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INTRODUCTION

Numerous factors influence the locational position of employment areas; this project intends to discuss and investigate those variables, which operate within Swindon.

A targeted consumer frequently affects location and type of industry. Correctly choosing a site is imperative in determining the sphere of influence, which ultimately, establishes a percentage market share. Historically companies were restricted to distance, some characteristics included:

- ***Locating near to workforce, often creating accommodation for employees as travel was expensive.***
  (S.W England, Swindon, Railway Village)

- ***Positioning near to major transportation routes such as road and rail, minimising distance reduced costs.***
  (S.W England, Swindon, Archers Brewery)

- ***Traditionally locating near to the Central Business District (CBD) in the inner city, therefore surrounding environments tended to be unpleasant.*** *(S.W England, Swindon, Barnfield)*

At present new factors allow industries to decentralise into virgin territories, such as:

- ***Improved transportation routes, providing quicker and cheaper access.*** *(M4 Motorway)*

- ***Realignment from the CBD by diversifying into rural areas, allowing for cheaper land.***
  (S.W England, West Swindon, Renault Factory)

- ***Efficient transport systems for employees, increasing sphere of influence.***

Push and pull factors surround the CBD; the following extract gives reason why to locate within a close proximity:

'…Businesses often locate in CBD's for prestige reasons, ease of access for their clients and staff, and to be near functional links…'

'Geography An Integrated Approach'
David Waugh

And why outside:

'…Modern methods of transferring data, the replacement of staff with computerisation and nearness to motorways and airports have reduced the importance of a central location…'

'Geography An Integrated Approach'
David Waugh

AIM

The aim is to determine why companies in Swindon choose to locate in particular areas, and discover whether factors such as residential housing or communication links influence the outcome. Environmental conditions of both old and newer sites shall be contrasted to discover if modern companies are attracted to more aesthetically pleasing surroundings. This will show if the development of new sites was influenced by the need to provide employment areas to attract both companies and employees.

HYPOTHESIS

The experimental hypothesis states that companies in Swindon will have a tendency to locate on employment areas near communication links and residential areas to attract employees, and modern companies will have a high environmental index score.

The null hypothesis states that companies in Swindon will tend not to locate on employment areas near communication links or residential areas, and environmental scores shall be homogeneous irrespective of age.

OBJECTIVES-

1. ***To see if companies in Swindon locate primarily for communication reasons.***

2. ***To see if a companies locational decisions in Swindon is affected by the surrounding environmental area.***

3. ***To see if companies in Swindon locate primarily for proximity to residential areas for a workforce.***

4. ***To see if modern companies in Swindon locate to aesthetically pleasing surroundings.***

5. ***To see if modern companies in Swindon tend to employ individuals in tertiary and quaternary class sectors rather than the traditional secondary class.***

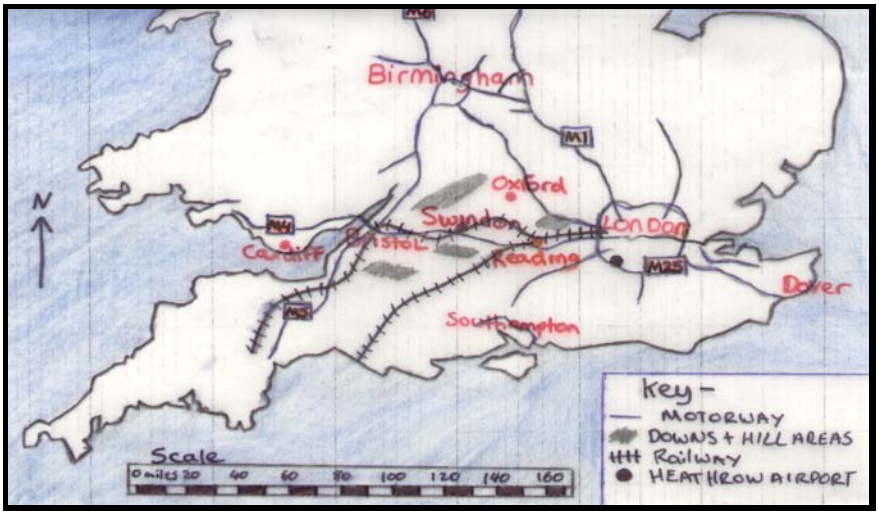
BACKGROUND

Swindon is in the county of Wiltshire, situated in the South–West of England. Outside of London it is the wealthiest settlement in England, and the fastest growing in Europe. Swindon attracts many national and multi-national companies; many choose Swindon for their central headquarters. Swindon has a population of 180,000, with an unemployment rate of 2.1%, more than half the national average.

Two hundred years ago Swindon was a small town within Wiltshire, however in 1835 the Great Western Railway (GWR) built its main line from London to Bristol, which passed through Swindon. In February 1841 Isambard Kingdom Brunel and Daniel Gooch chose Swindon as the main Western Railway works for the maintenance and building of locomotive stock. The railway created for its own town, a complete community. Over 15,000 people (62% of the towns work force) were employed in 1931.

After the world wide economic recession in the 1930's there was a drop in the demand for railway equipment in Britain and other countries. Up until 1986 thousands of men were made redundant as the works finally shut.

MAP 1 - SWINDON'S M4 CORRIDOR-



In 1953, under the Town Development Act Swindon was designated an expanding town. The council decided to attract more industry to Swindon. A decision was made to buy large areas of farmland around the town (Greenfield sites). The council also offered purpose-built industrial sites at low rates to expanding firms. During 1954 – 1964, 15,000 new industrial jobs were attracted to Swindon. In addition new housing areas such as Penhill and Walcott were developed to cope with the arrival of the overspill population from London. From 1953 – 1978 Swindon's population increased from 70,000 in 1953 to 130,000 in 1978. With the completion of the M4 motorway in April 1971, Swindon saw its communication links dramatically improved, and experienced a transition from mainly secondary jobs to tertiary and quaternary sectors. It was this influx of Hi-Tech industries that allowed Swindon to

become part of the M4 corridor, with access to all major southern cities. Map 1 displays Swindon on the M4 corridor and its communication links.

Today Swindon is a thriving town that has attracted many major firms such as Honda and Motorola, and many company head offices such as Nationwide and Readers Digest.

With the downfall of the railway, Swindon has become an ideal settlement to study as it was forced to attract new decentralised companies spread throughout the town. West Swindon is an area attracting many new businesses, and proved to be an ideal opportunity to grasp. The study incorporates *Section B, Part 6* of the Geography syllabus, '***Economic Activity and the Business World***'. Overall inspiration came from previous skills acquired on trips to Bath and London Docklands.

METHODS OF DATA COLLECTION

SAMPLING TECHNIQUE –

Within Swindon there are a total of 40+ employment areas, containing both national and multinational companies. To obtain a representative, yet workable sample it was decided that 15 sites were to be chosen at random, whereby each site had an equal chance of being picked. To select these sites employment areas were written on pieces of paper and placed into a hat, 15 were then selected. Other methods could have included a computer to randomly generate the 15 sites, but was rejected, as the necessary equipment was not available. These chosen sites aimed to provide an unbiased representative sample, covering both old and new sites with varying levels of environmental areas.

QUESTIONNAIRE –

Data collection was primarily derived by the use of questionnaires. This effective method of data retrieval was imperative, as it allowed for large quantities of numerous sets of information to be collected in a short space of time, whilst resolving the objectives. Initially as a means of primary collection, pilot questionnaires were distributed to 10 spatially differentiated companies within Swindon. This margin of control allowed for testing of the hypothesis and alteration, by using the responses sent back. See end of section to view pilot questionnaire.

Attached to each questionnaire was a letter (see end of section) stating the cause and intention of this project. A chance to suggest any alterations, such as question style or layout was also encouraged. All 10 questionnaires were received back with interesting comments. It appeared that the questionnaire was not adequate and something more precise with multiple answers was needed, the hypotheses also benefited by becoming slightly more defined. A new and improved questionnaire resulted from the feedback previously acquired, and was sent to all 40+ employment areas within Swindon, so that a minimum of 15 sites would be obtained, though these would not necessarily be the same 15 surveyed. See end of section for final questionnaire.

Each questionnaire was designed to obtain the maximum amount of data from each company regarding history, employees and other background data. This general data acquired was intended to help answer objective 3 '… *To see if companies in Swindon locate primarily for proximity to residential areas for a workforce.'* From the data gathered it would be clear why companies have settled where they are and reasons for rejecting other locations. This method of data collection proved extremely valuable as the hypothesis could be reworded and asked in the questionnaire itself.

Nothing is without its disadvantages, and the use of a questionnaire has many. Every company is not guaranteed to respond, therefore possibly leaving incomplete and patchy data. If this occurs, the data collected may not

be truly representative of the sample, thus the hypothesis could not be accepted or rejected.

30 out of the 40 questionnaires distributed, were received back, a 75% feedback rate, which well exceeded the minimum of 15 questionnaires needed.

OTHER METHODS OF DATA COLLECTION –

It is important to have a wide range of possible data collection methods, as some may be more appropriate than others. For this reason various methods were devised, revised and then either executed or rejected.

Initially a written letter was considered instead of a questionnaire, as this would allow for the acquisition of company specific data. However, this method was quickly rejected, as not only would it be tedious and time consuming but because the data gathered would be company specific, making direct comparisons difficult. A questionnaire would provide direct information of which hypothesis could be include in. Overall a large amount of data could be acquired in a short space of time.

Direct communication via the telephone was considered and later executed. This more personal approach took longer but provided instant data. It also gave the chance to query answers if they were unclear or misunderstood, something that cannot be achieved by the use of a questionnaire.

In the age of technology the Internet proved an irresistible tool. Although unable to answer all questions, it allowed for the acquisition of extensive background material, by accessing a company website. Pictures were common on the Internet, which allowed for visual representations, and proved useful in partially answering objective 4, which queried '…*if modern companies in Swindon locate to aesthetically pleasing surroundings*.*'* The data gathered from the use of this tool allowed a greater understanding and explanation of the results.

ENVIRONMENTAL INDEX –

Once 15 sites were confirmed (see Map 3), each location was visited and an environmental index survey was preformed. The purpose of this survey was to answer objective 2 asking '…*if a companies decisions on where to locate in Swindon is affected by the surrounding environmental area….'* The same fifteen sites were surveyed within a range of categories and given a mark out of ten.

An environmental index survey was chosen because it allowed each site to be marked using the same format, which would later allow for direct comparisons. Each site was visited over a two-week duration in which data was gathered as well as performing the environmental index scores. Due to the varying size of each employment area a strict vicinity to undertake the environmental index could not be set. Instead various parts of the site were

scored and then given an overall average, this provided a fair representation for all sites.

A strict criteria for scoring was enforced in the environmental index, and each site was accessed on 9 accounts, of which follows; Conditions of buildings: whether they are aesthetically pleasing, well structured and suite the surrounding area. Conditions of boundaries: are they complete, do they have holes in fences or are falling apart, do they completely restrict unauthorised access? Traffic parking: is there an adequate area to cope with traffic to that location is it well planned and structured? Accessibility: how many entrances lead into the area, are they signposted and give clear directions? Air pollution: is there a foul stench in the air, is the area situated next to a main road? Noise nuisance: is there a peaceful atmosphere, could an individual be able to concentrate on the task at hand in this environment? Dereliction: are there unsightly disused buildings or areas around, do they make the area look unattractive? Litter: are there numerous amounts of rubbish sprawled over the area does the environment look attractive? And a final overall impression summing up all categories. See photograph 1 for example of scoring.

All scores were presented in a table, which was divided into nine columns, where the last gave an overall impression mark. The mean results were calculated and displayed in a final column, quickly exhibiting the highest and lowest scoring sites. All scores were out of 10, were 10 is the highest and 0 is the lowest. Sites such as Windmill Hill scored 9.2 out of 10, compared to sites like Barnfield, which achieved 2.6. Once plotted onto a graph the differentiation between sites is clearly visible.

Other possible methods rejected include a simple observation at each site with no specific attention to detail, whilst this would be quick and simple it would not allow for direct comparisons, as different observations may have been noted. There would also be the possibility of data being left out or forgotten. An important feature of the environmental index was the inclusion of photographs; this not only gave a visual representation of each site but also allowed examination of them at leisure, making changes to the environmental index plausible.

TABLE 1 – FINAL CHOSEN EMPLOYMENT AREAS

SITE NUMBER	SITE DESCRIPTION
1	DELTA BUSINESS PARK
2	HILLMEAD INDUSTRIAL ESTATE
3	WINDMILL HILL BUSINESS PARK
4	KENDRICK INDUSTRIAL ESTATE
5	WESTMEAD INDUSTRIAL ESTATE
6	OKUS INDUSTRIAL ESTATE
7	TECHNO INDUSTRIAL ESTATE
8	RIVERMEAD INDUSTRIAL ESTATE
9	SOUTH MARSTON INDUSTRIAL ESTATE
10	BARNFIELD INDUSTRIAL ESTATE
11	GROUNDWELL INDUSTRIAL ESTATE
12	BLAGROVE INDUSTRIAL ESTATE
13	EUROPA INDUSTRIAL ESTATE
14	CHENEY MANOR INDUSTRIAL ESTATE
15	DORCAN INDUSTRIAL ESTATE

PILOT QUESTIONNAIRE

1. WHAT YEAR DID YOUR COMPANY CHOSE TO LOCATE AT THE CURRENT SITE?

2. HOW MANY EMPLOYEES DO YOU CURRENTLY HAVE IN SWINDON?

3. WHAT IS YOUR MAIN TYPE OF BUSINESS?

4. IS SWINDON YOUR HEAD OFFICE?

5. WHY DID THE COMPANY CHOOSE SWINDON AS THE LOCATION FOR YOUR CURRENT SITE?

6. WHY DID YOUR COMPANY SELECT THE SPECIFIC SITE IN SWINDON?

7. HOW DOES THE MAJORITY OF YOUR EMPLOYEES TRAVEL TO WORK?

8. WHERE ARE YOUR CUSTOMERS / GROUP COMPANIES LOCATED?

9. WHAT METHODS OF TRAVEL DO YOUR PRODUCTS / PEOPLES ON BUSINESS USE?

10. WHAT METHODS OF TRAVEL DO YOUR PRODUCTS / PEOPLE USE MAINLY?

11. WHAT WILL YOU DO WHEN YOUR COMPANY GROWS AND NEEDS TO RELOCATE?

12. WHAT ARE THE DRAWBACKS / BENEFITS OF BEING LOCATED IN SWINDON?

WHAT ARE THE DRAWBACKS / BENEFITS OF YOUR CURRENT LOCATION?

FINALISED QUESTIONNAIRE

NAME OF COMPANY……

ADDRESS……
……
……
……
……...

1) OVERVIEW

1.1 WHAT YEAR WAS THE SITE COMPLETED AT THE CURRENT LOCATION?

19…

1.2 HOW MANY EMPLOYEES DO YOU HOUSE IN SWINDON?

a) **UP TO 50**
b) **50 – 200**
c) **200 – 500**
d) **> 500**

1.3 WHAT IS YOUR MAIN TYPE OF BUSINESS?

a) **ADMINISTRATION**
b) **WAREHOUSE / DISTRIBUTION**
c) **MANUFACTURING**
d) **OTHER**

1.4 IS SWINDON YOUR HEAD OFFICE?

a) **YES**
b) **NO**

2) SITE + LOCATION

2.1WHY DID YOUR COMPANY CHOOSE SWINDON FOR YOUR CURRENT SITE?

a) **COMMUNICATION LINKS**
b) **EMPLOYEE AVAILABILITY**
c) **FACILITIES**
d) **COST**
e) **OTHER**

2.2 WHY DID YOUR COMPANY SELECT THE SPECIFIC SITE IN SWINDON?

a) **SIZE OF SITE**
b) **FACILITIES**
c) **EMPLOYEE AVAILABILITY**
d) **COMMUNICATION LINKS**
e) **OTHER**

2.3 HOW DOES THE MAJORITY OF YOUR EMPLOYEES TRAVEL TO WORK?

a) **CAR**
b) **PUBLIC TRANSPORT**
c) **WALK / CYCLE**
d) **OTHER**

3) COMMUNICATION

3.1 WHERE ARE YOUR CUSTOMERS / GROUP COMPANIES LOCATED?

a) **SWINDON**
b) **30 MILE RADIUS**
c) **ALL U.K**
d) **LONDON / BRISTOL**
e) **EUROPE**
f) **OTHER**

3.2 WHAT METHODS OF TRAVEL DO YOUR PRODUCTS / PEOPLE ON BUSINESS USE?

a) **ROAD**
b) **RAIL**
c) **AIR**
d) **OTHER**

3.3 DO YOUR PRODUCTS / PEOPLE USE MAINLY?

a) **RAIL**
b) **M4 MOTORWAY**
c) **M5 MOTORWAY**
d) **A ROADS**
e) **OTHER**

4) GENERAL

4.1 WHEN YOUR COMPANY GROWS AND NEEDS TO RELOCATE WILL YOU?

a) **RELOCATE IN SWINDON**
b) **MOVE TO A NEW AREA**
c) **EXPAND EXISTING SITE**
d) **OTHER**

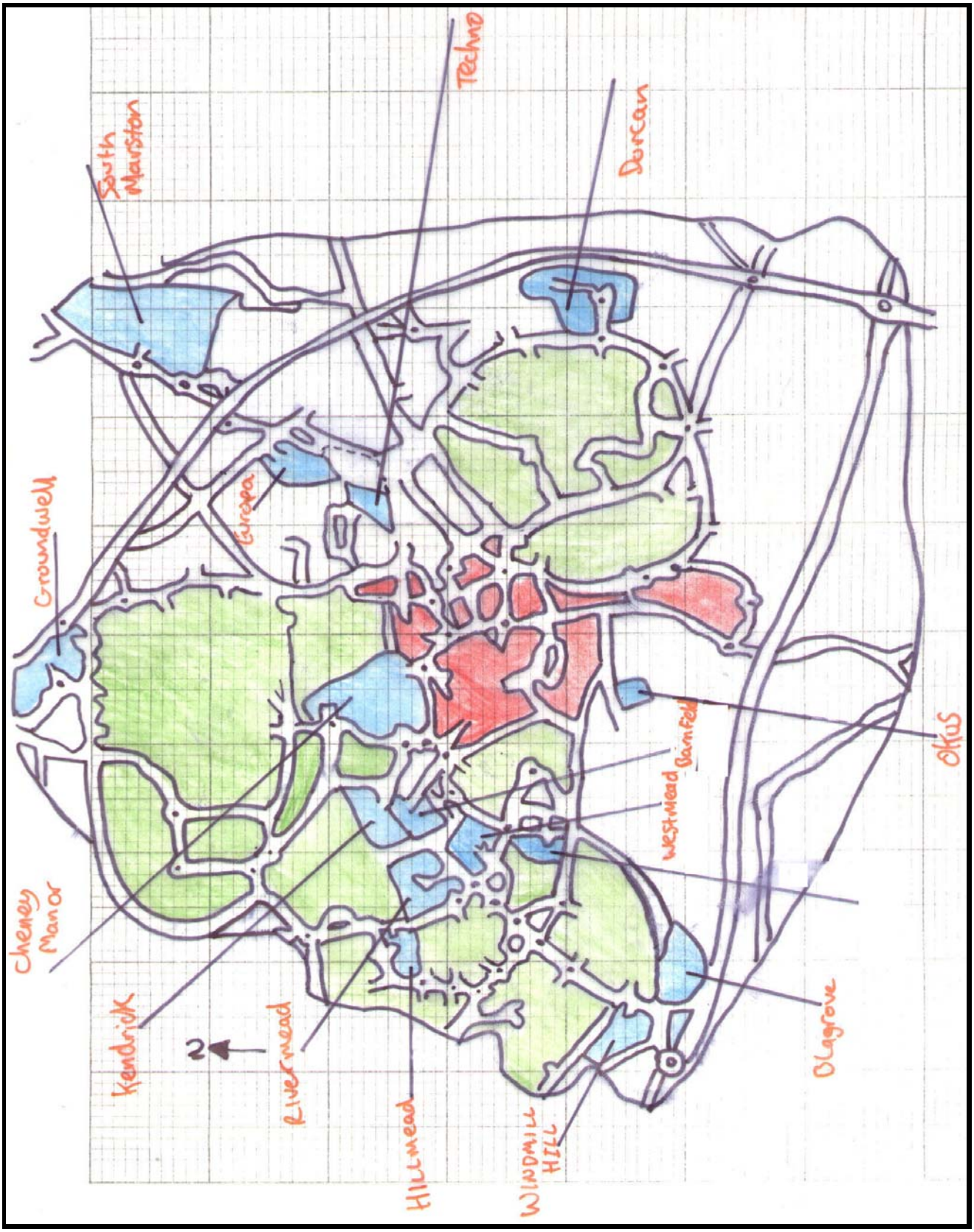
4.2 WHAT ARE THE BENEFITS / DRAWBACKS OF BEING LOCATED IN SWINDON?

