3
758.	1100	021021	00	210120	1010	6	0	6	2	S	7		3.6
759.	1000	000011	11	110000	1100	2	2	2	2	G			1.2
760.	0000	101002	02	210121	1110	4	2	7	3	F	4		1.2
761.	1000	101002	02	210121	1110	4	2	7	3	S	7		1.2
762.	1100	222022	00	211120	1110	10	0	7	3	S	5		1.3
763.	1000	222022	00	210121	0000	10	0	7	0	S	6		2.2
764.	0000	121021	00	221221	1111	7	0	10	4	F	3		2.2
765.	0000	121021	00	222221	1111	7	0	11	4	F	3		1.1
766.	1000	000002	11	010000	1010	2	2	1	2	G			3.16
767.	0000	101021	11	210121	1110	5	2	7	3	F	4		1.5
768.	0000	101022	11	222222	1111	6	2	12	4	F	3		1.3
769.	1000	101011	21	211100	1010	4	3	5	2	S	8		1.2
770.	0000	102112	22	210121	1010	7	4	7	2	F	4		1.3
771.	0000	121021	00	110120	1110	7	0	5	3	F	4		2.8
772.	1100	121021	00	000120	1110	7	0	3	3	S	6		2.3
773.	1000	221121	00	211221	1110	9	0	9	3	S	5		2.5
774.	1000	011021	00	120100	1010	5	0	4	2	S	8		1.5
775.	0001	010021	00	000000	0000	4	0	0	0	R			(1.1)
776.	1000	121021	00	000020	1000	7	0	2	1	G			(1.3)
777.	0000	121021	00	211121	1110	7	0	8	3	F	3		1.4
778.	0000	020021	10	210121	1011	5	1	7	3	F	4		2.10
779.	0000	111022	00	220100	1010	7	0	5	2	F			(2.5)
780.	1000	111122	10	120121	1010	8	1	7	2	S	5		1.6
781.	1000	100011	22	220100	0000	3	4	5	0	S	8		1.2
782.	0000	102002	10	210100	1010	5	1	4	2	F	4		1.2
783.	1100	212111	00	210120	1010	8	0	6	2	S	5		1.2
784.	0000	222222	00	222222	1010	12	0	12	2	F	1		1.1
785.	1000	121020	00	100120	1110	6	0	4	3	S	8		2.4
786.	1100	222122	00	222220	1110	11	0	10	3	S	5		1.1
787.	1100	222021	00	211221	1110	9	0	9	3	S	5		1.2
788.	0000	111021	01	221121	1011	6	1	9	3	F	3		1.3
789.	1100	121122	00	211120	1110	9	0	7	3	S	5		2.1
790.	0000	121022	00	211121	1111	8	0	8	4	F	1		1.1
791.	1100	221021	00	211121	1110	8	0	8	3	S	5		2.3
792.	1000	020020	00	000000	0000	4	0	0	0	G			(1.2)
793.	1100	222222	00	211120	1110	12	0	7	3	S	5		1.5
794.	1100	222222	00	211120	1110	12	0	7	3	S	5		1.1
795.	1000	010021	01	100100	1010	4	1	2	2	S	8		1.1
796.	1100	010021	01	210100	1010	4	1	4	2	S	8		1.5
797.	1100	222021	00	211121	1010	9	0	8	2	S	5		1.3
798.	1100	222222	00	221120	1010	12	0	8	2	S	5		2.1
799.	1000	010021	10	100000	1000	4	1	1	1	G			1.4
800.	1000	020021	00	100000	0000	5	0	1	0	G			1.3

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age	Brand
801.	1100	020021	00	110101	1110	5	0	4	3	S	8		2.3
802.	1100	020021	00	210120	0000	5	0	6	0	S	8		1.3
803.	0000	121021	00	222221	1110	7	0	11	3	F	3		2.5
804.	0000	121021	00	222220	1110	7	0	10	3	F	3		1.4
805.	1000	122022	10	210121	1110	9	1	7	3	S	5		2.8
806.	1100	122021	00	110120	1110	8	0	5	3	S	5		1.2
807.	1010	122221	00	210120	1010	10	0	6	2	S	5		1.1
808.	1000	020020	10	110120	1110	4	1	5	3	S	7		1.5
809.	1100	222021	00	220111	1110	9	0	7	3	S	5		1.2
810.	1000	112012	00	221121	1010	7	0	9	2	S	5		1.2
811.	1000	010021	10	110100	1110	4	1	3	3	S	8		1.1
812.	1100	121022	00	111120	1110	8	0	6	3	S	5		1.3
813.	1100	121022	10	220121	1110	8	1	8	3	S	5		1.1
814.	1100	010021	12	110120	1110	4	3	5	3	S	7		1.2
815.	1000	101012	01	211121	1010	5	1	8	2	S	7		1.5
816.	0000	101012	01	221121	1110	5	1	9	3	F	3		1.5
817.	1000	020021	10	211120	1110	5	1	7	3	S	7		1.6
818.	0000	112022	00	220100	1010	8	0	5	2	F	2		1.3
819.	1000	122012	00	220120	1010	8	0	7	2	S			(1.2)
820.	1100	102221	11	221121	1010	8	2	9	2	S	5		1.3
821.	0000	121001	21	110100	1000	5	3	3	1	F	4		1.1
822.	1000	121012	10	210120	1010	7	1	6	2	S	5		1.6
823.	0100	222011	00	210100	1110	8	0	4	3	S	6		1.1
824.	1100	222011	00	111120	1000	8	0	6	1	S	6		2.1
825.	1100	222021	00	210120	1110	9	0	6	3	S	5		2.2
826.	1100	222021	00	210121	1110	9	0	7	3	S	5		2.5
827.	1010	121021	00	100120	1100	7	0	4	2	S	6		1.2
828.	1000	111012	10	221120	1110	6	1	8	3	S	7		1.2
829.	1000	100011	22	010000	0000	3	4	1	0	G			1.1
830.	0000	221021	00	220121	1100	8	0	8	2	F	2		1.2
831.	0000	222012	01	211120	1110	9	1	7	3	F			(2.5)
832.	1000	222012	22	212120	1010	9	4	8	2	S	5		2.2
833.	1100	112012	11	220121	1110	7	2	8	3	S	5		2.2
834.	1000	221021	00	110120	1000	8	0	5	1	S	6		1.3
835.	1110	222021	00	010100	1000	9	0	2	1	S	6		1.1
836.	1000	222221	00	110120	1000	11	0	5	1	S	6		1.1
837.	1000	121021	22	210120	1110	7	4	6	3	S	5		1.4
838.	0000	222121	00	220120	0000	10	0	7	0	F	2		1.4
839.	1100	222221	00	220120	0000	11	0	7	0	S	6		2.1
840.	1100	221022	00	221120	1000	9	0	8	1	S	5		1.1
841.	1000	221121	00	010220	1100	9	0	5	2	S	6		1.5
842.	1100	020021	00	000000	0000	5	0	0	0	G			(1.3)
843.	0000	121021	00	220122	1100	7	0	9	2	F	3		2.10
844.	1000	020021	10	110120	1000	5	1	5	1	S	8		1.5
845.	1000	111011	11	221121	1010	5	2	9	2	S	7		1.3
846.	1100	010011	22	110100	1110	3	4	3	3	S	8		2.3
847.	1000	010021	10	110100	1000	4	1	3	1	S	8		2.6
848.	1000	102002	22	221121	1010	5	4	9	2	S	7		1.3
849.	1000	222221	00	110120	1000	11	0	5	1	S	6		1.1
850.	1100	222121	00	221121	0010	10	0	9	1	S	5		1.3

Ref. No.	Set 1	Set 2	Set 3	Set 4	Set 5	Sub-totals 2.	3.	4.	5.	F.	Gp.	Age	Brand
851.	1000	020021	00	010000	0000	5	0	1	0	G			1.4
852.	1000	020021	00	211111	1000	5	0	7	1	S	7		1.2
853.	0000	101002	10	221100	0010	4	1	6	1	F	4		3.10
854.	0000	101002	00	220100	0010	4	0	5	1	F			(1.6)
855.	1100	102222	22	221120	0010	9	4	8	1	S			(1.1)
856.	1100	122122	00	222221	1111	10	0	11	4	S	5		2.3
857.	1000	101002	10	210100	1000	4	1	4	1	S	8		1.3
858.	1100	122222	00	110120	1000	11	0	5	1	S	6		2.3
859.	1100	112122	00	221120	0010	9	0	8	1	S	5		1.5
860.	1100	111021	00	210120	0010	6	0	6	1	S	8		1.2
861.	1000	121021	00	000000	0000	7	0	0	0	G			(1.5)
862.	0000	122122	00	221121	1010	10	0	9	2	F	1		1.1
863.	1000	122122	00	221121	1010	10	0	9	2	S	5		1.1
864.	0001	122021	00	000000	0000	8	0	0	0	R			(1.2)
865.	1000	101212	11	210120	1010	7	2	6	2	S	5		1.3
866.	1100	101012	22	010000	0000	5	4	1	0	G			1.1
867.	1000	111022	00	210101	0100	7	0	5	1	S	6		1.2
868.	1000	111022	00	220121	1110	7	0	8	3	S	5		1.6
869.	1100	102002	22	000120	0000	5	4	3	0	S	8		1.5
870.	1000	102201	22	221120	0010	6	4	8	1	S	7		1.1

Appendix B : The Estimation of throughput - the customer-count method

In essence, this method is based on counting the numbers of customers patronising a particular station during a given time period. The observed number then becomes the base for the projection of the estimated number of customers during a longer period, normally a week, but must first be modified in terms of station opening hours, traffic flow and times of observation. Following this process of attempting to identify the possible number of customers in a week, the resultant value is multiplied by the known mean national purchase per visit to produce an estimate of gallonage sold.[1]

In order to explain the process in detail, an actual example will be used :-

1. A particular station is observed for a period of 30 minutes, during which time 6 customers are observed to enter.
2. As there are hourly variations in traffic flow which match quite closely the periods of low and peak activity at a station, the next step is the compilation of an index value to represent that particular day. (2) There are 2 sources from which the degree of hourly variation can be obtained.(3)
3. For periods of observation between 9.30 a.m. and 4. p.m., traffic flow may be regarded as average or standard.
   For periods between 8 a.m. and 9.30 a.m., and 4 p.m. to 6 p.m., when peak traffic conditions occur, the observed number of customers must be scaled down by 25% as this is the extent by which peak traffic exceeds the norm for the day.
   Observation during other periods of time have been found to be unreliable.
4. In this particular example, the period of observation was for 30 minutes between 2 p.m. and 3 p.m., so that the number of customers, 6, did not require modification as explained in 3 above.
5. The number of customers is then multiplied by the station's opening hours, in this case 7 a.m. to 8 p.m., viz. 13 hours. As the period of observation was 30 minutes, the multiplication factor here is 26.
6. The projected number of customers for a day is given by 26 x 6 = 156.

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1. In 1977, the mean purchase per visit was 4.6 gallons.
   Petroleum Review. March 1978.
2. During the survey of stations, operators were asked to indicate their busy and 'quiet' spells of day for custom, and these matched traffic flow very closely.
3. Highway Statistics. H.M.S.O. and the local authority's surveyors' department.

7. An allowance must now be made for the daily variation :-
In the major towns, daily traffic volume was as follows :-

Monday 93, Tuesday 92, Wednesday 92, Thursday 92, Friday 100.