……
……
……
……

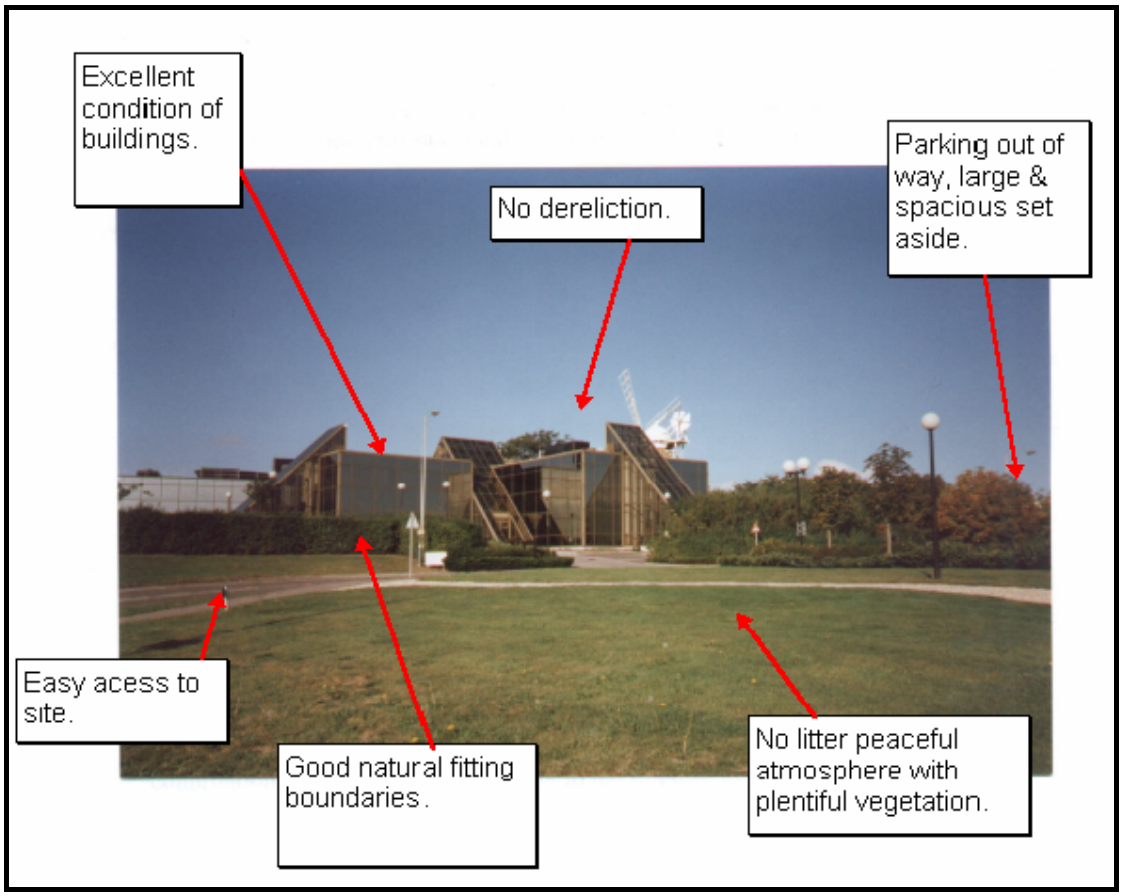
4.3 WHAT ARE THE DRAWBACKS / BENEFITS OF YOU CURRENT LOCATION?

……
……
……
……

MAP 2 - SELECTED INDUSTRIAL AREAS



PHOTOGRAPH 1 - ENVIRONMENTAL INDEX SCORING SYSTEM



Personal Observation – This site, Windmill Hill, is a very pleasant and fitting area. There is lots of vegetation including trees, shrubs, and grassland taking away the traditional concrete man made feel commonly experienced in the inner city. The area has lot of character and is interesting to look at, note Windmill in the background. Although it is near a road, there is little to no noise present and the air is of a high quality. Overall an excellent site in a fitting environment with excellent communication links.

RESULTS AND INTERPRETATION

Displayed in this portion of the investigation are the results of all raw and secondary data acquired, pursued by an interpretation that will give a clear overview of what has been shown, a valid conclusion shall be achieved. Methods such as the use of tables, graphs, statistical data and other relevant means have been used to portray the best presentation possible.

TABLE 2 – COMPANY DATA

							Type Of Business (%)			
SITE	COMPLETION OF SITE	NUMBER OF EMPLOYEES	NUMBER OF UNITS	DISTANCE FROM MAIN ACCESS LINE (MILES)	ADMINISTRATION	MANUFACTURING	WAREHOUSE / DISTRIBUTION	RETAIL	UNOCCUPIED	OTHER
HILLMEAD	1985	950	16	3.5	33	33	27	0	0	7
WINDMILL HILL	1990	2600	10	0.5	90	0	0	0	0	10
KENDRICK	1966	400	26	4.5	0	12	8	65	8	7
WESTMEAD	1981	2200	85	3	16	15	22	13	10	24
OKUS	1974	650	53	4	4	14	8	27	19	28
TECHNO	1976	680	61	1	0	36	25	2	23	14
RIVERMEAD	1981	1800	22	3	37	14	18	9	9	13
SOUTH MARSTON	1982	3150	50	1	12	48	22	0	4	14
BARNFIELD	1983	40	7	4.5	0	29	14	14	29	14
GROUNDWELL	1975	1100	33	0.5	7	16	36	7	16	18
BLAGROVE	1980	2700	8	0.75	14	29	57	0	0	0
EUROPA	1986	1300	40	1	3	8	35	27	3	24
CHENEY MANOR	1958	4250	87	5	6	21	21	22	7	23
DORCAN	1972	2200	58	1.5	16	7	21	4	18	34
DELTA	1988	850	27	3	85	0	0	0	15	0
	MEAN TOTAL	**1658**	**39**	**2.45**	**21.5**	**18.8**	**20.9**	**12.7**	**10.7**	**15.3**

INTERPRETATION OF TABLE 2

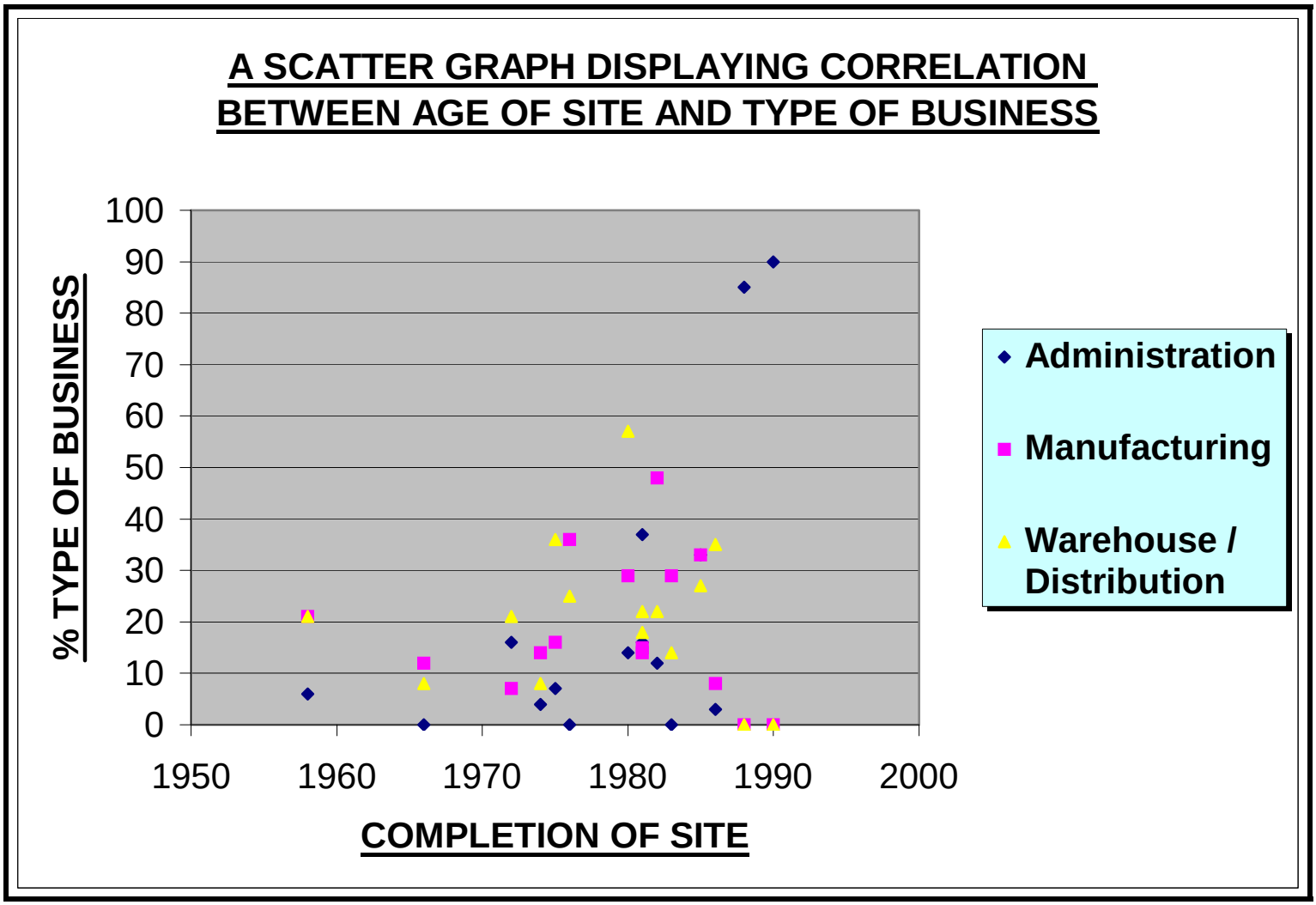
Table 2 represents all data collected relevant to the fifteen chosen sites. Interpretation reveals obvious details such as companies with fewer staff have fewer units per site than companies that have a larger workforce, as shown by Barnfield with 7 sites and Hillmead with 16 sites. There is however a noticeable transition between the type of business in new and older sites. The Cheney Manor site established in 1958 has only 6% employed in administration, whereas the Windmill Hill site established in 1990 has 90% employed in administration. This shows a trend towards higher end jobs from the traditionally secondary, to tertiary and quaternary class. Interpretation has helped to answer objective 5 that asks '…*if modern companies in Swindon tend to employ individuals in tertiary and quaternary class sectors…'*

It was interesting to note that those sites with the lowest environmental scores *(Table 3 pg 22)* such as the Barnfield (2.6) and Kendrick (3.9) sites also had the greatest distance from a main access line. This challenges objective 1 that asks '…*if companies in Swindon locate primarily for communication reasons.'* View Map 2 (*pg15*) for locational position of employment areas.

A table was selected to represent this data, as it possessed the ability to group together a large quantity of information within a small area. As a result all the data could be displayed on a single page in an orderly and collective fashion. Tabular representation also allowed for quick and easy comparisons between different sites. No major problems were encountered creating the table the only set back came in deciding a suitable layout

Other possible methods that may have been selected included a written list. This was later rejected, as it was unable to display all data in a compact area, thus making comparisons tiresome and tedious.

GRAPH 1 – A SCATTER GRAPH DISPLAYING CORRELATIONS BETWEEN AGE OF SITE AND TYPE OF BUSINESS



INTERPRETATION OF GRAPH 1

An interpretation of Graph 1 reveals that there is a positive correlation between administration employment and age of site. Administration starts low around the mid fifties and sixties averaging around 2.5%, it then gradually begins to increase over the early seventies to mid eighties rising to an 11.8% average. An exponential rise is then shown as the percentage increases from a maximum of 37% employment in administration during 1981, to 90% during 1990. This indicates that there is a trend for the newer business to employ more administrative staff, which backs up objective 5 that asks '…*if modern companies in Swindon tend to employ individuals in tertiary and quaternary class sectors rather than the traditional secondary class*.' This is best shown by table 2 *(pg18)* which reveals that the Windmill Hill employment area, established in 1990 contains 90% administrative staff, this is compared to the 6% in administration shown by the Cheney Manor site established in 1958.

Further analysis reveals that the number employed in manufacturing peaked around 20% during the late fifties, this then declined to under 10% in the mid sixties before sharply rising to reach a maximum of 48% employment in 1982. During the seventies to late eighties Swindon saw a positive correlation in the number of business employing manufacturing related staff. The early nineties saw a sharp decline in manufacturing, as mostly new modern business were coming to Swindon and were mainly administrative, such as the Windmill Hill and Delta areas. An almost identical pattern is found for warehouse and distribution.

One method of presenting raw data collected was in the form of a scatter graph. This visual representation allowed a group of figures to be plotted together on the same graph, allowing for easy comparisons.

Another method considered was the use of a bar graph, but was rejected, as the data would appear too grouped together, indistinguishable from the next.

Some problems were encountered with the scatter graph. As there were six categories for each type of business to be displayed for fifteen sites, this resulted in a lot of markings on the graph making it look messy and confusing. For this reason it was decided that only three of the six types of business category would be displayed to give a clear representation.

TABLE 3 – ENVIRONMENTAL INDEX SCORES

SITE	CONDITION OF BUILDINGS	CONDITION OF BOUNDARIES	TRAFFIC PARKING	ACCESSIBILITY	AIR POLLUTION	NOISE POLLUTION	DERELICTION	LITTER	OVERALL IMPRESSION	MEAN TOTAL
HILLMEAD	8	9	9	8	7	6	8	8	8	7.9
WINDMILL HILL	9	9	9	10	9	9	10	8	10	9.2
KENDRICK	5	6	5	4	2	2	4	3	4	3.9
WESTMEAD	9	9	9	9	9	9	8	8	10	8.9
OKUS	7	6	5	5	4	3	5	4	5	4.9
TECHNO	6	5	6	6	4	4	5	5	5	5.1
RIVERMEAD	9	9	8	8	8	8	9	9	8	8.4
SOUTH MARSTON	5	6	6	7	9	8	7	7	7	6.9
BARNFIELD	3	2	2	4	3	3	2	1	3	2.6
GROUNDWELL	8	8	8	7	9	8	8	8	9	8.1
BLAGROVE	9	9	10	8	9	9	10	8	9	9
EUROPA	7	7	8	8	7	6	7	8	8	7.3
CHENEY MANOR	6	5	5	6	7	8	7	8	7	6.6
DORCAN	5	5	6	6	5	5	8	7	7	6
DELTA	9	9	8	10	9	9	10	8	10	9.1
MEAN TOTAL	**7**	**6.9**	**6.9**	**6.8**	**6.7**	**6.5**	**7.1**	**6.7**	**7.3**	**6.9**

INTERPRETATION OF TABLE 3

Table 3 shows all the data gathered for the environmental index scores (for marking criteria view *pg 7-8*). It is clear that the Windmill Hill and Delta sites have the highest scores (9.2 + 9.1); it is worth noting they are also the most modern sites. This helps back up objective 4 that asks '…*if modern companies in Swindon locate to aesthetically pleasing surroundings.'* Barnfield was the site with the lowest score (2.6), not only because it was old, but also as it was near sewage works, rubbish tip, and an old incinerator. This shows us that not only can modern companies afford newer sites with better facilities, but also have higher standards.

Overall table three shows an increase in environmental score with a decrease in age. The exception is shown clearly by the two anomalies in Graph 5 (*pg 41*). Firstly the Cheney Manor site is the oldest employment area yet has a score of 6.6, this is due to the continually refurbishment of the site as new business are continually moving in and out. The Barnfield site although not very old (1983) has a low score due to its surroundings (full explanation on *pg 42)*

It was decided to collect data in a similar fashion to Table 2 (*pg 18*). Again it allowed lots of information to be presented in an orderly and understandable fashion. It gave a chance to make comparisons quickly and gain an overall impression.

Other methods rejected included simply making a note of the general appearance at each site, and then displaying the data in a written form. This had many drawbacks including not having a scoring system, which also made comparisons difficult. There were no major problems encountered with the table, the only problem came in deciding a suitable layout.

TALLY 1 – A TALLY CHARTS REVEALING ANSWERS PER QUESTION RECEIVED BY COMPANIES ON FINAL QUESTIONNAIRE

All percentages are out of 69, as 69 companies replied. Some percentages are over 100%, as in some cases more than one answer was given.

1.1 WHAT YEAR WAS THE SITE COMPLETED AT THE CURRENT LOCATION?

	TALLY	TOTAL	%
<1960		2	3
<1970		6	9
<1980		8	12
<1990		32	46
<2000		15	21
UNKNOWN		6	9

1.2HOW MANY EMPLOYEES DO YOU HOUSE IN SWINDON?

	TALLY	TOTAL	%
UP TO 50		23	33
50-200		18	26
200-500		17	25
500+		11	16

1.3WHAT IS YOUR MAIN TYPE OF BUSINESS?

	TALLY	TOTAL	%
ADMINISTRATION		12	18
WAREHOUSE/DISTRIBUTION		16	23
MANUFACTURING		21	30
OTHER		20	29

1.4 IS SWINDON YOUR HEAD OFFICE?

	TALLY	TOTAL	%
YES		44	64
NO		25	36

2.1 WHY DID YOUR COMPANY CHOOSE SWINDON FOR YOUR CURRENT SITE?

	TALLY	TOTAL	%
COMMUNICATIONS		31	44
EMPLOYMENT		19	27
FACILITIES		19	27
COST		10	7
OTHER		11	15

2.2 WHY DID YOUR COMPANY SELECT THE SPECIFIC SITE IN SWINDON?

	TALLY	TOTAL	%
SIZE		42	61
FACILITIES		16	23
EMPLOYMENT		11	16
COMMUNICATIONS		14	20
OTHER		6	9

2.3 HOW DOES THE MAJORITY OF YOUR EMPLOYEES TRAVEL TO WORK?

	TALLY	TOTAL	%
CAR		67	97
PUBLIC TRANSPORT		8	12
WALK / CYCLE		13	19
OTHER		0	0

3.1 WHERE ARE YOUR CUSTOMERS / GROUP COMPANIES LOCATED?

	TALLY	TOTAL	%
SWINDON		13	19
30 MILE RADIUS		11	16
U.K		36	52
LONDON / BRISTOL		0	0
EUROPE		10	7
OTHER		8	12

3.2 WHAT METHODS OF TRAVEL DO YOUR PRODUCTS / PEOPLE ON BUSINESS USE?

	TALLY	TOTAL	%
ROAD		63	91
RAIL		10	7
AIR		13	19
OTHER		7	10

3.3 DO YOUR PRODUCTS / PEOPLE USE MAINLY?

	TALLY	TOTAL	%
RAIL		7	10
M4		40	58
M5		26	38
A ROADS		22	32
OTHER		11	16

4.1 WHEN YOUR COMPANY GROWS AND NEEDS TO RELOCATE WILL YOU?

	TALLY	TOTAL	%
RELOCATE		25	36
MOVE		2	3
EXPAND		31	45
OTHER		14	14

INTERPRETATION OF TALLY 1

Tally 1 displays all answers received from the questionnaires. It reveals the percentage number for each answer allowing easy recognition of the most common response.

Using a tally proved to be the best method of displaying all the data collected in a confined area. It gave a clear representation of all answers and their outcomes. Other possible methods to display the data involved the use of graphs but it was decided that this would physically take up to much room, thus making comparisons difficult.