(the weekend is excluded as it was found to be unreliable).

8. As the differences are not great, an observation made during the first four days is increased by only 5% of its value, while one made on Friday is reduced by the same amount.

9. In this particular example, the observation took place on a Thursday so that the value of 156 is increased by 5% of its value -

156 + (5% of 156) = 156 + 7.8 = <u>163.8</u>

10. As this station was open for only 6 days during the week, being closed on Sundays, the value in 9 above is multiplied by 6 -

163.8 x 6 = <u>982.8</u>

11. A weekly total has now been obtained of the number of customers, but it is still necessary to take regard of monthly variations.
The months of April, May, June, October and November have approximately mean traffic flows, so that no further modification is required.
The months of July, August and September have above-average flows, so that the weekly total is reduced by 10%.
The remaining months, January, February, March and December have below-average flows, so that the weekly total is increased by 10%.

12. As the actual observation took place in May, no further action is required in this case.

13. The weekly total is multiplied by the average purchase per visit -

982.8 x 4.6 = <u>4520.88 gallons</u> (per week)

14. This result is upgraded to an annual amount by multiplying by 52 -

4520.88 x 52 = <u>235,085.76 gallons</u>.

15. This amount of detail is disregarded, the result being seen to fall in the 200,000 - 250,000 gallon band, this being the range indicated by the operator of this station.

Appendix C : Apparent degree of viability and non-viability of specialist outlets based on postulated thresholds and recorded throughputs.

Key :

Class	-	the classification made in Chapter 5.
Age	-	O - stations established prior to 1945, recording 4 or 5 in the Age column of Appendix A ; N - stations established post-1945, recording 1, 2 or 3 in the Age column of Appendix A.
Threshold	-	estimates based on Class and Age made in Chapter 6. (in thousands of gallons)
Throughput	-	approximate annual gallonages, recorded as explained in Chapter 6. (in thousands of gallons)
Viability	-	+ throughput apparently in excess of threshold ; - throughput apparently below threshold.
Control	-	2 company-managed station ; 1 company owned station, operated by a tenant ; 0 privately owned and operated station.
Brand	-	as indicated in the key to Appendix A.

Filling Stations:

Ref. No.	Class	Age	Threshold	Throughput	Viability	Control	Brand
4.	3	N	230	100-150	-	0	2.2
5.	3	N	230	200-250	+	1	2.6
6.	3	N	230	100-150	-	0	1.2
8.	3	N	230	200-250	+	1	2.6
9.	3	N	230	350-400	+	1	2.4
13.	1	O	300	350-400	+	1	1.4
19.	1	N	350	350-400	+	1	1.1
22.	4	O	150	50-100	-	0	1.2
26.	4	N	180	50-100	-	0	1.6
32.	4	N	180	500 +	+	1	1.1
34.	2	N	300	500 +	+	1	2.4
36.	1	N	350	500 +	+	1	2.4
45.	3	N	230	50-100	-	1	2.8
48.	1	N	350	350-400	+	1	2.6
62.	1	N	350	500 +	+	2	1.3
65.	1	N	350	500 +	+	2	1.3
68.	2	O	250	150-200	-	1	1.2
72.	3	N	230	200-250	+	1	2.6
73.	3	N	230	200-250	+	1	2.6
77.	3	N	230	400-500	+	1	1.4
89.	4	O	150	50-100	-	0	1.6
96.	3	O	200	50-100	-	1	1.1
103.	4	N	180	100-150	-	0	1.1
105.	1	N	350	500 +	+	2	1.3
114.	4	O	150	50-100	-	0	1.1
119.	1	N	350	500 +	+	2	1.3
128.	1	N	350	150-200	-	1	2.8
137.	4	O	150	50-100	-	0	1.5
143.	4	O	150	50-100	-	0	1.1
157.	4	O	150	50-100	-	0	1.1
160.	1	N	350	500 +	+	2	2.3
170.	1	N	350	500 +	+	2	2.2
171.	1	N	350	150-200	-	2	1.3
175.	2	N	300	300-350	+	1	1.1
178.	4	N	180	50-100	-	0	1.4
191.	2	N	300	100-150	-	1	1.6
192.	4	N	180	50-100	-	0	1.3
194.	2	N	300	300-350	+	1	2.4
198.	1	O	300	400-500	+	1	1.2
201.	4	N	180	50-100	-	0	1.1
207.	2	O	250	100-150	-	0	1.1
218.	3	N	230	100-150	-	1	2.6
221.	1	O	300	500 +	+	1	1.4
222.	1	O	300	500 +	+	1	2.4
234.	4	N	180	50-100	-	0	2.2
236.	2	O	250	150-200	-	0	1.1
238.	2	O	250	350-400	+	1	1.1
239.	1	N	350	500 +	+	2	2.4
240.	1	N	350	150-200	-	1	2.1
255.	1	N	350	500 +	+	2	1.1

Ref. No.	Class	Age	Threshold	Throughput	Viability	Control	Brand
263.	4	N	180	-50	-	0	1.6
275.	1	N	350	350-400	+	2	2.4
279.	1	N	350	350-400	+	2	1.1
280.	1	N	350	500 +	+	1	2.5
292.	1	N	350	500 +	+	2	2.7
294.	1	N	350	500 +	+	2	1.3
301.	4	O	150	50-100	-	0	1.4
302.	3	O	200	50-100	-	1	1.1
310.	1	N	350	350-400	+	1	2.1
312.	1	N	350	500 +	+	2	1.3
319.	2	N	300	100-150	-	1	1.2
320.	1	N	350	500 +	+	2	1.5
321.	1	N	350	500 +	+	2	2.2
323.	4	O	150	150-200	+	0	1.2
328.	1	O	300	400-500	+	2	2.3
330.	1	O	300	300-350	+	1	1.2
331.	1	N	350	350-400	+	2	1.3
339.	1	N	350	400-500	+	2	2.7
344.	1	O	300	250-300	-	1	2.2
354.	1	N	350	500 +	+	2	2.5
355.	1	N	350	500 +	+	2	1.3
362.	1	N	350	100-150	-	1	2.1
363.	1	O	300	100-150	-	0	1.1
367.	1	O	300	500 +	+	2	1.3
368.	2	N	300	100-150	-	1	2.9
371.	1	N	350	500 +	+	2	2.7
390.	1	N	350	500 +	+	2	2.1
396.	1	N	350	500 +	+	2	2.4
397.	1	N	350	500 +	+	2	1.4
400.	1	N	350	400-500	+	2	2.2
411.	1	O	300	500 +	+	1	1.1
417.	1	O	300	300-350	+	1	1.2
423.	2	N	300	150-200	-	1	1.2
424.	1	O	300	300-350	+	2	2.7
426.	2	N	300	100-150	-	1	1.2
427.	2	N	300	150-200	-	1	1.1
432.	1	N	350	500 +	+	2	1.3
441.	1	N	350	350-400	+	1	1.5
443.	2	N	300	100-150	-	1	2.1
453.	2	N	300	300-350	+	1	1.2
460.	1	N	350	300-350	-	2	2.7
465.	4	O	150	50-100	-	0	1.2
469.	1	N	350	500 +	+	2	1.5
471.	1	O	300	500 +	+	2	2.4
474.	1	O	300	300-350	+	1	2.1
482.	2	N	300	100-150	-	0	1.4
487.	4	O	150	50-100	-	0	1.4
494.	2	N	300	250-300	-	1	1.2
502.	4	O	150	150-200	+	0	2.4
505.	1	N	350	350-400	+	2	2.5

Ref. No.	Class	Age	Threshold	Throughput	Viability	Control	Brand
509.	4	N	180	50-100	-	0	1.2
510.	4	0	150	50-100	-	0	1.2
512.	4	0	150	150-200	+	0	1.1
515.	1	N	350	350-400	+	2	1.3
528.	4	0	150	150-200	+	0	1.5
533.	4	0	150	50-100	-	0	1.3
555.	1	N	350	350-400	+	1	1.1
556.	1	N	350	350-400	+	1	2.5
577.	4	N	180	200-250	+	1	1.1
578.	4	N	180	50-100	-	0	1.2
584.	4	0	150	150-200	+	0	2.2
586.	4	0	150	150-200	+	0	1.2
602.	4	0	150	50-100	-	0	1.2
615.	4	0	150	50-100	-	0	1.2
619.	4	0	150	150-200	+	1	1.1
629.	1	N	350	500 +	+	2	1.3
644.	1	0	300	500 +	+	0	1.5
650.	1	0	300	500 +	+	2	1.3
664.	1	0	300	500 +	+	2	2.2
673.	1	N	350	350-400	+	2	2.3
676.	1	N	350	400-500	+	2	1.3
680.	4	N	180	50-100	-	0	1.5
705.	4	N	180	50-100	-	0	1.1
706.	2	N	300	100-150	-	0	2.10
711.	1	0	300	350-400	+	1	1.1
712.	3	0	200	200-250	+	1	1.4
729.	3	N	230	300-350	+	1	1.3
735.	4	N	180	50-100	-	0	2.2
737.	4	0	150	50-100	-	0	2.2
738.	3	N	230	200-250	+	1	1.5
760.	4	N	180	300-350	+	1	1.2
764.	3	N	230	200-250	+	1	2.2
765.	3	N	230	300-350	+	1	1.1
767.	4	0	150	150-200	+	1	1.5
768.	3	N	230	350-400	+	2	1.3
770.	4	0	150	300-350	+	1	1.3
771.	4	N	180	150-200	+	0	2.8
777.	3	N	230	200-250	+	1	1.4
778.	4	N	180	150-200	+	1	2.10
782.	4	0	150	150-200	+	0	1.2
784.	1	0	300	500 +	+	2	1.1
788.	3	N	230	200-250	+	1	1.3
790.	1	N	350	350-400	+	1	1.1
803.	3	N	230	200-250	+	1	2.5
804.	3	N	230	200-250	+	0	1.4
816.	3	N	230	250-300	+	1	1.5
818.	2	0	250	250-300	+	0	1.3
821.	4	N	180	50-100	-	0	1.1
830.	2	N	300	150-200	-	1	1.2
833.	2	0	250	250-300	+	0	1.4
843.	3	0	200	200-250	+	2	2.10
853.	4	0	150	150-200	+	0	3.10
862.	1	N	350	350-400	+	1	1.1

Service Stations :