TABLE 4 – RESULTS COLLECTED BY QUESTIONNAIRE FOR ALL COMPANIES SELECTED

COMPANY NAME	LOCATION	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1
ANCHOR FOODS	BLAGROVE	*'80*	*C*	*C*	*A*	*A, B, E*	*A, D*	*A, C*	*C*	*A*	*B, B*	*N/A*
MAN	BLAGROVE	*'80*	*B*	*B*	*B*	*A*	*A, D*	*A*	*C*	*A*	*B, E*	*A*
MOTOROLA	BLAGROVE	*/*	*D*	*C*	*B*	*E*	*A, D*	*A*	*E*	*A, C*	*B*	*A*
READERS DIGEST	BLAGROVE	*'80*	*C*	*A, B*	*B*	*A, B, C*	*A, C*	*A, B, C*	*C*	*A*	*B, C*	*D*
GEC PLESSEY	CHEYNEY MANOR	*'57*	*D*	*C*	*A*	*A, E*	*D, E*	*A*	*E*	*A, C*	*B, C*	*A*
HB ELECTRIC	CHEYNEY MANOR	*'75*	*A*	*D*	*A*	*C*	*B*	*A*	*A*	*A*	*B*	*A*
ROAD RUNNERS	CHEYNEY MANOR	*'83*	*A*	*B*	*A*	*C*	*C*	*A*	*B*	*A*	*D*	*C*
EQUIPMENT SERVICES	CHEYNEY MANOR	*'81*	*A*	*B*	*A*	*B*	*C*	*A*	*A*	*A*	*B*	*D*
HOECHST	CHENEY MANOR	*'63*	*C*	*C*	*B*	*A, C*	*A, C, D*	*A, B, C*	*C, E*	*A, D*	*B, C*	*C*
L&J MECHANICAL	CHENEY MANOR	*'91*	*A*	*D*	*A*	*D*	*A, B*	*A*	*C*	*A*	*B, D*	*A*
RED POINT	CHENEY MANOR	*/*	*B*	*C*	*A*	*B, C*	*A, C*	*A, C*	*C*	*A, D*	*B, C*	*C*
SQUARE.D	CHENEY MANOR	*'75*	*C*	*C*	*B*	*B*	*A*	*A, B*	*C, E*	*A, B*	*A, B, C*	*D*
SWINDON SKIPS	CHENEY MANOR	*'90*	*A*	*D*	*A*	*E*	*B*	*A*	*B*	*A*	*D*	*A*
ICL	DELTA	*'91*	*A*	*A*	*B*	*A*	*B*	*A*	*C*	*A, B*	*B*	*C*
INTERGRAPH	DELTA	*'86*	*C*	*D*	*A*	*A, D*	*A, D*	*A*	*C*	*A*	*B*	*A*
MOD	DELTA	*'91*	*B*	*A*	*B*	*B*	*B*	*A*	*C*	*A, B*	*A, B*	*C*
QUADRANT	DORCAN	*'86*	*D*	*D*	*A*	*B*	*A*	*A*	*C*	*D*	*E*	*C*
POST OFFICE SUPPLIES	DORCAN	*'72*	*C*	*A, B*	*B*	*A, B*	*A, C*	*A*	*C*	*A, B*	*B, C*	*C*
RAYCHEM	DORCAN	*'61*	*D*	*C*	*A*	*A, D*	*A, E*	*A*	*A, C*	*A, C, D*	*B, C, D*	*A, C*
STRALFORS	DORCAN	*'80*	*A*	*C*	*A*	*A*	*B*	*A*	*B*	*A*	*B, C*	*A*
WOOLWORTH	DORCAN	*/*	*B*	*B*	*B*	*A*	*A*	*A, C*	*C*	*A*	*B, C*	*A*
ZIMMER	ELGIN	*'82*	*B*	*C*	*B*	*A*	*A*	*A*	*F*	*D*	*E*	*C*
H&T	ELGIN	*'90*	*B*	*C*	*A*	*B*	*A*	*A*	*B*	*A*	*B*	*C*
RIDGEWAY	ELGIN	*'88*	*A*	*B*	*B*	*C*	*A*	*A*	*A*	*A*	*D*	*A*
R&K WISE	GROUNDWELL	*'69*	*D*	*D*	*A*	*B*	*A*	*B, C*	*C*	*A*	*B, C*	*C*
GEC	GROUNDWELL	*'82*	*A*	*C*	*B*	*A*	*C*	*A*	*C*	*A*	*B*	*D*
BOOKCLUB ASSOCIATES	GROUNDWELL	*/*	*B*	*B*	*A*	*A*	*A*	*A, B*	*F*	*A*	*B, C*	*C*
CLOVERLEAF	GROUNDWELL	*'90*	*B*	*C*	*A*	*E*	*D*	*A*	*C, E, F*	*A, B, C*	*B, C*	*N/A*
CLARES	HAWKSWORTH	*'79*	*C*	*C*	*A*	*A, B*	*A*	*A, C*	*C*	*A*	*C, D*	*C*
DOEFLEX	HAWKSWORTH	*'78*	*B*	*C*	*A*	*A*	*A*	*A*	*E*	*D*	*D*	*A*
REGAL WINDOWS	HAWKSWORTH	*'80*	*A*	*C*	*A*	*C*	*B*	*A*	*A*	*A*	*D*	*C*
NTL	HAWKSWORTH	*'84*	*A*	*D*	*A*	*E*	*C*	*A, B*	*A*	*A*	*D*	*C*

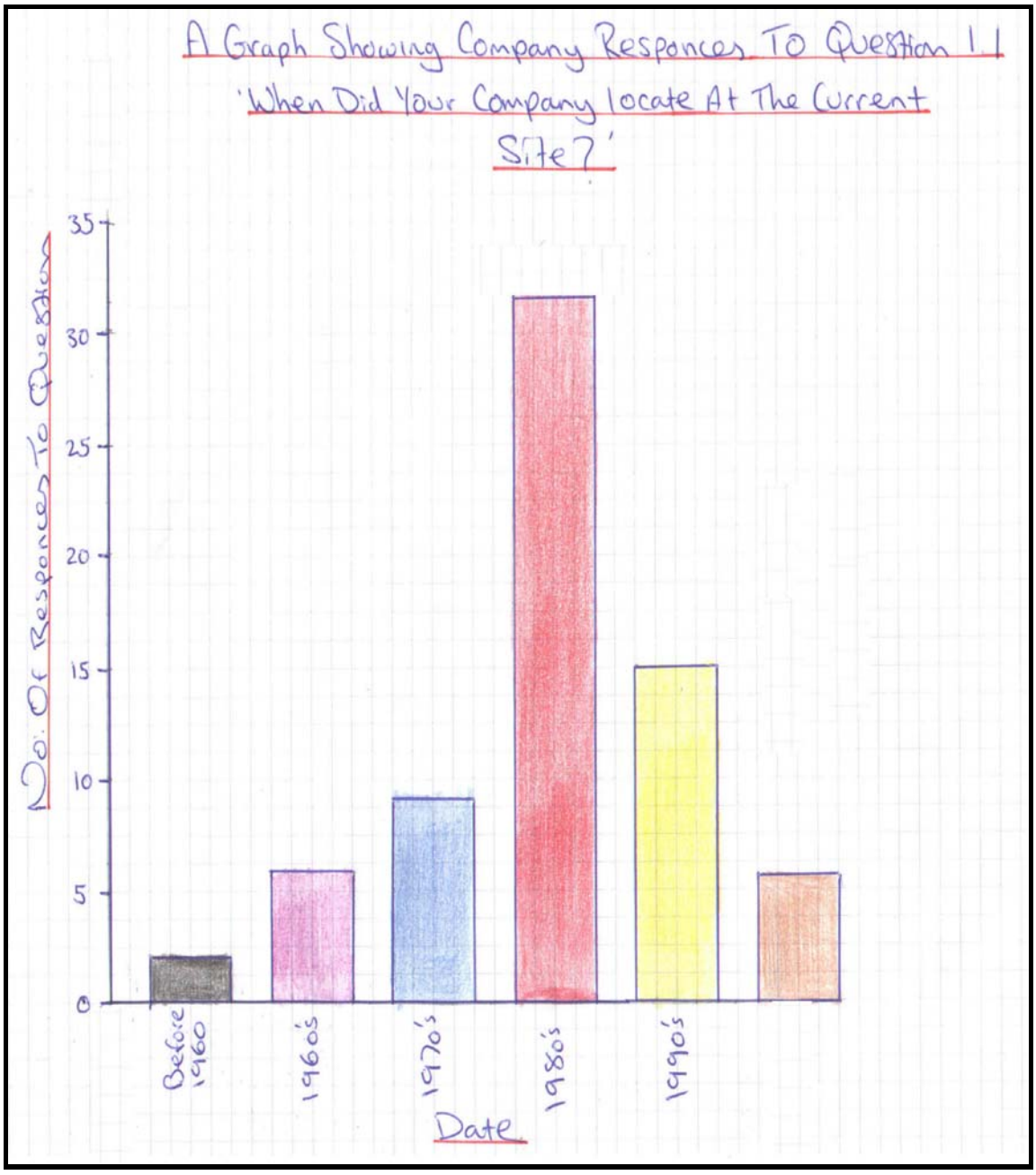
CLAIRON	HILLMEAD	*'87*	*B*	*B*	*A*	*A, B, C, D*	*A, D*	*A*	*F*	*A, C*	*B, E*	*D*
JOHNSON CONTROL	HILLMEAD	*'88*	*A*	*A*	*B*	*E*	*B*	*A*	*A*	*A*	*D*	*D*
BRS WESTERN	KEMBRY PARK	*'82*	*B*	*B*	*B*	*A, B, E*	*A, B, D*	*A*	*C*	*A, C*	*A, B, C, D*	*A, B, C*
NATIONAL SEMI CONDUCTORS	KEMBRY PARK	*'85*	*B*	*C*	*A*	*A*	*A*	*A, C*	*E*	*D*	*E*	*C*
THAMES WATER	KEMBRY PARK	*'89*	*D*	*D*	*B*	*B*	*A*	*A*	*F*	*A*	*B*	*N/A*
TJ SANSUM	KENDRICK	*'92*	*A*	*D*	*A*	*C*	*A*	*A*	*A*	*A*	*D*	*A*
M&W	KENDRICK	*'85*	*A*	*C*	*A*	*D*	*B*	*A*	*A*	*A*	*D*	*C*
BT	NORTH STAR	*'90*	*D*	*A*	*B*	*A*	*A, B*	*A*	*C*	*A, B, C*	*A, B, C*	*N/A*
NATURAL RESEARCH COUNCIL	NORTH STAR	*'90*	*B*	*A*	*A*	*A*	*A*	*A*	*C*	*A*	*E*	*D*
DIESELEC	OKUS	*'87*	*A*	*D*	*A*	*C*	*B*	*A*	*A*	*A*	*D*	*A*
GREAT WESTERN SECURITY	OKUS	*'86*	*C*	*D*	*A*	*B*	*A*	*A, C*	*C*	*A*	*B, C*	*A*
SWINDON TRAILURE CENTRE	OKUS	*'89*	*A*	*D*	*A*	*C*	*B*	*A*	*B*	*C*	*D*	*C*
THAMESDOWN COATING	OKUS	*'89*	*A*	*D*	*A*	*E*	*E*	*A*	*B*	*A*	*D*	*A*
TIMBER DIRECT	OKUS	*/*	*A*	*D*	*A*	*A*	*A*	*A*	*B*	*A*	*B, D*	*A*
BURMAH CASTROL	PIPERS WAY	*'72*	*C*	*A*	*A*	*A, B*	*A*	*A, B*	*C*	*A*	*B, C*	*C*
INTEL	PIPERS WAY	*'87*	*D*	*A*	*A*	*A*	*A, B*	*C, E*	*A, B*	*B, C*	*A*	*A*
NATIONWIDE	PIPERS WAY	*'92*	*D*	*A*	*A*	*A*	*A*	*A*	*C*	*A*	*B, D*	*C*
SEMA	RIVERMEAD	*'94*	*B*	*D*	*A*	*D*	*A*	*A*	*C*	*A*	*B, C*	*C*
RENAULT	RIVERMEAD	*'83*	*C*	*B*	*B*	*A, D*	*A, D*	*A*	*C*	*A*	*B, D*	*C*
THORNLINK	RIVERMEAD	*'96*	*C*	*D*	*B*	*E*	*E*	*A*	*C*	*A, B, C*	*B*	*A, B*
PENTAL	SOUTH MARSTON	*'89*	*A*	*B*	*B*	*A*	*C*	*A*	*C*	*A*	*E*	*D*
EARLT LEARNING CENTRE	SOUTH MARSTON	*'88*	*C*	*B*	*A*	*A, B*	*A*	*A*	*C*	*A*	*B, C*	*A*
BOC	SOUTH MARSTON	-	*A*	*B*	*B*	*A*	*D*	*A*	*A*	*A*	*D*	*C*
HONDA	SOUTH MARSTON	*'88*	*D*	*C*	*B*	*D*	*A*	*A, D*	*E*	*A*	*E*	*C*
ROBNOR RESINS	SOUTH MARSTON	*'65*	*B*	*C*	*A*	*E*	*A*	*A*	*C, E, F*	*A, C*	*B, C*	*C*
SALAMANDRE	SOUTH MARSTON	*'72*	*B*	*C*	*A*	*C*	*A*	*A*	*C*	*A*	*E*	*A*
AMEC	STRATTON	*'82*	*B*	*A*	*B*	*D*	*D*	*A*	*C*	*A*	*B, C*	*A*
BAMPTON	STRATTON	*'67*	*A*	*D*	*A*	*C*	*A*	*A*	*B*	*A*	*D*	*AH*

ROVER	STRATTON	*'58*	*D*	*C*	*B*	*A, B, C*	*A, C, D*	*A, B, C*	*E, F*	*A, C*	*B, C, D*	*C*
PUMP CENTRE	TECHNO	*'89*	*A*	*B*	*B*	*C*	*B*	*A*	*A*	*A*	*D*	*C*
COOPERS	TECHNO	*'65*	*A*	*D*	*A*	*C*	*A*	*A, C*	*C*	*A, B*	*A, E*	*C*
BROWN BROS	TECHNO	*'70*	*B*	*A*	*A*	*C*	*C*	*A, C*	*C*	*A*	*B, C*	*D*
RETRAC	TECHNO	*'87*	*B*	*D*	*A*	*C*	*E*	*A*	*B*	*A*	*D*	*C*
BRAKE BROS	WESTMEAD	*'94*	*B*	*B*	*B*	*A*	*D*	*A*	*C*	*A*	*B, C*	*C*
ACORN PRESS	WESTMEAD	*'94*	*B*	*D*	*A*	*C*	*B*	*A*	*B*	*A*	*B*	*A*
GALILEO	WINDMILL HILL	*'88*	*C*	*D*	*A*	*D*	*E*	*A*	*F*	*A, C*	*B, E*	*D*
PHH	WINDMILL HILL	*'90*	*D*	*A*	*A*	*B*	*A*	*A*	*C*	*A, B*	*A, B, C*	*D*

INTERPRETATION OF TABLE 4

Table 4 collectively displays all data acquired from the distributed questionnaires. Important information such as company name and location are displayed in a row like arrangement easily showing how that company answered. Due to the fact that all data is displayed using the same format, direct comparisons are quickly achieved. Questions such as 2.1 asking *'Why did your company choose Swindon for your current site?*' And 2.2 asking *'Why did your company select the specific site in Swindon?'* assist in the resolution of all hypotheses.

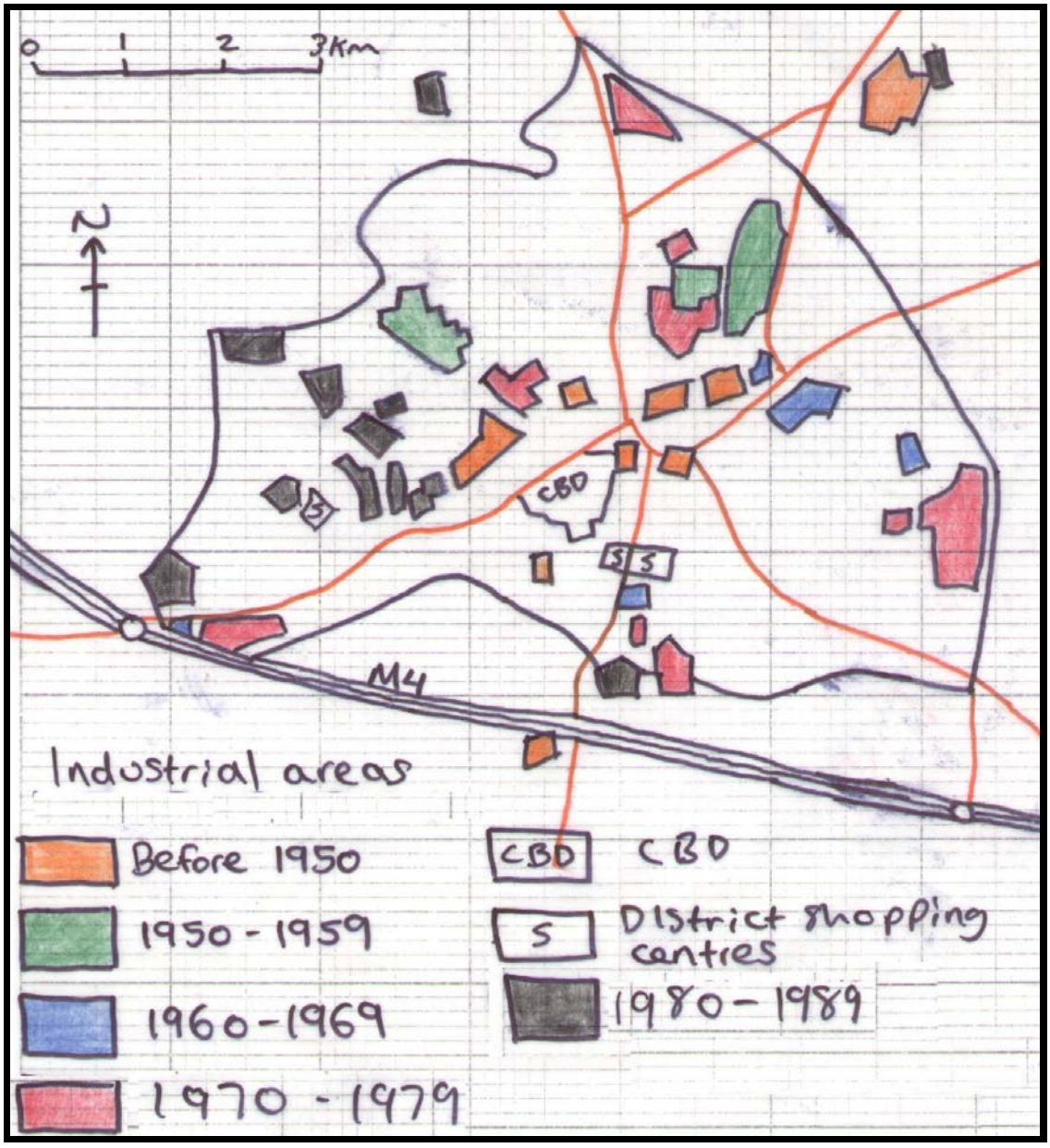
GRAPH 2 – SHOWING COMPANY RESPONSES TO QUESTION 1.1 '*WHAT YEAR WAS THE SITE COMPLETED AT THE CURRENT LOCATION*?'



INTERPRETATION OF GRAPH 2

Graph 2 represents the percentage of answers gained from the questionnaire question 1.1 asking *What year was the site completed at the current location?* After the completion of the M4, motorway business began to expand due to improved communication links, thus lead to the creation of the M4 corridor during the late 70's and early 80's. This is clearly shown by graph 2 *(pg 31)*, which displays a large column stemming from 1980. Companies began to move into Swindon during the 70's but the real boom came during the 80's and then halved during the 90's. The M4 became a major communication link between London and Bristol, thus making Swindon an ideal stopping place for business. Map 3 shows the influx of business throughout the 1960's – 1990's and where they located.

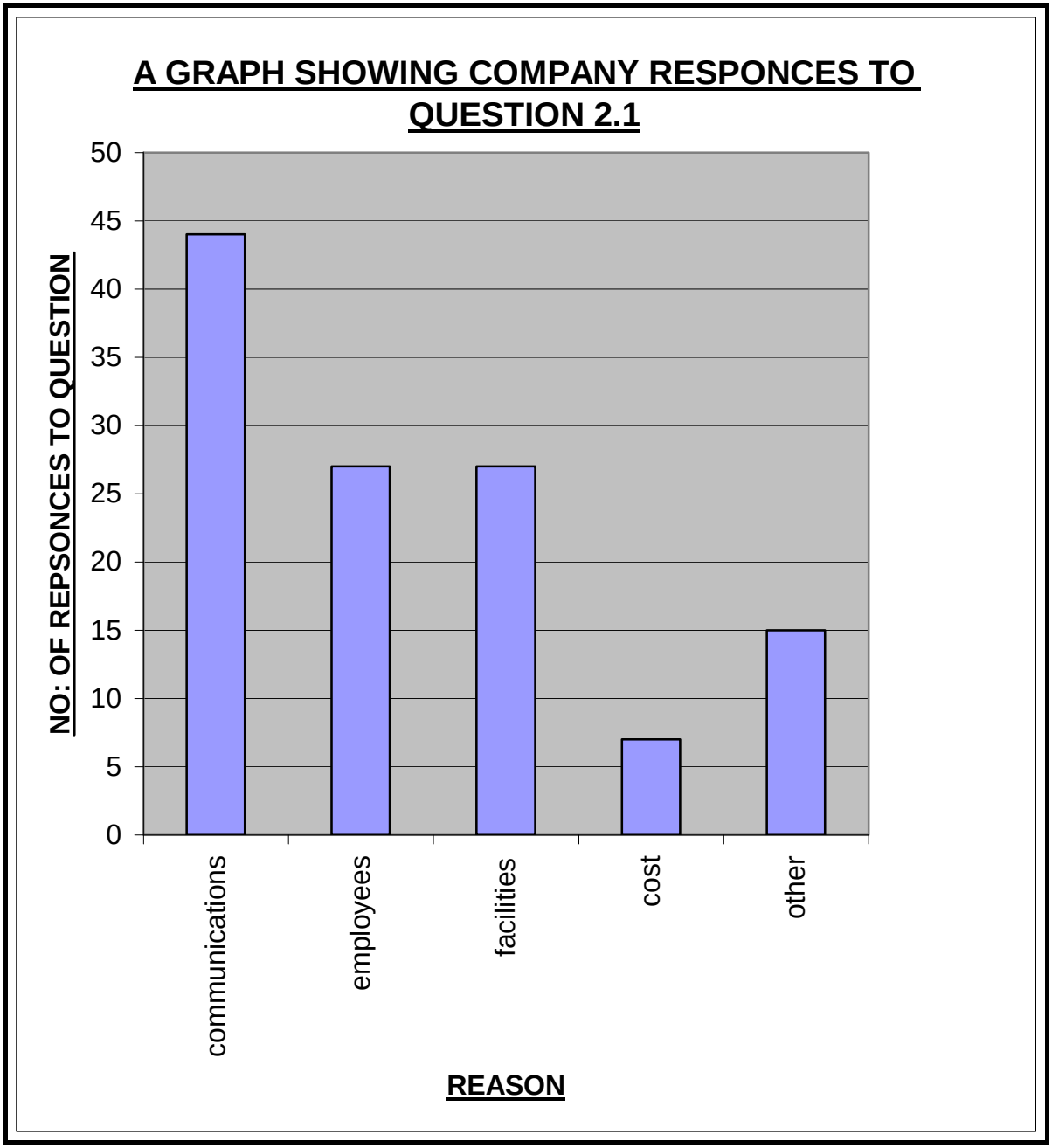
MAP 3 - INDUSTRIAL AGE LOCATIONS



Interpretation helps to support objective 1 asking '…. *if companies in Swindon locate primarily for communication reason',* as Swindon experienced an influx of companies shortly after the completion of the M4 motorway.

A bar graph was used as only a small portion of data needed to be displayed thus this was best achieved by using a bar graph which allowed any major points to be easily spotted. Other methods could have included the use of a scatter graph, but this was rejected as it would only show a trend and not make the 1980's column seem large and obvious in comparison to the rest of the data.