Ref. No.	Class	Age	Threshold	Throughput	Viability	Control	Brand
1.	7	0	130	150–200	+	0	1.3
2.	7	N	150	150–200	+	1	1.1
3.	7	N	150	150–200	+	1	1.1
7.	8	0	80	100–150	+	0	1.1
12.	7	N	150	50–100	–	0	1.2
17.	8	0	80	–50	–	0	1.5
20.	5	N	260	150–200	–	1	1.5
21.	7	0	130	50–100	–	0	2.2
23.	8	N	100	100–150	+	0	2.1
24.	5	N	260	100–150	–	0	2.3
25.	5	N	260	250–300	+	1	1.1
27.	8	N	100	100–150	+	0	1.1
28.	5	0	240	100–150	–	0	1.1
30.	7	0	130	100–150	+	0	1.2
31.	5	N	260	100–150	–	0	2.9
33.	7	0	130	50–100	–	0	2.6
40.	7	0	130	250–300	+	1	1.4
42.	5	N	260	250–300	+	1	2.5
46.	7	N	150	50–100	–	1	2.3
49.	5	0	240	250–300	+	1	2.1
51.	6	0	180	50–100	–	0	1.1
53.	6	0	180	300–350	+	0	3.1
55.	8	N	100	100–150	+	1	2.6
57.	8	0	80	50–100	+	0	1.1
60.	6	0	180	50–100	–	0	1.1
61.	6	N	200	250–300	+	1	2.9
63.	5	N	260	300–350	+	1	1.1
64.	6	0	180	50–100	–	0	2.6
67.	6	0	180	50–100	–	0	1.5
69.	7	0	130	100–150	+	0	1.1
70.	6	0	180	50–100	–	0	2.1
71.	5	0	240	200–250	+	1	2.5
74.	5	0	240	100–150	–	1	2.5
78.	5	N	260	100–150	–	1	1.4
79.	8	0	80	50–100	+	0	1.2
80.	8	N	100	100–150	+	0	1.3
82.	7	0	130	50–100	–	0	1.2
83.	7	0	130	50–100	–	0	1.4
84.	5	0	240	300–350	+	0	1.3
87.	5	N	260	250–300	+	1	2.4
88.	6	0	180	50–100	–	0	1.1
90.	5	N	260	100–150	–	1	1.2
91.	5	N	260	250–300	+	1	2.2
92.	6	0	180	50–100	–	1	1.2
97.	5	0	240	100–150	–	0	1.5
98.	5	0	240	200–250	+	0	2.1
99.	5	N	260	150–200	–	1	2.6
100.	7	N	150	150–200	+	0	2.1
101.	7	0	130	50–100	–	1	2.8
102.	7	0	130	100–150	+	0	2.2

Ref. No.	Class	Age	Threshold	Throughput	Viability	Control	Brand
106.	5	0	240	200-250	+	1	1.1
108.	7	N	150	50-100	-	0	2.1
109.	6	N	200	200-250	+	0	2.2
110.	8	0	80	-50	-	0	2.1
112.	7	0	130	50-100	-	0	1.1
115.	8	0	80	-50	-	0	1.4
117.	5	0	240	100-150	-	0	1.5
118.	5	0	240	100-150	-	1	1.4
121.	7	0	130	100-150	+	0	3.1
122.	6	0	180	50-100	-	0	3.2
123.	7	N	150	50-100	-	0	1.4
124.	8	0	80	50-100	+	0	1.2
132.	5	N	260	250-300	+	1	1.3
134.	7	0	130	50-100	-	0	1.6
135.	8	N	100	50-100	-	0	1.3
136.	7	0	130	50-100	-	0	1.2
138.	8	0	80	50-100	+	0	2.1
139.	7	0	130	100-150	+	0	3.1
140.	6	0	180	50-100	-	0	2.10
141.	6	N	200	50-100	-	0	2.6
144.	8	0	80	50-100	+	0	1.5
148.	8	0	80	-50	-	0	1.1
149.	7	N	150	150-200	+	1	1.1
150.	7	0	130	100-150	+	0	1.2
151.	7	0	130	50-100	-	0	1.5
152.	8	0	80	50-100	+	0	3.1
153.	6	0	180	50-100	-	0	1.2
154.	8	N	100	-50	-	0	3.2
158.	8	0	80	50-100	+	0	1.4
159.	8	N	100	100-150	+	0	1.1
161.	6	0	180	100-150	-	0	2.6
162.	6	N	200	50-100	-	0	1.6
166.	8	0	80	50-100	+	0	1.1
167.	8	N	100	-50	-	0	1.1
168.	5	N	260	100-150	-	0	2.4
172.	5	0	240	100-150	-	0	1.3
173.	7	N	150	150-200	+	0	2.4
174.	7	0	130	100-150	+	0	1.6
176.	5	N	260	250-300	+	1	2.4
179.	5	N	260	100-150	-	0	1.1
180.	5	N	260	150-200	-	1	2.4
182.	8	0	80	50-100	+	0	1.1
184.	8	N	100	50-100	-	0	1.2
185.	5	N	260	250-300	+	1	2.1
188.	5	0	240	250-300	+	1	1.1
193.	6	0	180	150-200	+	0	1.2
195.	5	N	260	100-150	-	0	1.6
196.	8	N	100	50-100	-	0	1.2
200.	5	N	260	350-400	+	1	1.6
203.	5	0	240	150-200	-	1	2.7

Ref. No.	Class	Age	Threshold	Throughput	Viability	Control	Brand
205.	5	0	240	100-150	-	0	1.1
206.	5	0	240	250-300	+	0	2.4
208.	6	0	180	150-200	+	1	2.5
209.	8	0	80	50-100	+	0	2.3
210.	5	0	240	250-300	+	0	1.2
211.	6	0	180	50-100	-	0	1.2
212.	5	N	260	100-150	-	0	1.2
215.	7	0	130	50-100	-	0	1.5
217.	7	N	150	50-100	-	1	1.1
220.	5	N	260	300-350	+	1	1.4
223.	7	N	150	50-100	-	0	1.6
227.	8	N	100	100-150	+	0	2.4
228.	6	0	180	50-100	-	0	1.2
231.	5	N	260	300-350	+	1	2.1
232.	8	N	100	100-150	+	0	1.5
246.	5	0	240	100-150	-	0	2.6
250.	5	0	240	350-400	+	1	1.1
251.	6	0	180	150-200	+	0	2.1
252.	5	0	240	350-400	+	1	1.4
256.	6	0	180	50-100	-	0	1.4
257.	6	0	180	50-100	-	0	1.2
258.	6	N	200	100-150	-	1	2.1
259.	6	0	180	150-200	+	0	3.1
260.	5	N	260	300-350	+	2	2.10
261.	6	N	200	100-150	-	1	2.1
262.	5	N	260	100-150	-	0	2.1
265.	5	0	240	100-150	-	0	1.1
266.	7	0	130	50-100	-	0	2.2
267.	8	0	80	50-100	+	0	1.5
268.	7	N	150	50-100	-	1	1.6
273.	5	0	240	300-350	+	1	1.4
274.	5	0	240	100-150	-	1	1.2
276.	6	0	180	50-100	-	0	1.5
277.	6	0	180	50-100	-	0	1.1
284.	7	N	150	50-100	-	0	1.2
287.	8	0	80	-50	-	0	1.1
289.	8	N	100	50-100	-	0	1.2
290.	7	0	130	100-150	+	0	2.10
291.	5	0	240	250-300	+	1	1.1
293.	5	0	240	250-300	+	1	1.3
295.	6	0	180	50-100	-	0	2.4
296.	5	0	240	300-350	+	1	1.4
297.	6	0	180	50-100	-	0	3.2
299.	7	N	150	50-100	-	0	3.2
306.	7	0	130	50-100	-	0	1.1
308.	5	0	240	50-100	-	0	1.1
314.	6	0	180	150-200	+	0	1.2
315.	5	N	260	100-150	-	0	1.2
316.	6	0	180	100-150	-	1	2.9
317.	6	0	180	50-100	-	0	1.2