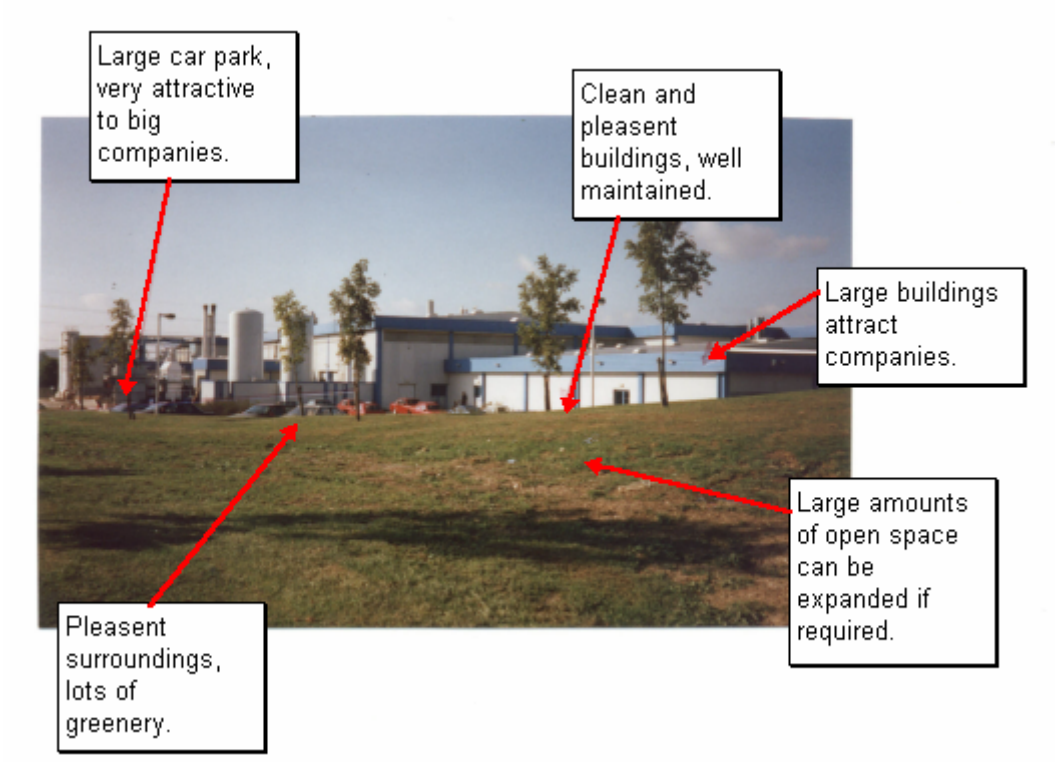
GRAPH 3 – SHOWING COMPANY RESPONSES TO QUESTION 2.1 '*WHY DID YOUR COMPANY CHOOSE SWINDON FOR YOUR CURRENT SITE*?'



INTERPRETATION OF GRAPH 3

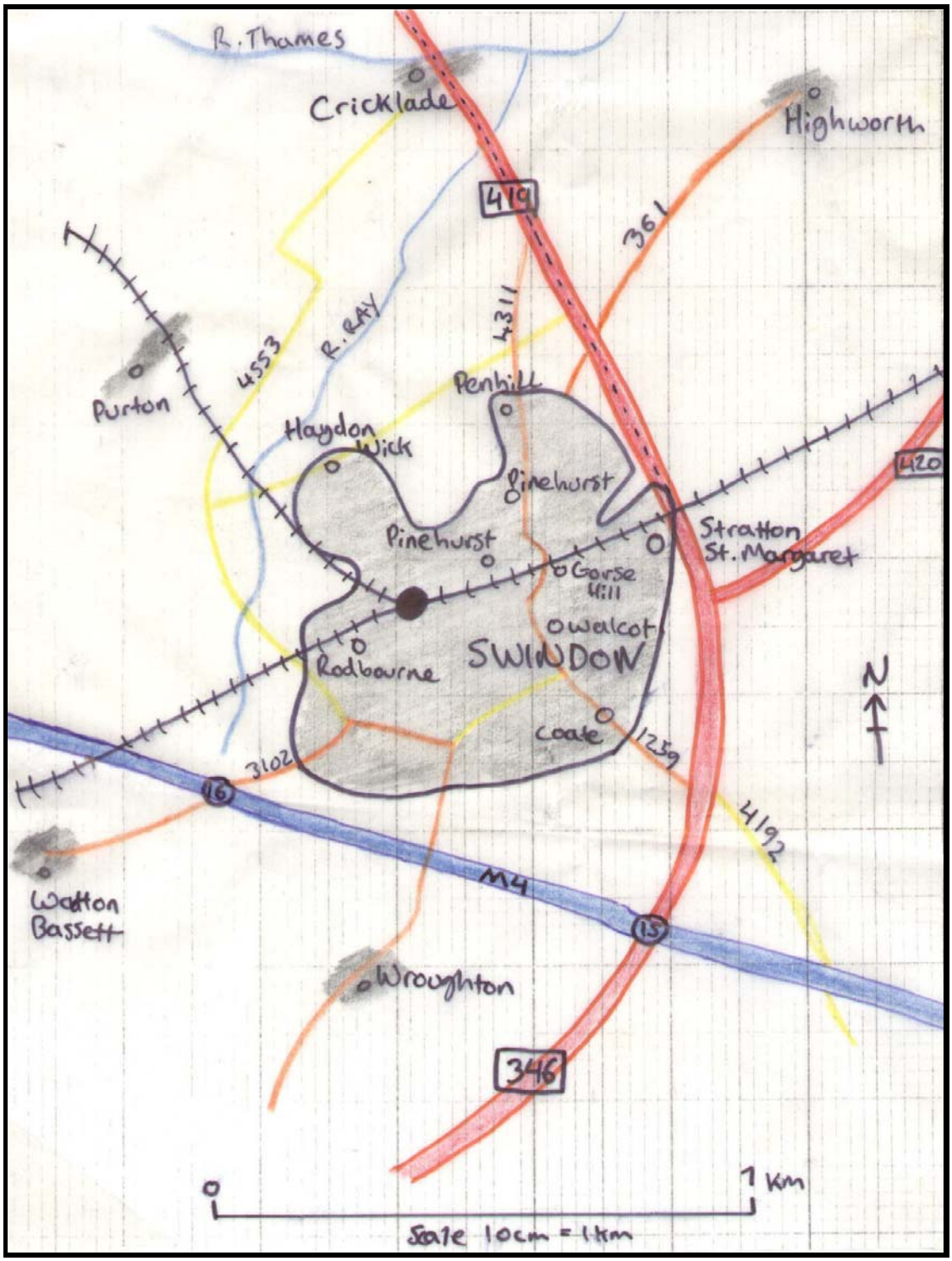
Graph 3 represents the percentage of answers gained from the questionnaire question '*Why did your company choose Swindon for your current site?'* It is clear that most companies chose Swindon due to its excellent communication links, most noticeable the M4 motorway. Map 1 (*pg 4*) shows Swindon and its communication links well. The M4 became the main source of communication between London, Swindon and Bristol (*see graph 4 pg38*). This gave rise to an increase of businesses looking for locations whereby they can locate near the M4. Swindon is the perfect location, with many A-roads leading through Swindon (*see Map 4 pg 36*), to the M4, and many areas, which were directly next to the M4 itself. The A-roads connect with the midlands and the South coast. It was this set of reasons along with two other influences that attracted many businesses to Swindon. These influences are: Employee figures and Facilities/Space.

PHOTOGRAPH 2 - BLAGROVE



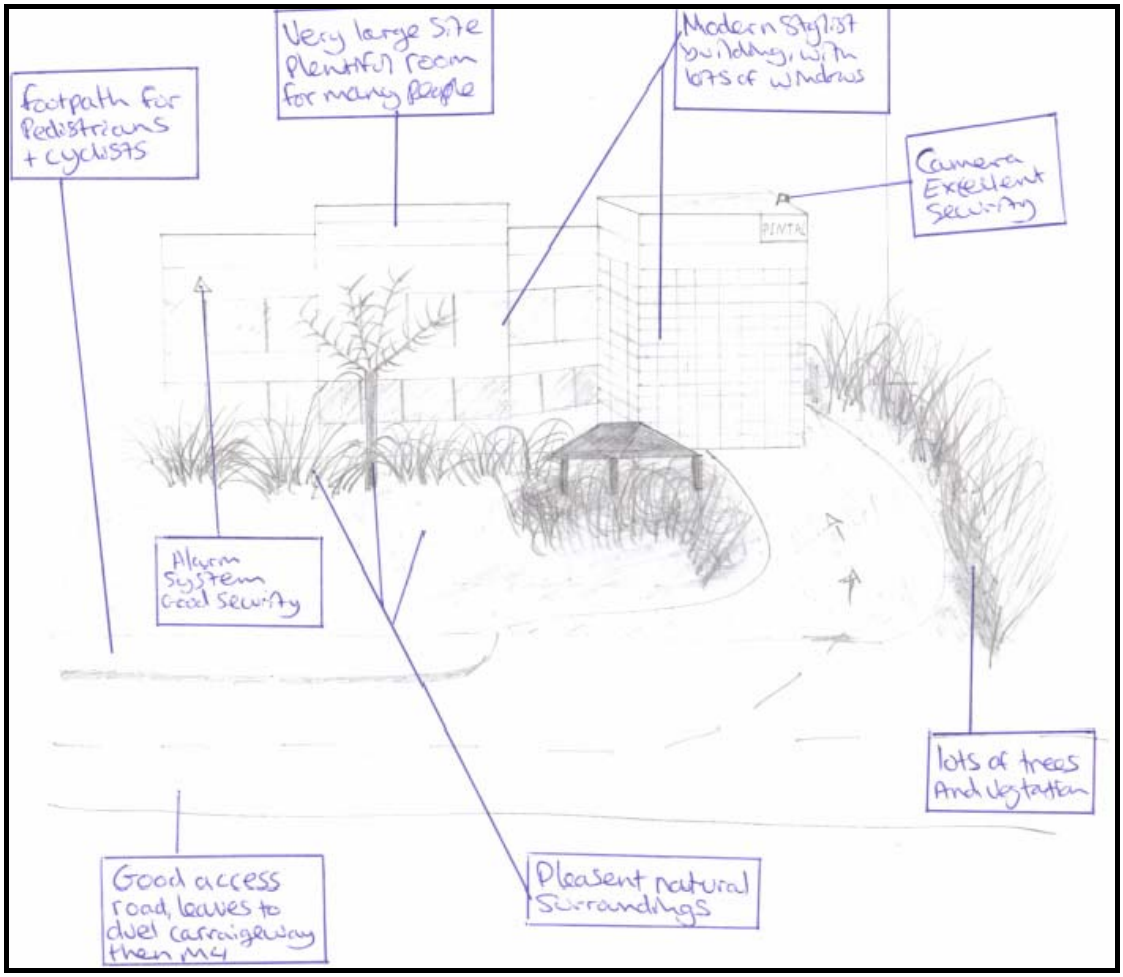
The numbers of employees were growing in Swindon as the town itself grew. From Graph 3 it can be seen that the increased employee availability was another main factor that influenced businesses to locate in Swindon. The other main influence was the amount of facilities and space (*see photograph 2*) that Swindon offered, these two factors combined made businesses interested in Swindon.

MAP 4 – SWINDONS INNER COMMUNICATION LINKS



As well as being close to suburban communication links, Swindon, at this time a rapidly developing town, had many areas that were being built upon, but still had space for future development. Employment areas with many units for businesses were being built in areas close or in simple access to new main links and areas of vast employee availability. The land was of vast space with further developing areas attached or close by. A good example of this is Delta industrial estate (*see sketch 1*), which is closely linked to the M4.

SKETCH 1 - DELTA EMPLOYMENT AREA-



Interpretation helped test objective 3, which asked if '…*companies in Swindon locate primarily for proximity to residential areas for a workforce'.*

Personal Observation – An extremely nice area with pleasant surroundings, very near to main road but set aside therefore reducing noise levels. Lots of greenery and by a public footpath, people daily pass this site to work. It is near to residential housing (Westlea) and so must be in style with the area. Near to a local corner shop. Very well maintained with alarm system visible accompanied by security camera.

GRAPH 4 – SHOWING COMPANY RESPONSES TO QUESTION 3.3 '*DO YOUR PRODUCTS / PEOPLE USE MAINLY*?'

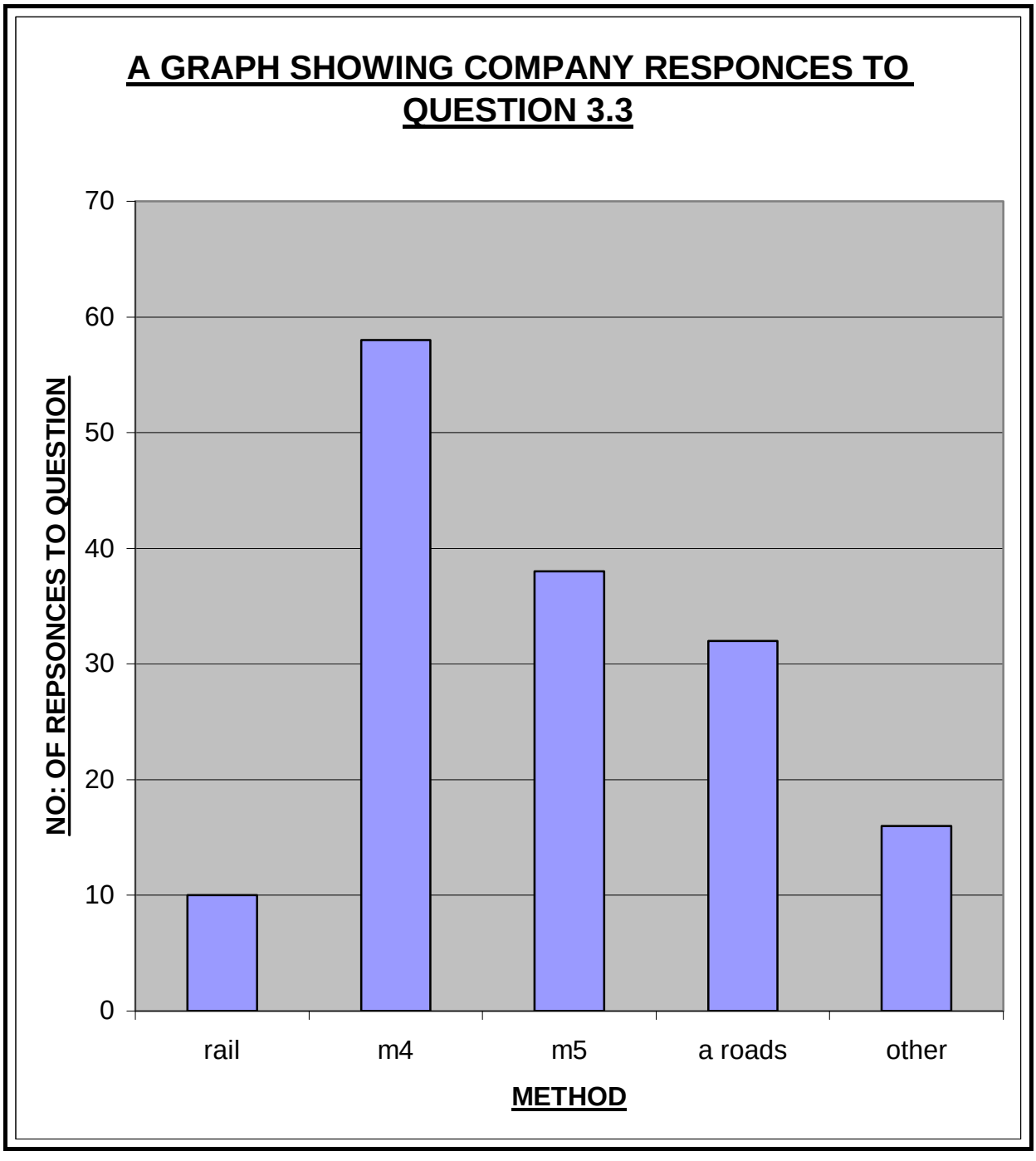


TABLE 4 - SPEARMAN RANK THEORY FOR THE AGE OF THE EMPLOYMENT ARE AND THE DISTANCE FROM THE MAIN ACCESS LINE

SITE	AGE	RANK	DISTANCE (M)	RANK	d	d^2
BARNFIELD	14	**11**	4.6	**2**	9	81
BLAGROVE	17	**8**	0.75	**13**	5	25
CHENEY MANOR	39	**1**	5	**1**	0	0
DORCAN	25	**3**	1.5	**9**	6	36
EUROPA	11	**13**	1.2	**11**	2	4
GROUNDWELL	22	**5**	0.6	**14**	9	81
HILLMEAD	12	**12**	3.5	**5**	7	49
KENDRICK	31	**2**	4.5	**3**	1	1
OKUS	23	**4**	4	**4**	0	0
RIVERMEAD	16	**9**	3.4	**6**	3	9
SOUTH MARSTON	15	**10**	1.3	**10**	0	0
TECHNO	21	**6**	1.1	**12**	6	36
WESTMEAD	18	**7**	3.1	**8**	1	1
WINDMILL HILL	7	**15**	0.5	**15**	0	0
DELTA	9	**14**	3.3	**7**	2	4

$\sum d^2 = 327$

SPEARMAN RANK FORMULA – $$r^2 = 1 - \frac{6\sum d^2}{n^3 - n}$$

SPEARMAN RANK COEFFICIENT $$= 1 - \frac{6 \times 327}{15^3 - 15}$$

$$= 1 - \frac{1962}{3360}$$

$$= 1 - 0.5839$$

$$= + 0.461$$

The results show a significant positive correlation between the age of site and the distance between the main access link, this agrees with objective 1 which asks '…*if companies in Swindon locate primarily for communication reasons*.'

On checking the significance of the result in the table of critical values (*see appendix 1*) the result of 0.4161 is less than the value of 0.44 at the 0.05 significance level. It was decided to use this level of significance as it gave a good level of accuracy. This means that the result is not statistically significant even though there is a strong correlation, which is quite close to that of significance.

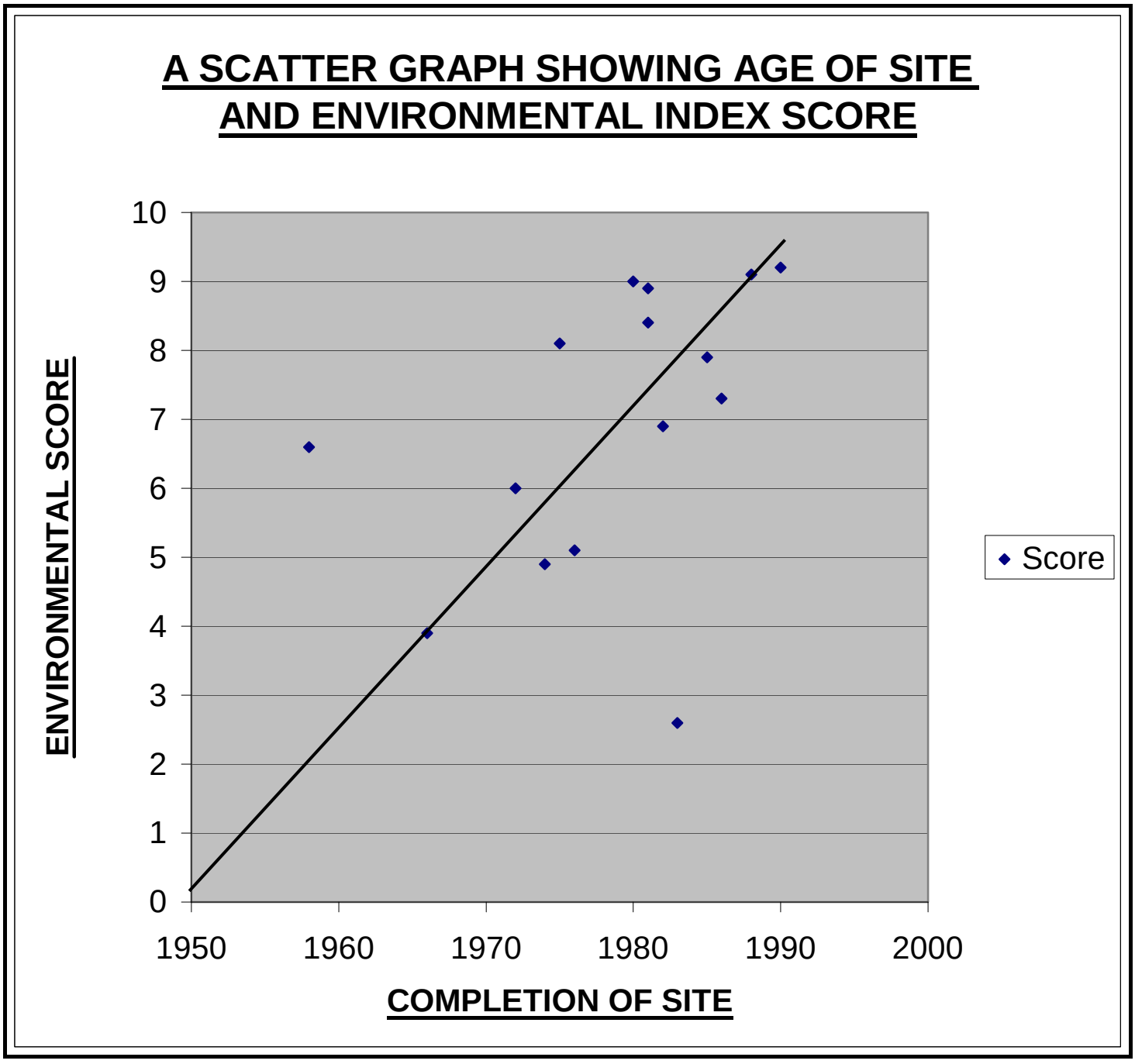
Spearman rank was used to:

- Analyse the correlation between age of the site and the distance from the main access links

- The method was used in previous fieldtrips to analyse correlations between two variable of importance.