Ref. No.	Class	Age	Threshold	Throughput	Viability	Control	Brand
318.	5	N	260	100-150	-	0	1.2
322.	5	0	240	300-350	+	0	1.1
324.	8	0	80	-50	-	0	1.2
325.	7	0	130	50-100	-	0	1.2
327.	8	0	80	50-100	+	0	1.3
329.	5	N	260	150-200	-	1	2.1
333.	5	0	240	200-250	+	1	1.1
335.	5	N	260	100-150	-	0	1.5
336.	5	N	260	100-150	-	1	1.2
337.	6	0	180	50-100	-	0	1.2
338.	5	0	240	50-100	-	1	1.2
340.	6	N	200	200-250	+	0	2.4
341.	5	N	260	250-300	+	1	1.5
345.	6	0	180	50-100	-	0	1.1
347.	8	0	80	-50	-	0	1.2
348.	5	N	260	250-300	+	1	1.2
349.	6	0	180	50-100	-	0	1.2
350.	7	0	130	50-100	-	0	1.4
352.	7	N	150	50-100	-	0	1.5
353.	7	0	130	100-150	+	0	1.1
356.	6	N	200	100-150	-	0	2.4
357.	5	0	240	250-300	+	1	2.10
359.	5	N	260	150-200	-	0	1.5
360.	5	0	240	100-150	-	0	1.2
370.	5	0	240	250-300	+	0	1.4
372.	5	N	260	250-300	+	0	1.2
373.	5	N	260	250-300	+	1	1.2
375.	5	N	260	150-200	-	1	1.2
376.	5	0	240	100-150	-	0	1.1
380.	8	N	100	50-100	-	0	1.1
383.	7	0	130	50-100	-	0	1.3
384.	7	N	150	50-100	-	0	1.4
385.	8	N	100	50-100	-	0	2.6
386.	5	N	260	100-150	-	1	2.1
388.	5	0	240	250-300	+	1	2.1
389.	5	N	260	100-150	-	1	1.2
393.	6	N	200	50-100	-	0	1.2
398.	6	0	180	50-100	-	0	1.1
401.	5	N	260	300-350	+	1	1.1
403.	5	N	260	150-200	-	1	1.3
404.	7	0	130	50-100	-	0	1.1
408.	7	0	130	200-250	+	1	1.2
410.	6	N	200	50-100	-	0	1.1
412.	5	N	260	250-300	+	1	1.4
413.	6	0	180	150-200	+	0	1.1
414.	6	N	200	100-150	-	0	1.3
415.	5	N	260	250-300	+	1	1.2
416.	5	0	240	250-300	+	1	1.5
419.	6	0	180	50-100	-	0	1.2
430.	6	N	200	50-100	-	0	2.1

Ref. No.	Class	Age	Threshold	Throughput	Viability	Control	Brand
431.	5	N	260	100-150	-	0	1.1
434.	6	N	200	100-150	-	0	3.2
435.	6	0	180	50-100	-	0	1.2
437.	8	0	80	-50	-	0	1.1
438.	6	0	180	50-100	-	0	1.1
439.	6	0	180	50-100	-	0	1.1
442.	7	N	150	50-100	-	0	1.2
444.	5	N	260	100-150	-	0	1.2
447.	8	0	80	50-100	+	0	3.1
448.	7	0	130	100-150	+	0	1.2
449.	7	0	130	-50	-	0	1.2
450.	5	N	260	350-400	+	1	1.2
452.	8	0	80	-50	-	0	1.1
455.	6	0	180	50-100	-	0	2.1
457.	5	0	240	250-300	+	1	1.2
459.	5	N	260	100-150	-	0	2.4
461.	8	N	100	50-100	-	0	1.1
462.	8	N	100	100-150	+	0	3.1
464.	8	N	100	100-150	+	0	3.1
468.	8	0	80	50-100	+	0	1.4
472.	5	N	260	250-300	+	1	1.2
473.	7	N	150	150-200	+	1	2.1
476.	6	0	180	50-100	-	0	1.3
477.	6	0	180	250-300	+	0	2.2
478.	5	0	240	250-300	+	1	2.5
480.	6	0	180	150-200	+	0	1.1
483.	6	0	180	150-200	+	0	2.6
484.	6	0	180	150-200	+	0	3.2
485.	6	0	180	150-200	+	0	1.1
488.	5	0	240	100-150	-	1	2.3
490.	5	0	240	200-250	+	0	1.1
492.	6	0	180	100-150	-	0	1.1
495.	5	0	240	250-300	+	0	2.1
496.	7	0	130	50-100	-	0	1.4
497.	6	N	200	50-100	-	0	1.3
498.	6	0	180	50-100	-	0	3.8
499.	5	N	260	250-300	+	0	1.5
500.	6	0	180	150-200	+	0	3.14
501.	8	0	80	50-100	+	0	1.2
503.	6	0	180	50-100	-	0	1.4
504.	6	0	180	150-200	+	0	1.2
506.	5	0	240	250-300	+	1	1.2
507.	5	N	260	100-150	-	0	1.3
508.	7	N	150	50-100	-	0	1.4
511.	8	0	80	-50	-	0	1.1
513.	8	0	80	50-100	+	0	2.4
516.	6	0	180	-50	-	0	1.2
517.	8	0	80	50-100	+	0	1.6
519.	5	0	240	100-150	-	0	1.4
522.	8	0	80	-50	-	0	1.1