The result indicates that a degree of significance between the age and distance from the main access link is present. It is therefore also significant in the planning of employment area sites within a town and growth of the town. The relationship and closeness to the main access links is a major factor. This can be shown by table 2 (*pg 18*) where the oldest site (*Cheney Manor*) is also the furthest site from an access link, and the newest site (*Windmill Hill*) is the closest to an access link.

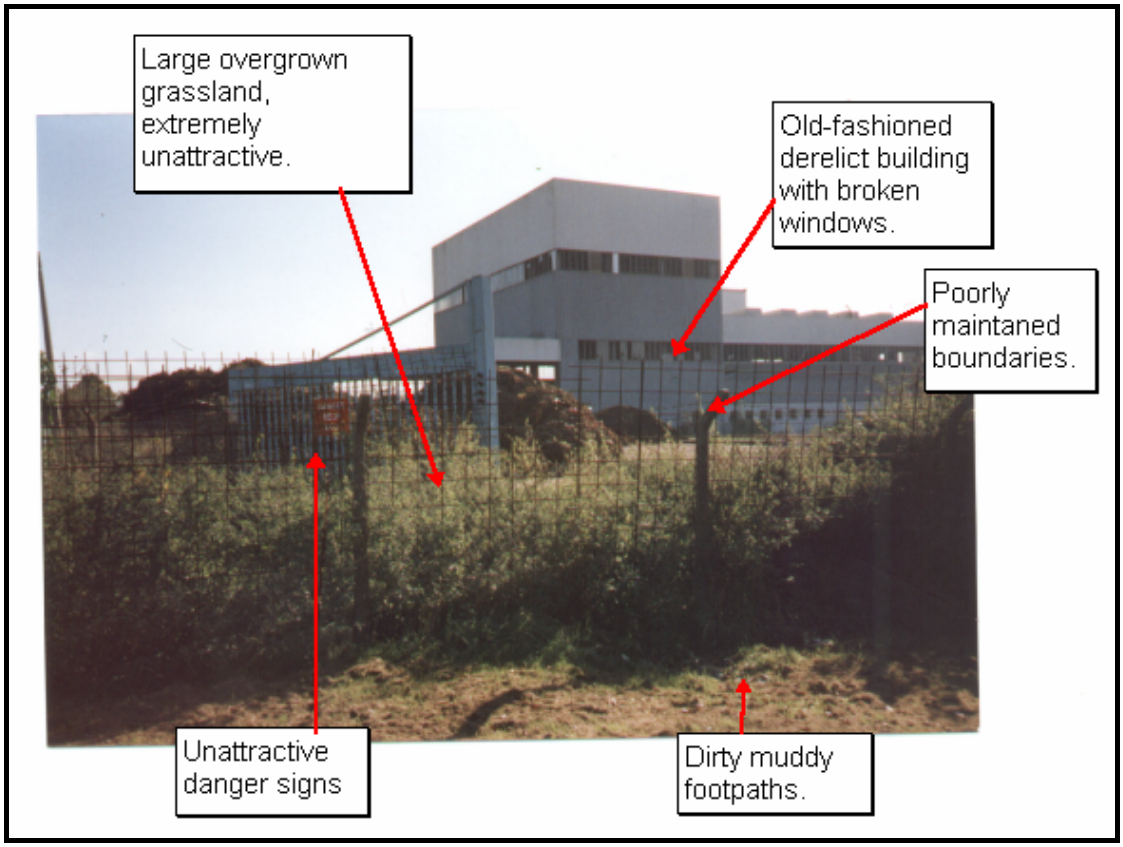
GRAPH 5 - A SCATTER GRAPH DISPLAYING CORRELATIONS BETWEEN AGE OF SITE AND ENVIRONMENTAL INDEX SCORE



INTERPRETATION GRAPH

Graph 5 shows a strong positive correlation between age of site and environmental score. It shows that the newer a site is the higher its environmental score will be. There are two exceptions, or anomalies, to this trend. The first anomaly occurs with the Cheney Manor site established in 1958, it has a score of 6.6 putting it way above those sites of a similar age. Although Cheney Manor is an old site, new businesses are continually moving into the area as old ones leave, as they do this the site tends to be refurnished and tidied up, thus explaining why this old site has a higher average score than its age group. Barnfield however was established in 1983 yet it only scores 2.6. The explanation lies in the fact that Barnfield is centred around the old incinerator and now rubbish tip. Thames water sewage works is also next to the tip contributing to the polluted environment. This result indicates that with age employment areas deteriorate and can sometimes loose environmental characteristics such as cleanliness and boundary fences. This is shown by photograph 3.

PHOTOGRAPH 3 - BARNFIELD

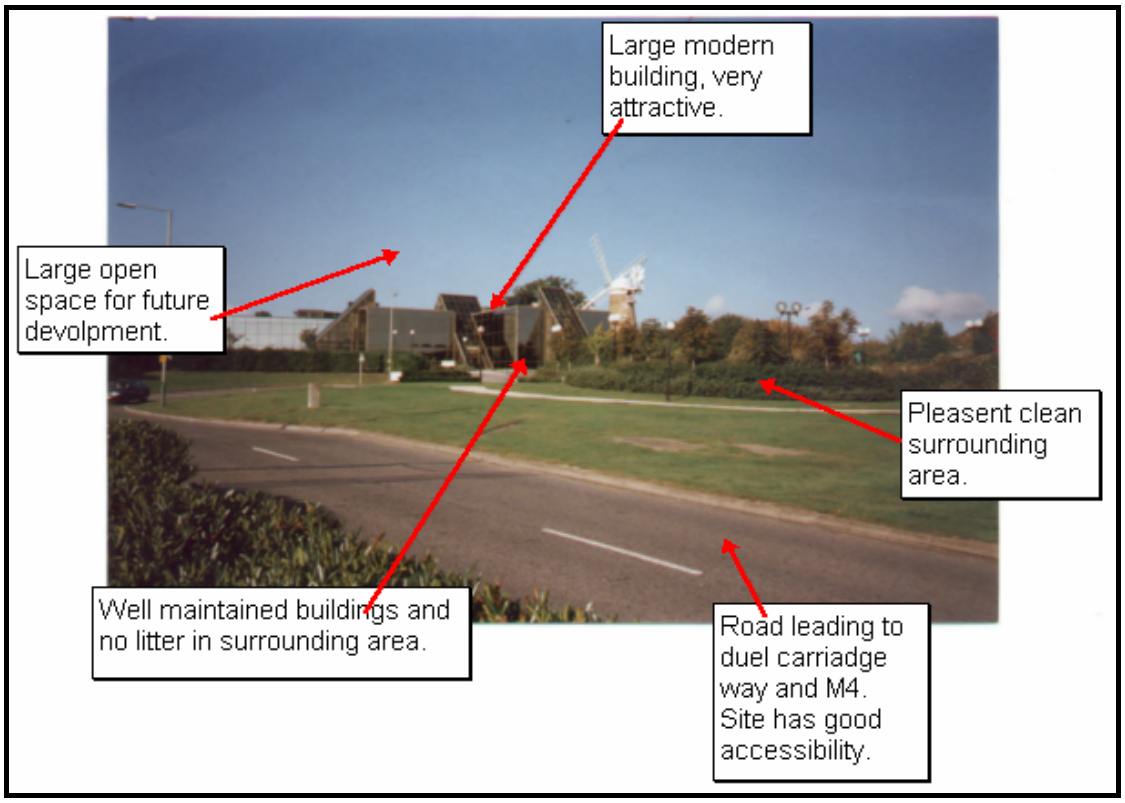


Graph 5 is a graphical representation of the data displayed in table 3 (*pg 22*). It is shown in the form of a scatter graph, which allows any trends or correlations to be displayed. Other methods rejected included a bar graph. This was rejected because although it displayed the data clearly, any trends or correlations would not appear as obvious. The drawbacks of using this type of data representation lye in the fact that only two sets of data are being

displayed, whereas a table can display much more information. This type of data representation is said to be data specific.

Windmill Hill and Delta both scored over 9, thus making them the highest scoring sites. Logic behind this may lye in the fact that they are new and so have better facilities and equipment, they are well suited to their purpose. Expensive companies able to refurnish the surrounding environment for its employees may also occupy them. Graph 5 showed that more recent areas had a higher environmental score, which maybe due to the fact that newer companies have more advanced facilities, such as larger and cleaner car parks, thus meeting the needs for today's employment. Photograph 4 shows how modern sites hold such a high standard and also helps to answer objective 2 which asks '…*if a companies locational decisions in Swindon is affected by the surrounding environmental area.'*

PHOTOGRAPH 4 - WINDMILL HILL



Kendrick was the second lowest scoring after Barnfield. This may be because it is an old site, established in 1966, therefore the companies attracted to that area may not be able to afford refurbishment, thus the site will prioritise employment and leave environment to last.

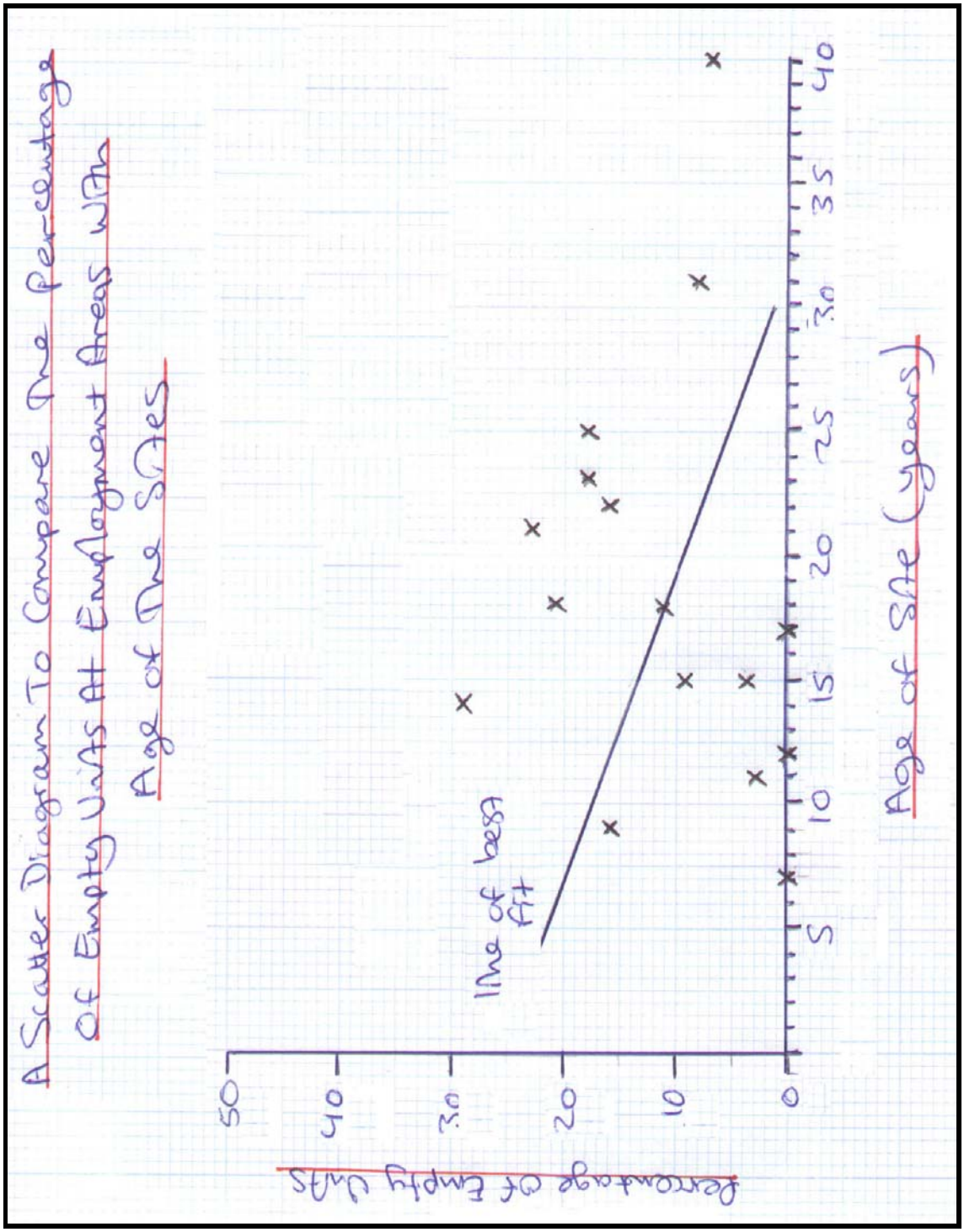
The fact that litter and conditions of the older sites was poorer shows a lack of maintenance of the buildings. This reveals that the employment areas are used as means of creating finance for Swindon and are not repaid in ways of maintaining the quality of the sites. It can also be shown (see Table 3 *pg 22*) that the poorer the environmental scores (Barnfield) the more empty units that

will exist, whereas Windmill Hill, a modern site, has no empty units at all. This indicates that the better the environment quality the more attractive the site is to new companies locating in the Swindon area.

Both Windmill Hill and Delta, the highest scoring sites are both business parks containing office blocks and have decentralised from the town centre. This is in contrast to the lowest scoring sites Kendrick and Barnfield, which are very central in town, and as newer companies have arrived and decentralised, these two sites have been used less often. This queries objective 1 that asks '…*if companies in Swindon locate primarily for communication reasons.'*

Personal Observation Of Barnfield – Very unpleasant area. Next to main road so pollution and noise levels are extremely high. Constant foul stench of sewage in the air as next to sewage works. Overall very dirty, poorly maintained, derelict ridden area. Little vegetation present.

GRAPH 6 – A SCATTER GRAPH DISPLAYING THE CORRELATION BETWEEN EMPTY UNITS AND THE AGE OF A SITE



ANALYSIS OF GRAPH 6

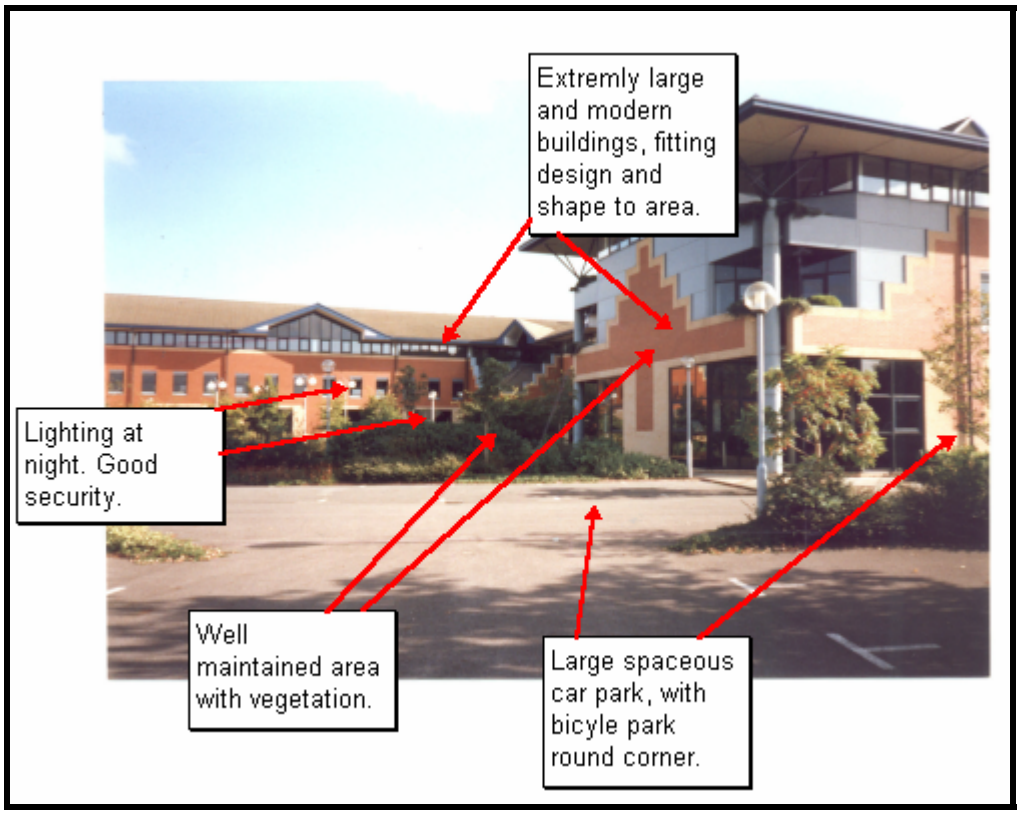
The scatter graph was produced to discover whether there is relationship between the age of an employment area and the number of empty units present at the site. The graph shows that as the age of an employment area increases the percentage of empty units decreases.

This may be due to the amounts of new employment companies being attracted to the development of the Swindon area and therefore using the units that are available in the older, more established sites. These units will be cheaper to buy or rent as the facilities are of a lower standard, than the newer more modern sites.

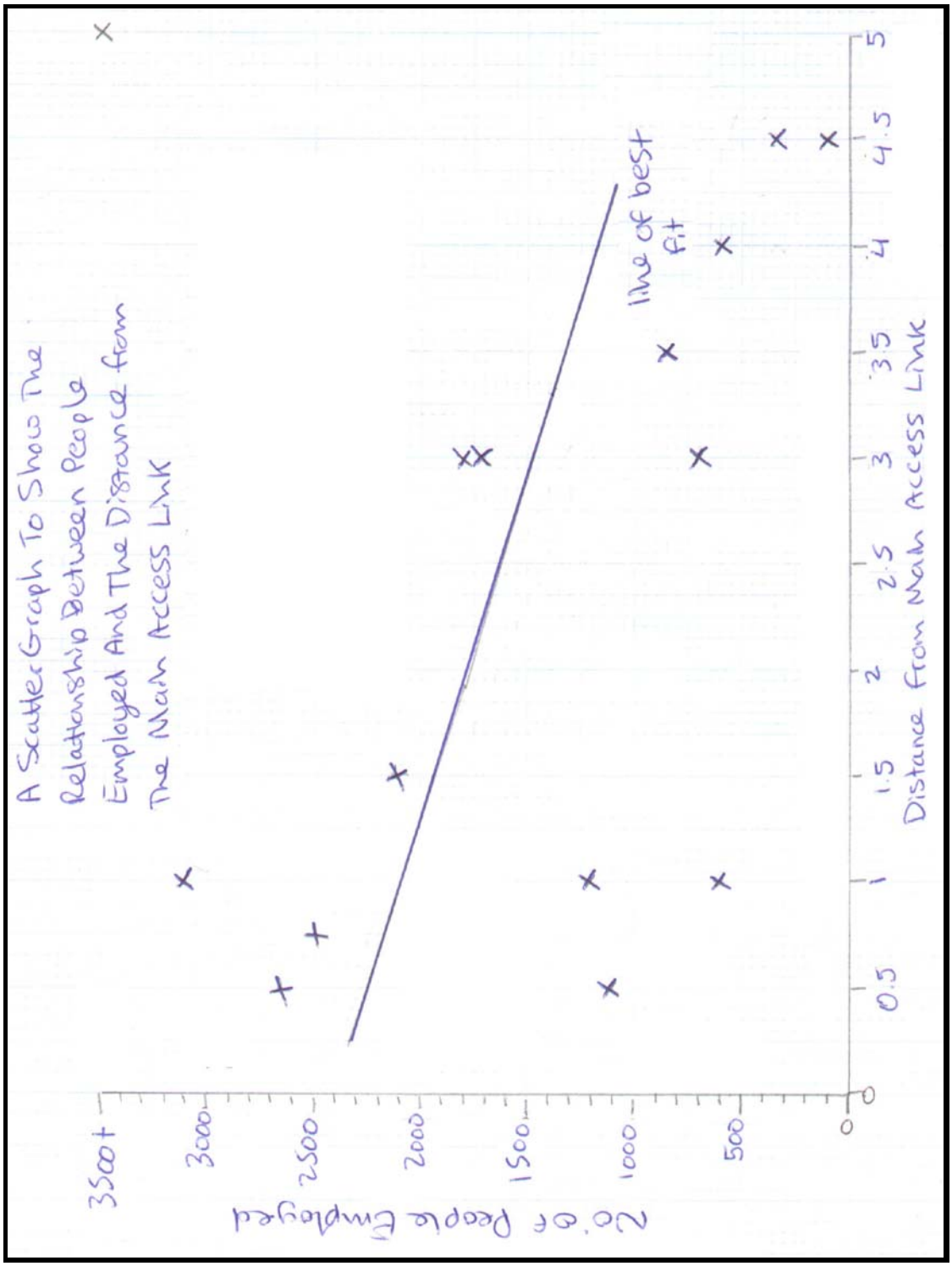
The reason why older sites have empty units is because the successful companies that have developed within the older sites move to larger, normally, newer areas, so that the company can further develop.

Another reason why employment areas may have empty units is that the new units may be too expensive for businesses to afford. This was the case with the Westmead area, which until recently stood vacant as no company could afford it. But larger multinational companies such as Lucent Technologies, are able to afford the high costs and now use it as one of their units, as shown by photograph 5.