Ref. No.	Class	Age	Threshold	Throughput	Viability	Control	Brand
523.	8	0	80	50-100	+	0	2.2
530.	8	0	80	50-100	+	0	1.2
535.	7	N	150	150-200	+	1	2.9
536.	8	N	100	50-100	-	0	3.3
543.	5	0	240	100-150	-	0	1.4
544.	5	N	260	100-150	-	1	1.3
547.	5	N	260	250-300	+	0	1.2
548.	6	0	180	50-100	-	0	1.5
549.	6	0	180	150-200	+	0	1.4
550.	5	0	240	250-300	+	0	2.6
551.	6	0	180	150-200	+	0	1.2
552.	8	0	80	50-100	+	0	1.2
553.	6	N	200	100-150	-	0	2.2
563.	5	0	240	250-300	+	1	1.1
565.	5	0	240	350-400	+	1	1.1
566.	5	N	260	100-150	-	0	1.5
567.	5	0	240	250-300	+	0	2.2
568.	6	0	180	50-100	-	0	1.5
569.	8	0	80	50-100	+	0	1.6
572.	8	0	80	100-150	+	0	1.2
573.	7	0	130	-50	-	0	1.2
575.	7	0	130	100-150	+	0	1.2
580.	7	0	130	100-150	+	0	1.5
581.	7	0	130	100-150	+	0	1.1
582.	8	0	80	-50	-	0	1.5
587.	7	0	130	100-150	+	0	1.1
593.	8	0	80	50-100	+	0	1.1
594.	8	0	80	50-100	+	0	1.1
596.	5	0	240	100-150	-	0	1.4
597.	8	0	80	50-100	+	0	1.2
599.	6	0	180	50-100	-	0	1.5
604.	8	N	100	-50	-	0	1.4
605.	8	N	100	100-150	+	0	1.2
606.	8	0	80	50-100	+	0	1.2
609.	8	0	80	50-100	+	0	1.1
610.	7	0	130	50-100	-	0	1.6
611.	8	N	100	100-150	+	0	1.3
614.	8	0	80	50-100	+	0	1.1
616.	7	0	130	50-100	-	0	1.1
617.	8	N	100	50-100	-	0	1.4
618.	8	0	80	50-100	+	0	1.1
623.	5	0	240	200-250	+	0	1.5
624.	7	0	130	-50	-	0	1.3
625.	5	N	260	100-150	-	0	1.6
626.	7	0	130	50-100	-	0	1.4
627.	8	0	80	50-100	+	0	3.1
633.	8	0	80	-50	-	0	2.2
635.	5	0	240	250-300	+	0	2.5
639.	7	N	150	100-150	-	0	1.5
641.	8	0	80	50-100	+	0	1.1

Ref. No.	Class	Age	Threshold	Throughput	Viability	Control	Brand
643.	5	0	240	200–250	+	1	1.1
645.	5	0	240	200–250	+	0	1.4
646.	5	0	240	100–150	–	0	1.3
648.	7	0	130	–50	–	0	1.2
649.	5	N	260	350–400	+	1	1.1
651.	6	0	180	50–100	–	0	1.5
652.	5	N	260	150–200	–	1	1.2
658.	5	N	260	250–300	+	1	1.2
659.	6	N	200	200–250	+	0	2.4
660.	5	N	260	300–350	+	1	1.4
661.	8	0	80	50–100	+	0	1.2
662.	7	0	130	50–100	–	0	1.4
663.	5	0	240	50–100	–	0	1.3
665.	5	0	240	250–300	+	1	2.1
668.	6	N	200	100–150	–	0	1.2
669.	5	0	240	1oo–150	–	1	1.1
670.	6	N	200	200–250	+	1	2.9
671.	5	0	240	200–250	+	1	1.2
675.	5	N	260	250–300	+	2	2.7
677.	8	0	80	100–150	+	0	2.2
678.	7	N	150	150–200	+	1	2.3
679.	8	N	100	–50	–	0	1.2
681.	5	0	240	250–300	+	1	1.6
682.	5	0	240	300–350	+	1	1.1
684.	8	N	100	100–150	+	0	1.1
685.	7	0	130	50–100	–	0	1.5
687.	8	0	80	50–100	+	0	1.5
688.	8	0	80	50–100	+	0	2.2
689.	6	0	180	150–200	+	0	1.4
690.	5	N	260	100–150	–	0	1.5
693.	5	N	260	100–150	–	1	1.1
694.	5	0	240	100–150	–	0	1.6
695.	8	0	80	50–100	+	0	1.2
697.	5	N	260	100–150	–	1	2.1
699.	8	0	80	50–100	+	0	1.2
700.	8	0	80	50–100	+	0	2.1
701.	7	0	130	100–150	+	0	1.1
702.	8	0	80	50–100	+	0	2.2
703.	5	0	240	200–250	+	0	1.2
704.	8	N	100	100–150	+	0	1.5
708.	8	0	80	–50	–	0	3.3
709.	8	0	80	–50	–	0	1.1
710.	6	0	180	250–300	+	1	2.2
715.	5	0	240	250–300	+	1	1.4
716.	7	N	150	50–100	–	0	2.8
717.	7	0	130	100–150	+	0	2.3
718.	7	N	150	150–200	+	1	1.3
721.	7	0	130	50–100	–	0	1.5
722.	6	N	200	100–150	–	0	2.1
724.	8	0	80	–50	–	0	1.2