PHOTOGRAPH 5 - BLAGROVE INDUSTRIAL ESTATE



GRAPH 7 – A SCATTER GRAPH DISPLAYING THE CORRELATION BETWEEN NUMBER OF EMPLOYES AND DISTANCE FROM THE MAIN ACCESS LINK



ANALYSIS OF GRAPH 7

The scatter graph was chosen to show if a relationship occurred between the distance of an employment area from a main access link and the number of people employed on site. The figures were taken from table 2 (*pg 18*), where the information was gained from the maps of Swindon.

It is apparent that the further away an employment area is from the main access link the fewer people the employment area employs.

The main factor that influences this is that employees may find it difficult to reach the employment area. This therefore would cause employees to work nearer to their homes or at a workplace that has easier access, for example closer to a main access link like the M4.

Increasing distance from an access link makes the employees journey difficult, as they are forced to travel through many suburbs of Swindon, which creates a longer and harder journeys for the employees.

Employers wishing to encourage people to work for them require easy access to the site, or from people to live locally so that they can travel to work easier and are therefore willing to do so.

Another factor affecting the result shown on graph 7 is the size of the employment areas that are situated nearer to the access links. These sites are often larger and are therefore more capable of employing a greater number of people.

The sites that are situated nearer to the access links also are normally near to large residential areas, (Blagrove see map 2 pg 15), this allows employee availability to the site from local residents and employees that can reach the area easily through access roads.

SUMMARY OF SCATTER GRAPH RESULTS

Overall and in general the results can be summarised as follows:

- **SUBJECT: DISTANCE FROM ACCESS LINK AND EMPLOYMENT NUMBERS**
  The closer an employment area is to the main access link the higher the numbers of employment figures are. This helps to answer objective 1 asking ***'…if companies in Swindon locate primarily for communication reasons.'***

- **SUBJECT: AGE OF SITE AND THE QUALITY OF THE ENVIRONMENT**
  The newer the site the better the environmental quality. This helps to answer objective 2 asking '…***if a companies locational decisions in Swindon is affected by the surrounding environmental area.'***

- **SUBJECT: AGE OF A SITE AND THE NUMBER OF EMPTY UNITS**
  The older the site the fewer empty units present at the employment area.

TABLE 6 – NEAREST NEIGHBOUR INFORMATION

EMPLOYMENT AREA	SITE	NEAREST NEIGHBOUR	DISTANCE (MILES)
WINDMILL HILL	1	2	0.5
BLAGROVE	2	1	0.5
DELTA	3	4	0.5
WESTMEAD	4	7	0.25
RIVERMEAD	5	4	0.25
HILLMEAD	6	5	1
BARNFIELD	7	8	0.25
KENDRICK	8	7	0.25
OKUS	9	3	1.5
CHENEY MANOR	10	7	0.5
TECHNO	11	12	0.25
EUROPA	12	11	0.25
DORCAN	13	11	2.5
SOUTH MARSTON	14	15	1.5
GROUNDWELL	15	14	1.5

$\Sigma = 11.5$

Area of map = 214 mm (Vertical) x 193 (Horizontal) = 41302

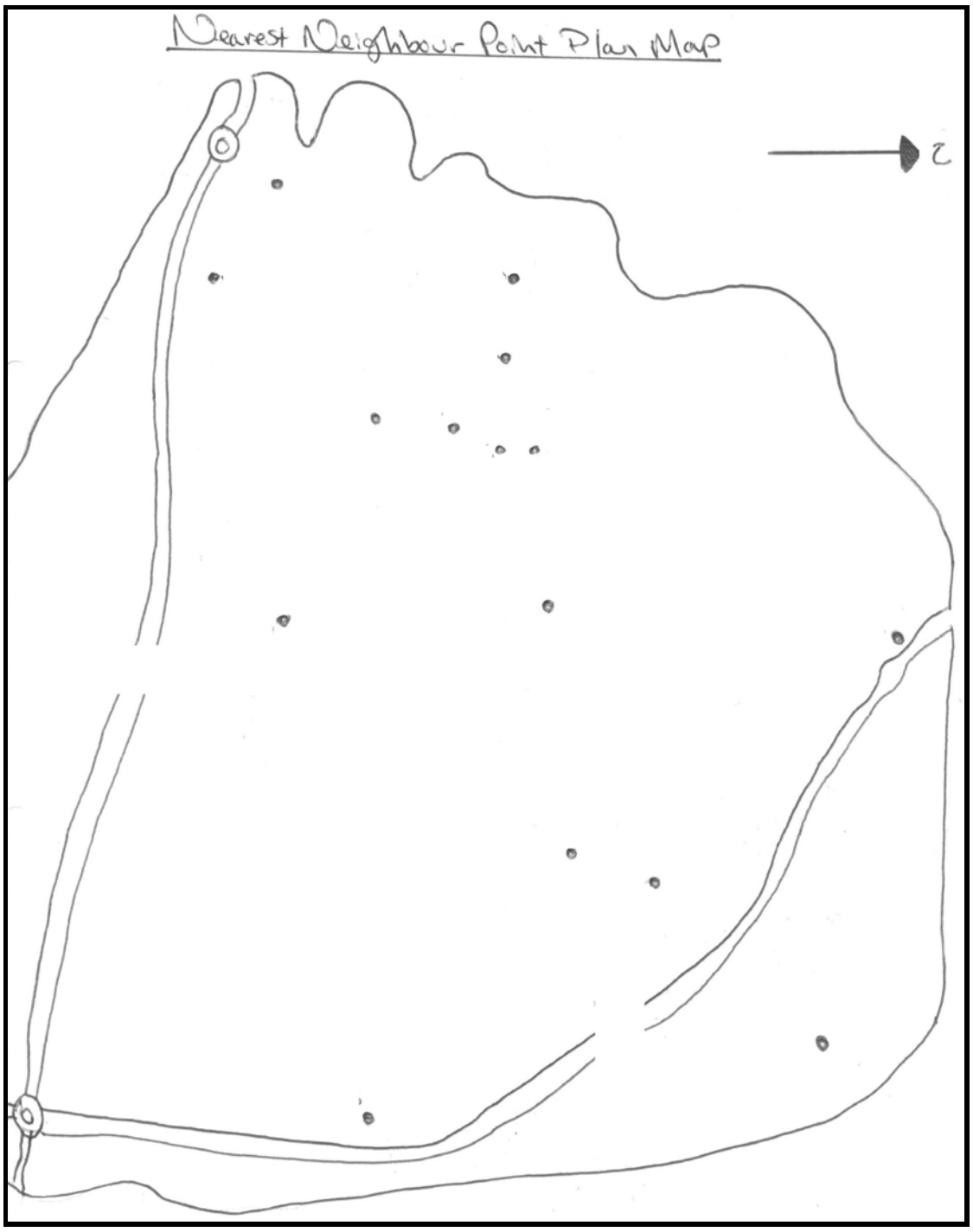
Total distance for all nearest neighbours = 11.5 (miles)

$$\frac{11.5}{15}$$

= 0.77

The table uses the results gained from Map 5 (*pg 51*), the distances were calculated using the improved scale for this map. The result of 0.77 was checked with the table of significance as can been seen in the appendix.

MAP 5 – NEAREST NEIGHBOUR POINT PLAN MAP

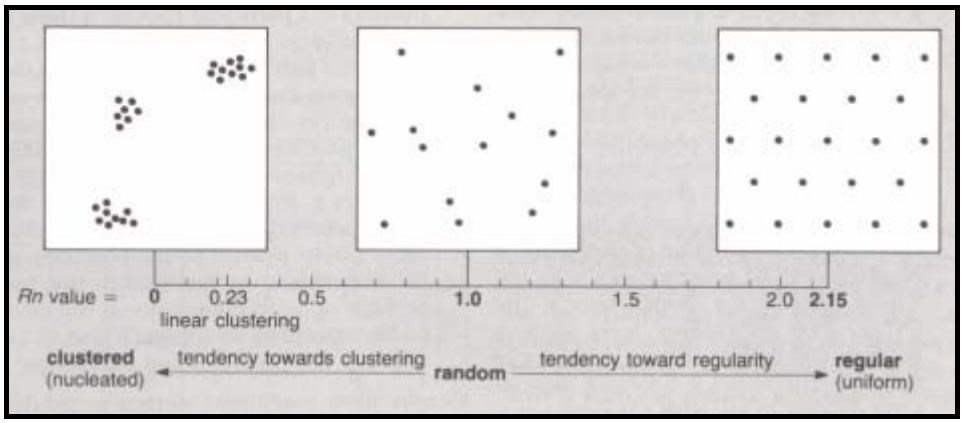


NEAREST NEIGHBOUR ANALYSIS

A nearest Neighbour analysis was carried out to show the distribution of 15 employment areas within Swindon, and help answer objective 3. The results of this method are indicated in table 4 (*pg 27*), and in diagram form on the point map 5 (*pg 51*).

This exercise was carried out to illustrate the type of distribution of employment areas i.e. regular, random or clustered (*see figure below*), in order to enable an analyses of the connection between locations and other factors such as population spread and access links.

FIGURE 1 - NEAREST NEIGHBOUR CLUSTERING



This technique of analysis was chosen because the point pattern gives a graphical and clear indication of the distributions of sites and can be easily positioned with the boundaries of the area and showing relationships with communication links, as shown on the standard map of the Swindon area. The results were then tabulated and statistically analysed, using a table of critical value (*see appendix*)

WHAT THE RESULTS SHOW-

The result of 0.77 (*for the 15 points in the survey*), from the nearest Neighbour analysis indicates that the dispersal of the sites is Random with a tendency towards clustering. The random is with the vicinity of a) the M4 motorway and b) the A4 19 main road. These two are the major communication links in and out of Swindon.

Tendency towards clustering is near to the town centre and the new western expansion. This is most possibly because the easy access to the M4, Junction 16 and closeness to new residential areas, as employees, and traditional sites within the older central area.

The sites are located close to residential areas so that companies can capture locally based employees; the employment areas are randomly distributed so

that employees can be gained from all areas within Swindon. The sites, which are within the clustering area, are located within the western and central expansion areas of Swindon, as these areas are also large residential growth areas, this indicates that the choice of location of sites is partly determined by the closeness of potential employees. This agrees with objective 3 asking '…*if companies in Swindon locate primarily for proximity to residential areas for a workforce.'*

Of the 15 sites, 7 (roughly 50%) are within the cluster, these include 2 of the oldest sites Cheney Manor and Okus and the other 5 sites; Delta, Westmead, Rivermead, Barnfield and Kendrick are within the new Western expansion. The remainder of the sites are randomly distributed within the Swindon area and are situated near to the main access links.

The nearest Neighbour analysis has given the result that the employment areas in Swindon are distributed randomly, in areas of residential growth and areas close to access links. The employment areas are distributed randomly due to the land available for building upon. Map 2 (*pg 15*) clearly shows the proximity between employment and residential areas.

PROPORTIONAL CIRCLE

PROPORTIONAL CIRCLE INTERPRETATION

The proportional circle technique was used to show the distribution of employment areas. It revealed how the sites vary according the number of people employed on them. The types of employment are shown using this technique with the pie chart representing the percentage of employment types for each site. (*also see pgs 60 - 74*)

The relevance of this technique is that it shows the different sizes of employment areas in connection with where they are situated within Swindon. It also gives a clear indication of the employment types and how they may vary with the situation of the sites.

Map 6 shows that the majority of the larger employment areas are situated on the outer regions of Swindon, close to main access links. This gives a conclusion that employment areas located nearer to the main access links have higher employment figures.

It is also noticeable that the employment areas nearer to the centre of Swindon have a relatively even mixture of employment type. The map shows that the earlier sites, like Cheney Manor, are within central regions of Swindon and are divided into many types of employment. This is in contrast with the newer sites, like Windmill Hill, which can be seen on the map to be located on the outskirts of the town and are dominated by a certain type of employment Windmill Hill is also a good example of this. The company has investments from foreign countries, namely Saudi Arabia, to finance foreign business e.g. National Power. The site is located on the edge of town directly in contact with Junction 16 of the M4, this provides the international firms with easy access to Heathrow airport.

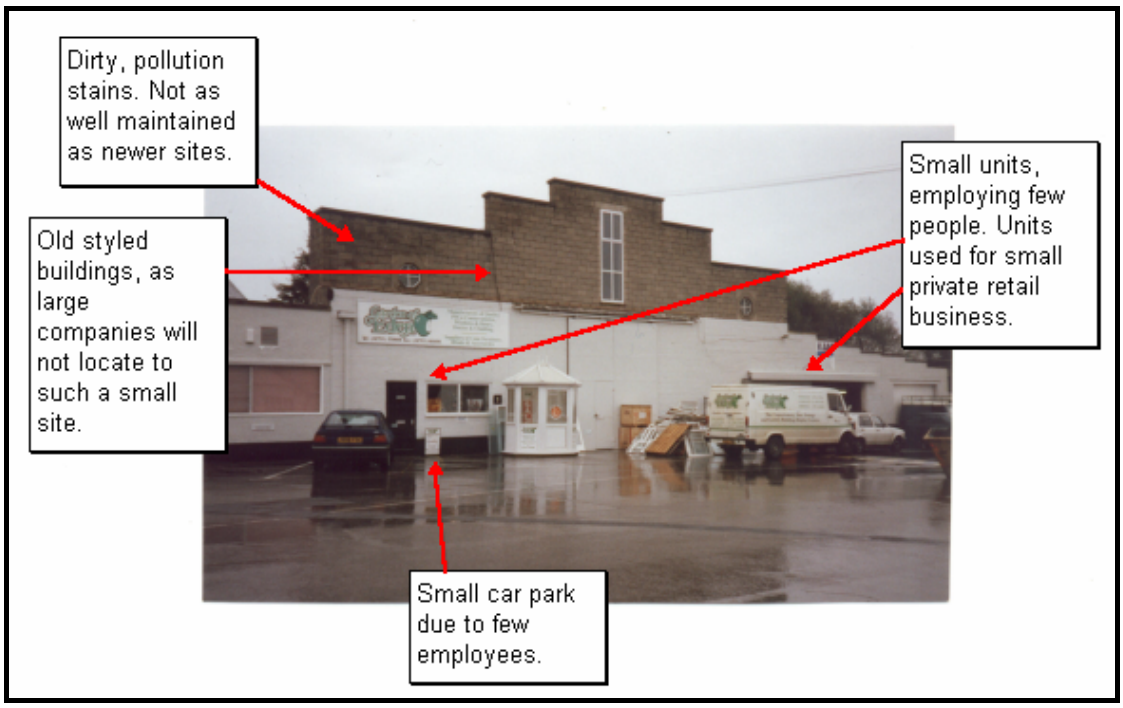
The circle representing South Marston is made up of nearly 50% warehouse and distribution, employing 1500 people in this employment type. This type of employment is situated at this site to allow better and easier access, as South Marston is located on the A4, which leads directly to the M4.

It can be seen from the map that the majority of the larger sites are situated on the outskirts of Swindon. This is because of the better access links available at these sites. The M4 and the A4 19 are both main access links that can be used on the outskirts of the town. The other reason why the larger sites are located in these areas is that there is more land available for future development.

The smaller sites in the centre of Swindon accommodate smaller businesses. This is why there is more variety of business types within the smaller employment areas in central Swindon. An example of this is Okus industrial estate (*see photograph 6*).

The units at Okus are very small and only accommodate a limited number of people and size of business. Although Okus is a small site it accommodates many units, giving employment to over 600 people.
In contrast with the size and number of units at the Okus industrial estate, is the site at Blagrove. Blagrove has only 8 units, however all of these units are large and together employ 2500 people (*see photograph 7*).

PHOTOGRAPH 8 - OKUS INDUSTRIAL ESTATE



Map 6 shows the site of Blagrove as a very large site of employment, which has a large percentage of manufacturing and warehouse businesses. The location of this site is ideal for these types of business because it is adjacent to Junction 16 of the M4, enabling large vehicles easy access for deliveries.

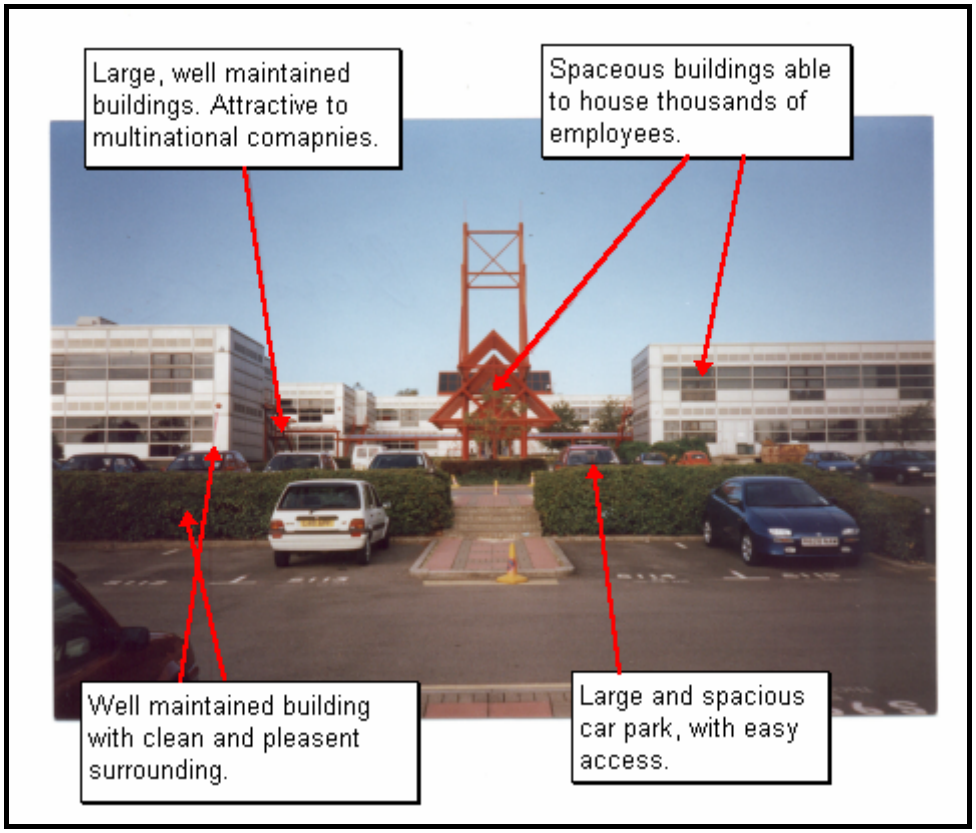
The location of Blagrove is next to a large growth residential areas. This has enabled the site to grow knowing that the number of people required to be employed will be available in their locality.

The largest site in Swindon is in the centre of the town. Cheney Manor is one of the oldest employment areas in Swindon. It has a relatively even Percentage of employment types, showing that it has many units which are both small, mainly used for retail, and larger units mainly used for bigger business types such and warehouse and distribution.

The reason why Cheney Manor is still the largest site is because it was traditionally placed on the edge of town, over 30 years ago. Since being built the site has grown and developed of that now it is within the town centre it. This shows that the site is a success, therefore remaining to employ many people (over 4000), and continues to develop.

The trio of circles on the map, of Hillmead, Rivermead and Westmead are some of the newer developments of Swindon' s employment areas. These sites are located on the edge of town, in areas of new growth and development of residential property. The spread of businesses on the sites in these areas indicates that there is mixture of businesses of different employment types. This is because the areas are made up of mainly smaller units, which encourages small new businesses to locate at the site. The businesses, which do locate in these areas, are often companies, which are themselves growing and can accommodate standard office units, which are available for rent. However some of the units at these sites are large, for example Renault manufacturing unit at Westmead. This is a large building, which has a lot of land surrounding it for future development.

PHOTOGRAPH 9 - BLAGROVE INDUSTRIAL ESTATE



Alternatively, where large employers require a custom built factory of warehouse they choose a Greenfield site, a good example of this is the Motorola manufacturing unit currently being built at Groundwell. This unit is designed to produce products to the whole of Europe.

Another example of a large manufacturing site which was custom built on a Greenfield site is Honda. Honda is a very large building, which manufactures cars by assembling components brought in from Japan and the whole of Europe. Honda employs over 2000 people within the Swindon area. Honda is located next to the A449, which provides direct communication to Junction 15 of the M4. This is ideal for the company as it enables easy access for lorries

to make and to collect deliveries for the company from other parts of the country.

In conclusion, the proportional circles show that the majority of larger employment areas are situated on the outskirts of the town. The chart shows that sites on the outskirts of Swindon often have larger units, which are used for particular employment types, which the employment areas usually specify in.

The chart also shows that within the central areas of Swindon the majority of sites are smaller with a large variety of employment types. This is mainly because the smaller units are more easily adaptable to small companies, which require development. Overall, larger companies tend to situate on the outer regions of the town, mainly due to easy access of communication links, and availability land for future growth, whereas the smaller sites choose to locate within central areas where there is not such a great reliance on communication links, facilities, and availability of employees.

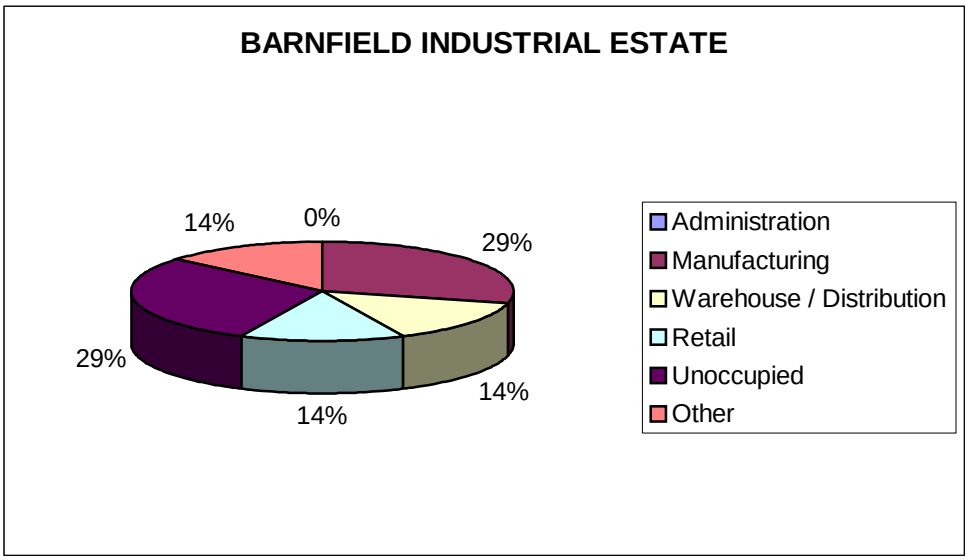
Personal Observation Of Blagrove – A very nice area, no litter, lots of mixed vegetation. An extremely well equipped area with plentiful facilities. Interesting building that is in keeping with the surrounding environment.

PIE CHARTS

The reason that the pie charts were produced is because they showed the percentage of employment types at each employment area.

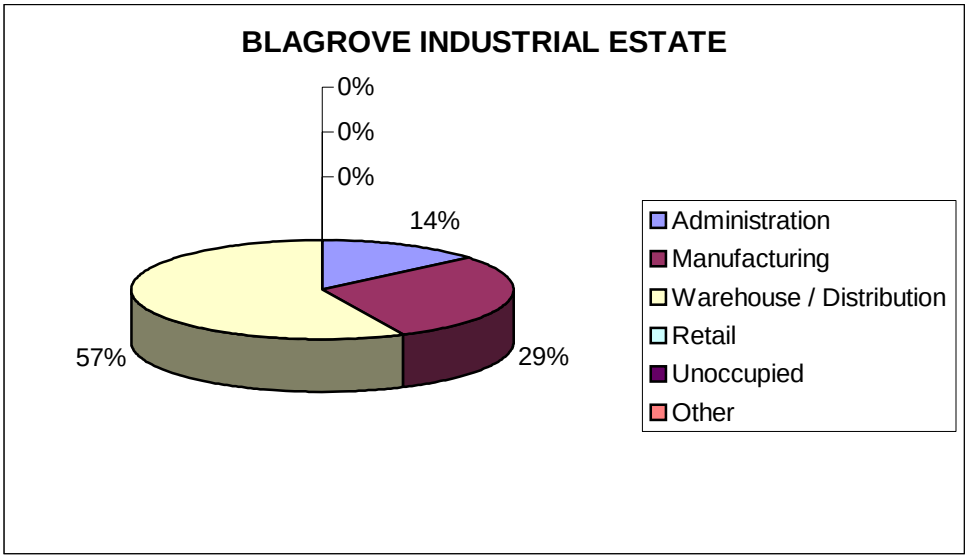
The percentages of different employment areas is shown well on the pie charts, this allows an analyses to be made on why companies in the employment areas are there and why the types of business are located at these sites.

PIE CHART 1



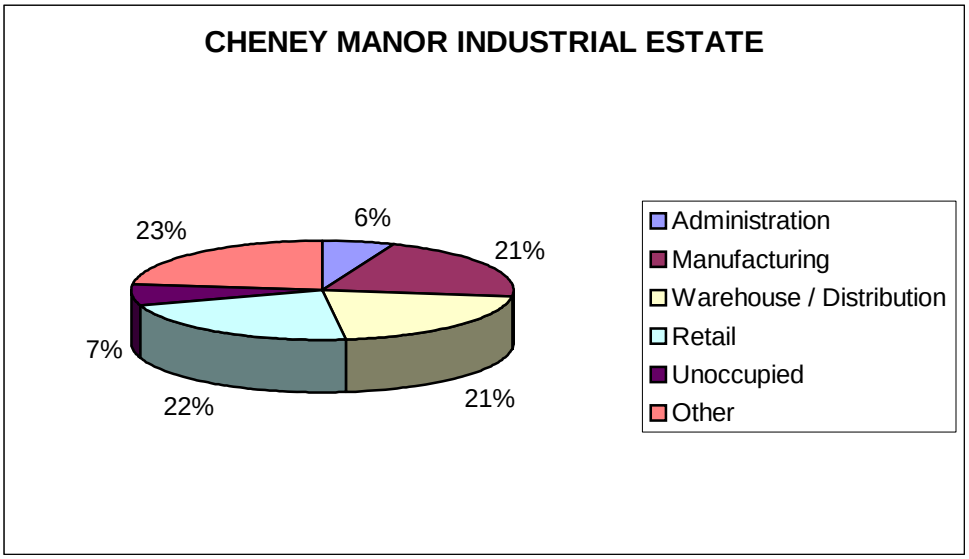
This pie chart shows that the Barnfield employment area has a varied type of employment. This site is situated within central Swindon, with relatively poor accessibility. It is for this reason that Barnfield has a varied employment area. The graph shows that the site has a number of units that are adaptable for a number of different companies.

PIE CHART 2



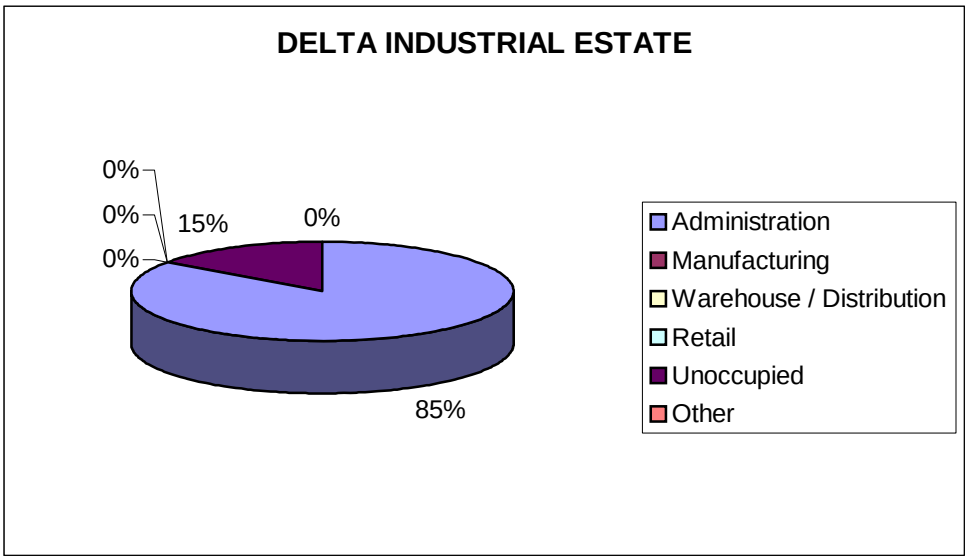
The pie chart shows that the main types of employment at this site is manufacturing, also with a large percentage in warehouse and distribution. Blagrove is located adjacent to Junction 15 of the M4 motorway. This means that there is good accessibility for large vehicles. The main employment types are ideal for this location as they involve large vehicles delivering and collecting, such as Readers Digest.

PIE CHART 3



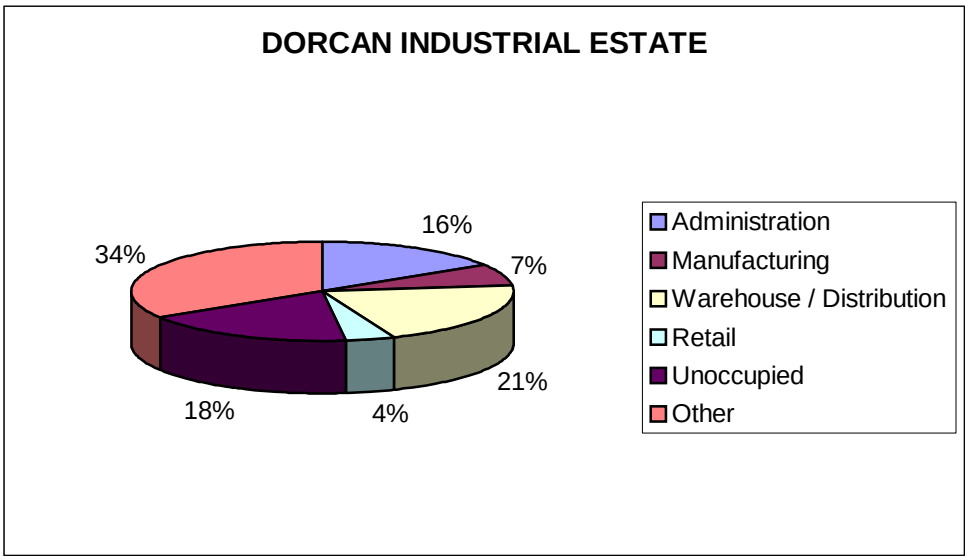
The graph shows that Cheney Manor has a wide variety of employment types. The reason for this is because the site has both large and small units. This difference in size of units available gives a mixture of business types to the area. The larger units are used for warehousing and manufacturing, while the smaller units are used for retail and administration.

PIE CHART 4



The pie chart shows that Delta is an area of administration employment. This business park has many companies, some of which are foreign e.g. Intergraph (American). These large businesses are located at this site in new modern office blocks.

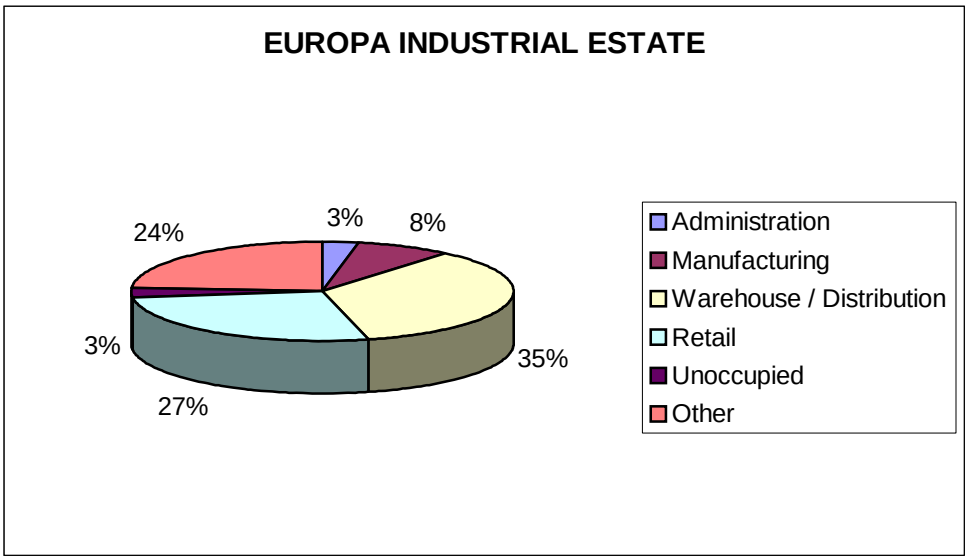
PIE CHART 5



Dorcan is situated on the east side of Swindon, near the A419. This location allows the site to operate in a mixture of employment types, as can be seen above. The manufacturing business is the largest due to the easy access of the main road making it easy for large vehicles to operate.

This site is one of the oldest sites in Swindon, having a mixture of different sized units. This mixture offers several different types of businesses to operate in the area. Due to its age the site has companies that were located there before the introduction of the A419, this is another factor influencing the variety in employment types.

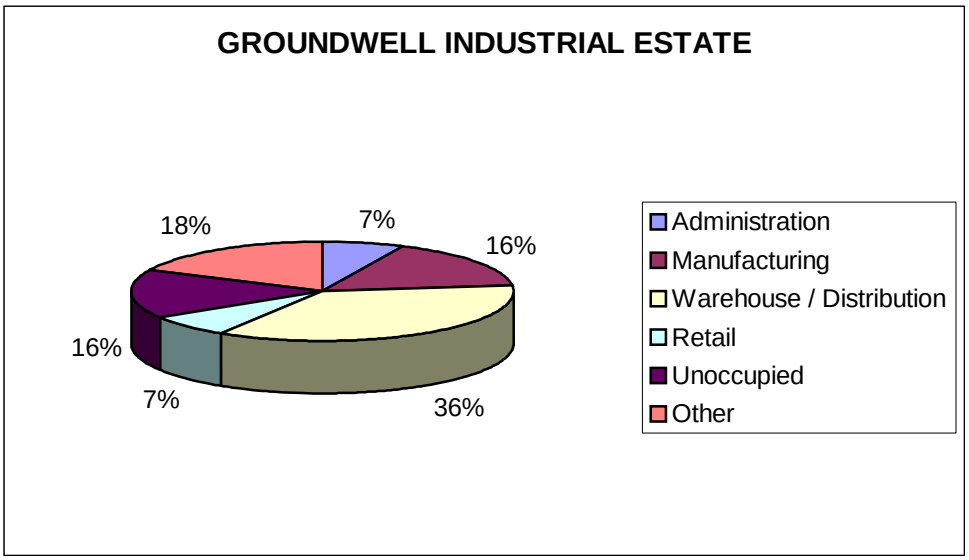
PIE CHART 6



The main employment type at Europa is manufacturing. This is because the site has mostly large buildings, which can be used for large machinery etc. The situation of this site is close to the A419, which leads to the M4 motorway, allowing easy access for large vehicles. This site also has a large percentage of retail employment.

The area in which Europa is located is near to large residential areas, which therefore attracts customers from the surrounding areas to use both the goods and services available. This helps to answers objective 3, which asks, '…*if companies in Swindon locate primarily for proximity to residential areas for a workforce.'*

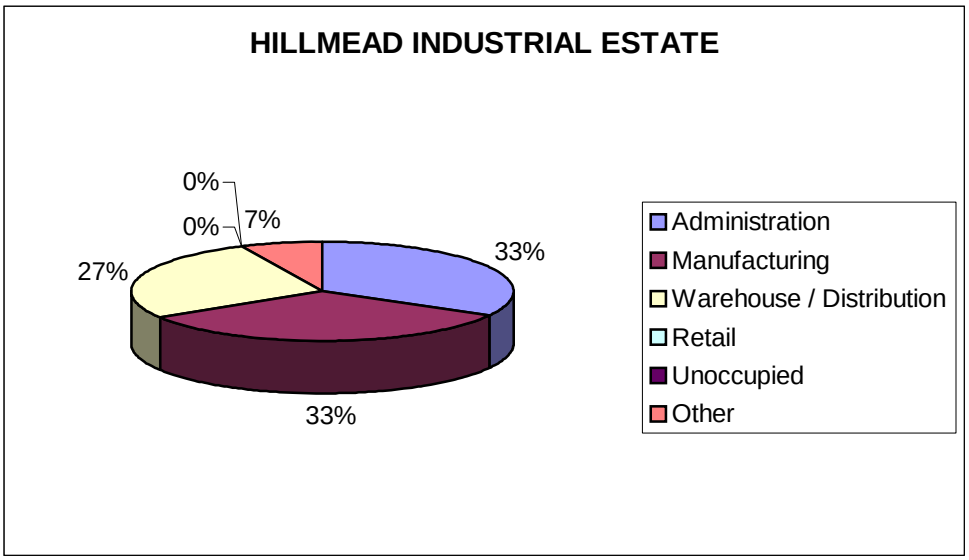
PIE CHART 7



The pie chart for Groundwell shows that the main employment type is manufacturing, with a large percentage of warehouse employment. There are also a large percentage of empty units (16%). This is because the site is undergoing development of the older units, as well as creating new units, e.g. Motorola are constructing new larger units.

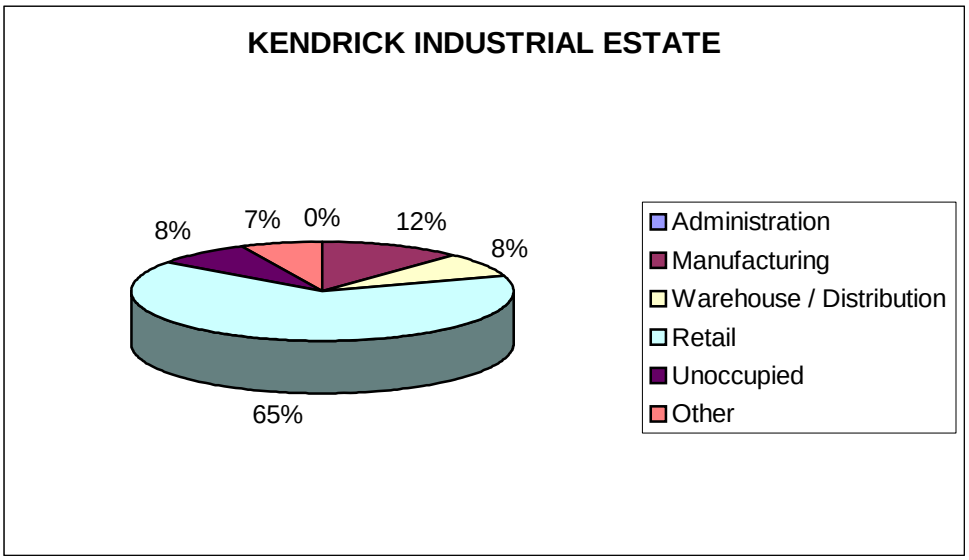
Groundswells situation favours the manufacturing business as it directly next to the A419, and so allows easy access for vehicles.

PIE CHART 8



Hillmead has three main employment types, Administration, Warehouse and distribution and manufacturing. This are has many large units some of which have been converted to large offices, and others to units with vast space for storage etc. The situation of this site is next to many new residential areas; this has created new employment in the area.

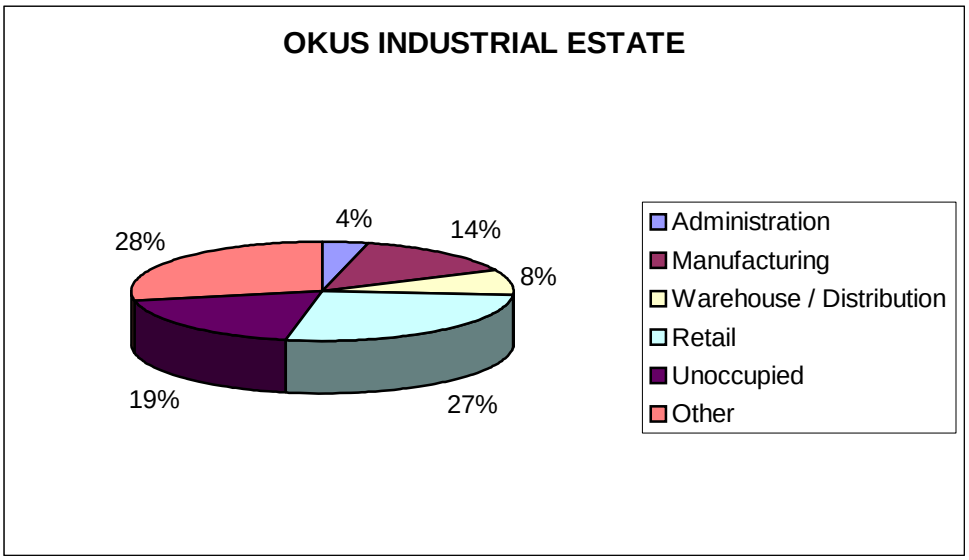
PIE CHART 9



The pie chart shows that Kendrick Park is dominated by retail employment. Kendrick is located in central Swindon, meaning that the public pass the site frequently as they travel to work or through Swindon. The retail industry will benefit from this as services will be noted and used by these people.

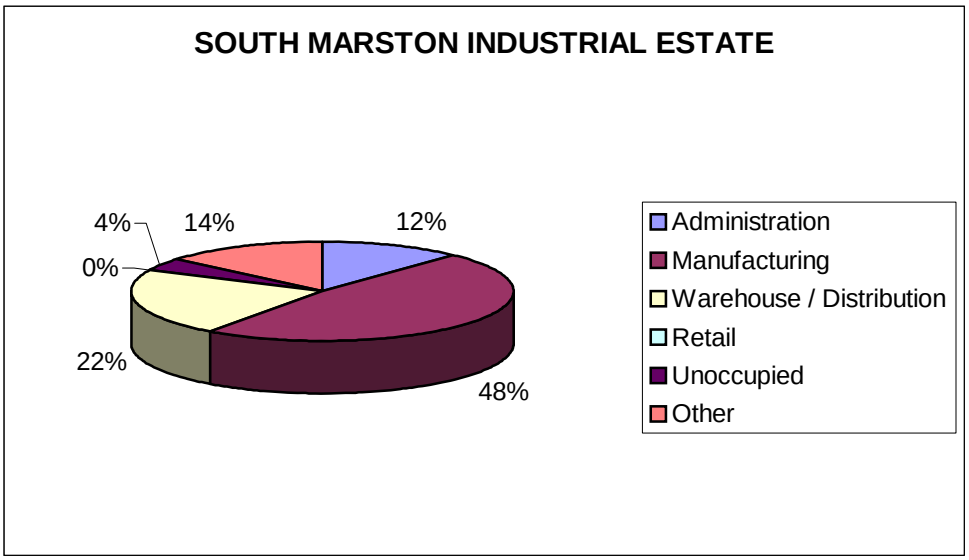
Kendrick is situated close to two other main employment areas, Cheney Manor and Barnfield; this means that the companies at these sites may also use the retail services available.