Ref. No.	Class	Age	Threshold	Throughput	Viability	Control	Brand
726.	7	N	150	150-200	+	1	2.4
727.	7	O	130	100-150	+	0	1.2
728.	7	O	130	100-150	+	1	1.2
731.	5	O	240	50-100	-	0	1.1
732.	5	N	260	250-300	+	1	2.4
733.	7	N	130	100-150	+	0	1.3
736.	8	O	80	100-150	+	0	2.3
739.	7	N	150	50-100	-	0	2.3
740.	7	N	150	50-100	-	0	1.2
741.	8	O	80	50-100	+	0	1.3
742.	7	O	130	100-150	+	0	1.5
743.	7	O	130	100-150	+	0	1.2
744.	7	O	130	-50	-	0	1.2
745.	7	O	130	50-100	-	0	2.2
746.	7	O	130	100-150	+	0	1.5
747.	8	O	80	100-150	+	0	3.1
748.	8	O	80	100-150	+	0	1.1
749.	7	O	130	50-100	-	0	1.2
751.	5	O	240	300-350	+	1	2.3
752.	7	N	150	150-200	+	1	1.2
753.	8	O	80	50-100	+	0	1.6
755.	8	N	100	100-150	+	0	1.1
756.	8	O	80	50-100	+	0	1.2
757.	8	O	80	50-100	+	0	2.3
758.	7	O	130	50-100	-	0	3.6
761.	7	O	130	100-150	+	1	1.2
762.	5	O	240	200-250	+	0	1.3
763.	6	N	200	200-250	+	1	2.2
769.	8	O	80	50-100	+	0	1.2
772.	6	O	180	50-100	-	0	2.3
773.	5	N	260	150-200	-	1	2.5
774.	8	O	80	100-150	+	0	1.5
780.	5	O	240	150-200	-	1	1.6
781.	8	O	80	50-100	+	0	1.2
783.	5	O	240	200-250	+	0	1.2
785.	8	N	100	100-150	+	0	2.4
786.	5	O	240	50-100	-	0	1.1
787.	5	N	260	250-300	+	1	1.2
789.	5	O	240	250-300	+	0	2.1
791.	5	O	240	250-300	+	1	2.3
793.	5	O	240	300-350	+	0	1.5
794.	5	O	240	300-350	+	0	1.1
795.	8	N	100	50-100	-	0	1.1
796.	8	O	80	50-100	+	0	1.5
797.	5	O	240	250-300	+	1	1.3
798.	5	O	240	250-300	+	0	2.1
801.	8	N	100	100-150	+	1	2.3
802.	8	N	100	100-150	+	0	1.3
805.	5	O	240	200-250	+	1	2.8
806.	5	N	260	150-200	-	0	1.2

Ref. No.	Class	Age	Threshold	Throughput	Viability	Control	Brand
807.	5	N	260	150–200	–	0	1.1
808.	7	0	130	–50	–	0	1.5
809.	5	0	240	200–250	+	1	1.2
810.	5	N	260	250–300	+	1	1.2
811.	8	0	80	50–100	+	0	1.1
812.	5	0	240	250–300	+	0	1.3
813.	5	0	240	200–250	+	1	1.1
814.	7	N	150	50–100	–	0	1.2
815.	7	N	150	150–200	+	1	1.5
817.	7	N	150	150–200	+	0	1.6
820.	5	0	240	300–350	+	1	1.3
822.	5	0	240	200–250	+	0	1.6
823.	6	0	180	50–100	–	0	1.1
824.	6	N	200	100–150	–	0	2.1
825.	5	0	240	200–250	+	0	2.2
826.	5	N	260	250–300	+	1	2.5
827.	6	0	180	50–100	–	0	1.2
828.	7	N	150	50–100	–	0	1.2
832.	5	N	260	150–200	–	0	2.2
833.	5	0	240	200–250	+	1	2.2
834.	6	0	180	50–100	–	0	1.3
835.	6	0	180	50–100	–	0	1.1
836.	6	0	180	150–200	+	0	1.1
837.	5	0	240	100–150	–	0	1.4
839.	6	0	180	150–200	+	0	2.1
840.	5	0	240	200–250	+	0	1.1
841.	6	0	180	150–200	+	0	1.5
844.	8	0	80	50–100	+	0	1.5
845.	7	N	150	150–200	+	1	1.3
846.	8	0	80	50–100	+	0	2.3
847.	8	0	80	50–100	+	0	2.6
848.	7	0	130	150–200	+	1	1.3
849.	6	0	180	50–100	–	0	1.1
850.	5	0	240	250–300	+	1	1.3
852.	7	N	150	150–200	+	1	1.2
856.	5	N	260	250–300	+	1	2.3
857.	8	N	100	100–150	+	0	1.3
858.	6	0	180	300–350	+	0	2.3
859.	5	0	240	250–300	+	0	1.5
860.	8	0	80	50–100	+	0	1.2
863.	5	N	260	350–400	+	1	1.1
865.	5	N	260	150–200	–	0	1.3
867.	6	N	200	50–100	–	1	1.2
868.	5	N	260	100–150	–	1	1.6
869.	8	0	80	50–100	+	0	1.5
870.	7	0	130	100–150	+	0	1.1

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