PIE CHART 10



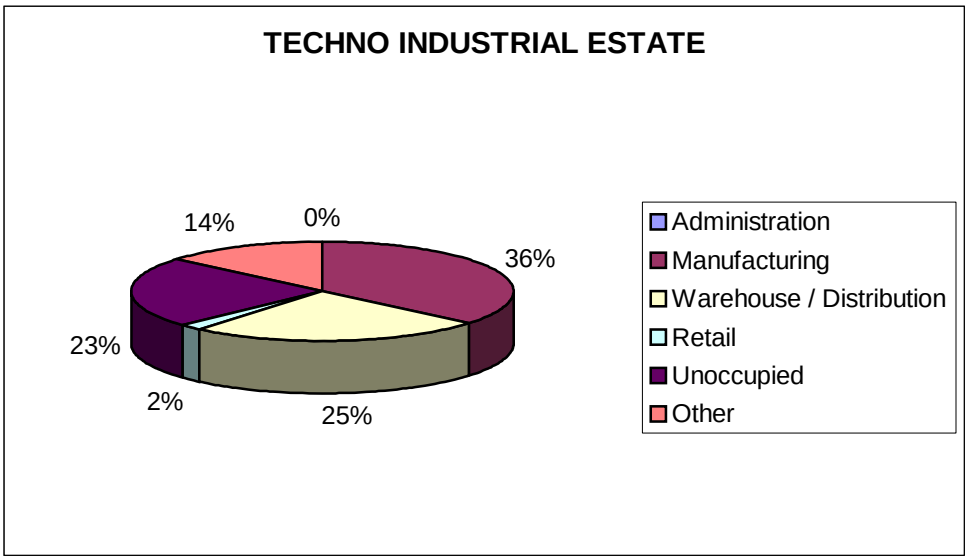
The chart shows that Okus industrial estate has a wide variety of employment types. Okus is a small site with many small units. This creates a wide variety of small businesses to enter the area, causing a mixture of employment types.

PIE CHART 11



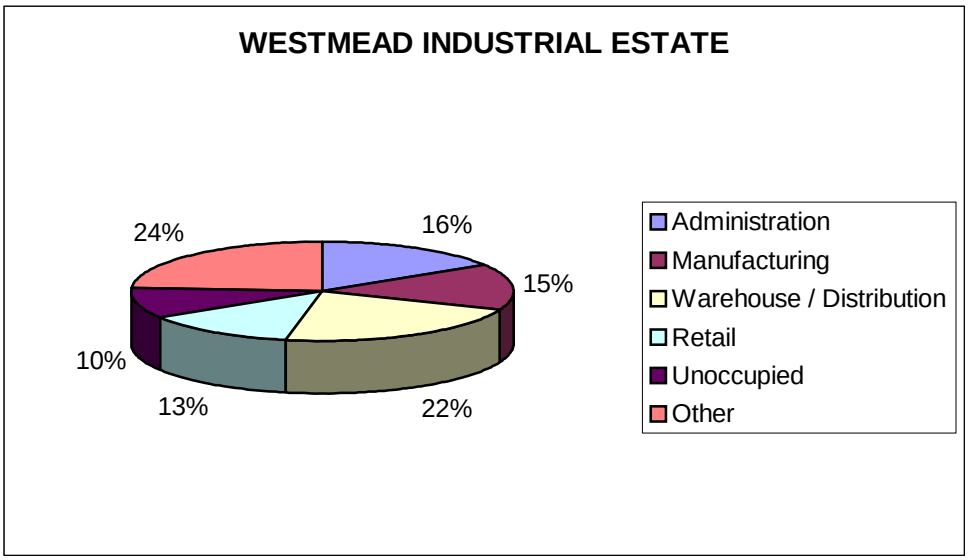
South Marston is dominated by warehouse & distribution employment, with a large percentage of manufacturing also present. The reason for this employment type dominating the area is because of its location next to the A419, allowing easy access to the M4 for transportation of goods.

PIE CHART 12



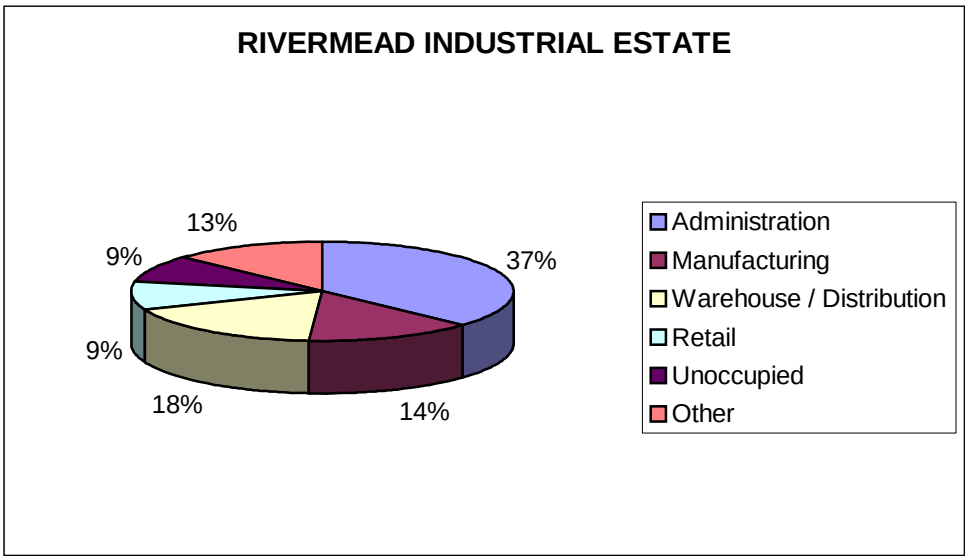
Techno has a very large percentage of its employment in warehouse & distribution, and manufacturing. There are also a large percentage of empty units, this is because the site is old and contains small units. As newer developments have taken place, companies are more reluctant to use Techno, as the newer, modern units on other sites are more easily adaptable to the company's requirements.

PIE CHART 13



Westmead has a relatively even spread of employment types. The area offers large and small units, giving opportunities to all types of companies. This area of West Swindon is therefore able to capture employees easily for all the different types of employment required.

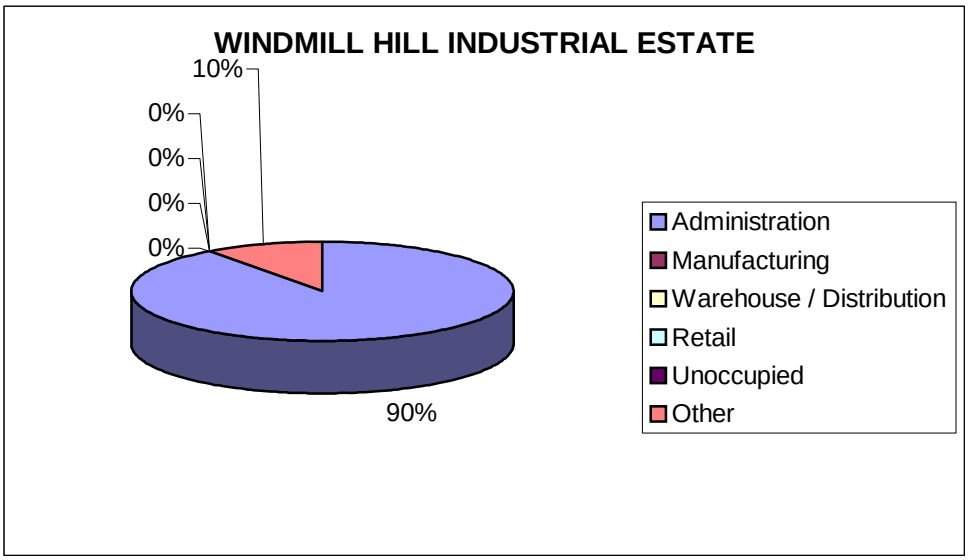
PIE CHART 14



Rivermead has a variety of employment types. The largest percentage however is administration. The site has many new companies arriving in Swindon, e.g. Thornlink U.K. This area is very modern, with new offices being present at the site. This encourages companies to move to the area.

The administration is often customer service related, meaning that a large number of employees are required. The location of Rivermead is in a Central position to the new Western residential expansion of Swindon, creating the opportunity of new employment to the area.

PIE CHART 15



This chart shows that Windmill Hill is dominated by administration. This is due to the fact that the site is a business park with many modern offices and buildings.

CONCLUSION

The project set out to investigate the hypothesis that '*companies in Swindon will have a tendency to locate on employment areas near communication links'* e.g. Motorways and A roads, and near *to 'residential areas to attract employees.*'

In summary the findings from the investigations indicate that the initial attraction to the Swindon area is predominately determined by the access to communication links. The main factor attracting companies to the area is the closeness of the M4 Motorway, which gives good access to London, Bristol and other motorway links. The presence of A roads is a dominant factor in both employment area and company locations as they offer good access to Motorways and other areas of employment. The questionnaire showed that due to the rapid growth within Swindon the area offered large Greenfield sites on which companies could build premises to accommodate their requirements, this factor attracted over fifty percent of companies to locate on specific sites. The tally chart indicates that over half of the companies questioned deal with customers and clients throughout the UK. Thus it is clear that Swindons excellent communication links play a vital role in the attraction of companies to the Swindon area. It can be stated therefore that objective 1 asking '…*if companies in Swindon locate primarily for communication reasons'* can be accepted as there is strong evidence supporting this.

There is some evidence, as indicated from the clustered distribution analysis and the proportional circles, that the position of employment sites and choice of location by companies is partly determined by the closeness to residential areas for the provision of potential workforces. Due to the rapid growth of Swindon over the past twenty years there has been an abundance of Greenfield sites for both residential and employment areas, as the central area has existed for a lot longer new companies have been forced to locate on new sites. The closeness of these sites to the M4 and major access roads is somewhat coincidental as these areas were available for growth. Thus with the supporting evidence objective 3 asking '…*if companies in Swindon locate primarily for proximity to residential areas for a workforce'* can be accepted as the evidence shows a strong tendency to do so.

The study indicates that the larger and usually newer sites are located on the outskirts of Swindon; the main reason for this is possibly due to the access links present at these locations. It was also found that sites within the central area mainly function in a variety of employment types, whereas sites on he outskirts tend to concentrate on specific types of business e.g. warehousing and manufacturing.

The environment study was carried out to establish if characteristics, such as quality of buildings, had additional influence on the choice of site. The study found that, predictably, the newer the location the better the environment.

New companies locate in newer sites offering better facilities; this is evidenced by the fact that older sites had a greater number of empty units while more recently constructed sites had a higher proportion of occupied units. Perhaps the strongest and most convincing evidence comes from the environmental index, thus strongly allowing the acceptance of objective 4 asking '…*if modern companies in Swindon locate to aesthetically pleasing surroundings.'*

There is some evidence however supporting objective 5 which asks '…*if modern companies in Swindon tend to employ individuals in tertiary and quaternary class sectors rather than the traditional secondary class.'* Namely Table 2 (*pg 18*) and Graph 1 (*pg 20*) provide the most compelling evidence, showing that modern companies attracted to Swindon have now made the transition from traditionally secondary to tertiary and quaternary class sectors. This is best shown by the newer sites of Windmill Hill and Delta, which employ the majority of administrative staff.

The contents and findings of the study have gone some way to evaluating the hypothesis, however the project did not determine all possible reasons for choice of location within the Swindon area. It may be, for example, that the local council give incentives to companies in order to attract them to the area and land prices may be lower in Swindon than other parts of the UK. While the study gives a strong indication that the road communication links are a large factor in determining location of employment sites further study and analysis of wider factors, as mentioned above, could strengthen the study and give a more definite explanation of location factors.

The findings of this investigation and further study could be used for the planning of other towns to aid the growth, determine employment area locations and enable local councils to market those sites.

Overall the project indicates that the original hypothesis was in the main correct when the evidence collected was analysed, further study could identify further reasons for location decisions but would add to and are unlikely to significantly change the findings of this study. Therefore on the evidence collected acceptance of the experimental hypothesis stating '*that companies in Swindon will have a tendency to locate on employment areas near communication links and residential areas to attract employees, and modern companies will have a high environmental index score'* can be achieved. However based on the evidence the null hypothesis is rejected.

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APPENDIX

Appendix 5 — Critical Values of Spearman's Rank Correlation Coefficient r_s

Degrees of Freedom	*Significance level* 0.05	0.01
4	1.000	
5	0.900	1.000
6	0.829	0.943
7	0.714	0.893
8	0.643	0.833
9	0.600	0.783
10	0.564	0.745
11	0.523	0.736
12	0.497	0.703
13	0.475	0.673
14	0.457	0.646
15	0.441	0.623
16	0.425	0.601
17	0.412	0.582
18	0.399	0.564
19	0.388	0.549
20	0.377	0.534
21	0.368	0.521
22	0.359	0.508
23	0.351	0.496
24	0.343	0.485
25	0.336	0.475
26	0.329	0.465
27	0.323	0.456
28	0.317	0.448
29	0.311	0.440
30	0.305	0.432

Degrees of freedom = number of paired measurements in total sample.
Reject H_o if the calculated value exceeds the critical value at the chosen confidence limit.

Appendix 6 — Critical Values of Pearson's Product – Moment Correlation Coefficient r

Degrees of Freedom	*Significance level* 0.05	0.01
1	0.9877	0.995
2	0.900	0.980
3	0.805	0.934
4	0.729	0.882
5	0.669	0.833
6	0.622	0.789
7	0.582	0.750
8	0.549	0.716
9	0.521	0.685
10	0.497	0.658
11	0.476	0.634
12	0.458	0.612
13	0.441	0.592
14	0.426	0.574
15	0.412	0.558
16	0.400	0.543
17	0.389	0.529
18	0.378	0.516
19	0.369	0.503
20	0.360	0.492
25	0.323	0.445
30	0.296	0.409
35	0.275	0.381
40	0.257	0.358
45	0.243	0.338
50	0.231	0.322
60	0.211	0.295
70	0.195	0.274
80	0.183	0.257
90	0.173	0.242
100	0.164	0.230

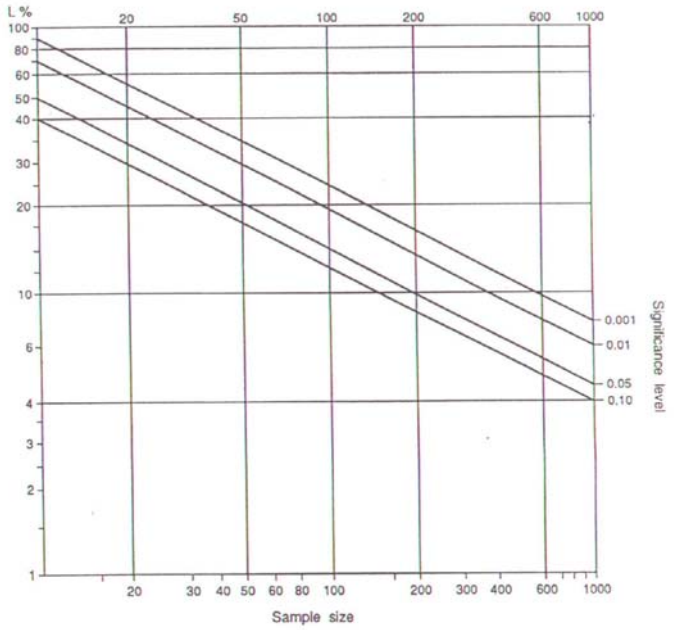
Degrees of freedom = N – 1 where N is the number of paired observations.
Reject H_o if calculated value of r is greater than critical value at chosen significance level (in absolute terms).

Appendix 7 — Critical Values of the Nearest Neighbour Index r (two tailed)

n	Clustered Pattern 0.05	Clustered Pattern 0.01	Dispersed Pattern 0.05	Dispersed Pattern 0.01
2	0.392	0.140	1.608	1.860
3	0.504	0.298	1.497	1.702
4	0.570	0.392	1.430	1.608
5	0.616	0.456	1.385	1.544
6	0.649	0.504	1.351	1.497
7	0.675	0.540	1.325	1.460
8	0.696	0.570	1.304	1.430
9	0.713	0.595	1.287	1.406
10	0.728	0.615	1.272	1.385
11	0.741	0.633	1.259	1.367
12	0.752	0.649	1.248	1.351
13	0.762	0.663	1.239	1.337
14	0.770	0.675	1.230	1.325
15	0.778	0.686	1.222	1.314
16	0.785	0.696	1.215	1.304
17	0.792	0.705	1.209	1.295
18	0.797	0.713	1.203	1.287
19	0.803	0.721	1.197	1.279
20	0.808	0.728	1.192	1.272
21	0.812	0.735	1.188	1.266
22	0.817	0.741	1.183	1.259
23	0.821	0.746	1.179	1.254
24	0.825	0.752	1.176	1.248
25	0.828	0.757	1.172	1.243
26	0.831	0.762	1.169	1.239
27	0.835	0.766	1.166	1.234
28	0.838	0.770	1.163	1.230
29	0.840	0.774	1.160	1.226
30	0.843	0.778	1.157	1.222
31	0.846	0.782	1.155	1.219
32	0.848	0.785	1.152	1.215
33	0.850	0.788	1.150	1.212
34	0.853	0.791	1.148	1.209
35	0.855	0.794	1.145	1.206
36	0.857	0.797	1.143	1.203
37	0.859	0.800	1.141	1.200
38	0.861	0.803	1.140	1.197
39	0.862	0.805	1.138	1.195
40	0.864	0.808	1.136	1.192
41	0.866	0.810	1.134	1.190
42	0.867	0.812	1.133	1.188
43	0.869	0.815	1.131	1.186
44	0.870	0.817	1.130	1.183
45	0.872	0.819	1.128	1.181
50	0.878	0.828	1.122	1.172
60	0.889	0.843	1.111	1.157
70	0.897	0.855	1.103	1.145
80	0.904	0.864	1.096	1.136
90	0.909	0.872	1.091	1.128
100	0.914	0.378	1.086	1.122

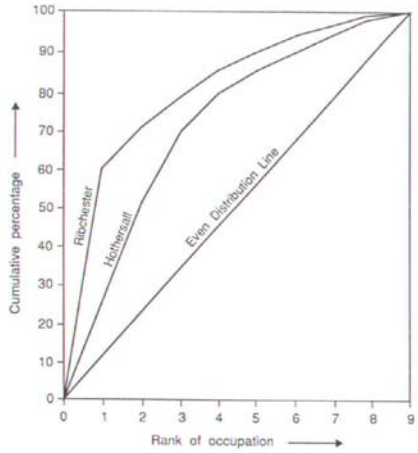
n = number of points in the survey.
To test for clustering: reject H_o if calculated value of R is less than value at chosen significance level.
To test for dispersion: reject H_o if calculated value of R is greater than value at chosen significance level.

Appendix 8 – Significance of preferred orientation (from Lord Rayleight)



To test for orientation: reject H_o if calculated value of L is greater than value (diagonal line) at chosen significance level.

Fig 9.3 Lorenz curve to show employment structure in the parishes of Ribchester and Hothersall 1871



The Gini Coefficient

This is easily calculated using the following formula:—

$$\text{Gini coefficient} = \frac{\text{Area of graph above the Even Distribution line (ED)}}{\text{Area of graph between Even Distribution line and the Lorenz curve (AD).}}$$

This is best achieved by counting squares on the graph paper and portions of bisected squares. The area above the Even Distribution line is simply half the total area of the graph. The resulting coefficient will range from 1 to infinity. The smaller the number the greater the deviation from the even distribution, therefore the greater the concentration of activities. The larger the coefficient the greater the diversity of activities.

Example

Using the graph previously constructed (fig 9.3)

Ribchester

$$\text{Gini coefficient} = \frac{ED}{AD}$$

Total area of graph = 360 squares

therefore $ED = \frac{360}{2} = 180$ squares

AD = 107 squares therefore Gini coefficient $= \frac{180}{107} = \mathbf{1.68}$

Hothersall

ED = 180 (same graph) whilst AD = 76

Gini coefficient $= \frac{180}{76} = \mathbf{2.37}$

These figures confirm our observations from the graph and further investigations into other parishes in 1871 or the same parishes through time would be useful.

The Gini coefficient has the same weaknesses as the Lorenz curve as the data for its calculation is derived directly from it. Despite this it must be said that it is a more accurate indicator, for example it may be difficult to visually compare two similar Lorenz curves but the Gini coefficient will put an exact numerical value onto the difference. With a second variable eg. time, correlations may be made using the resulting coefficients.

Measuring Dispersions

A

When to use

Many fieldwork enquiries involve the observation of spatially arranged data, for example the location of specific functions within an urban area. The usual way of displaying such data is by the use of maps. Maps alone will not however describe, interpret or compare patterns numerically and therefore specific statistical methods have to be adopted. This chapter deals with two such methods.

Method 1 — The Nearest Neighbour Analysis

The nearest neighbour analysis provides us with an index (NNI). This resulting index provides a test for 'non randomness' and helps to give us a statistical meaning to such terms as clustered, dispersed, random and regular distribution of phenomena over space eg. villages, C.B.D. functions, drumlins, shakeholes.

The index ranges are as follows:—

0 = points are completely clustered together.
1.0 = points have a completely random distribution.
2.15 = points have a completely uniform distribution (points are spread as far apart from each other as is possible).

The three diagrams below give a visual impression of these indices:—

NNI = *0* *1.0* *2.15*

FORMULA — the nearest neighbour index is usually referred to as R

$$R = 2\bar{D}\sqrt{\frac{n}{A}}$$

Where; $\bar{D}$ = mean observed nearest neighbour distance.
n = total number of points in survey.
A = area of study.

Method

1) Define the boundary of the study area (take care). Calculate its area (A).
2) Plot the points onto the base map and give each one a number (fig 10.1).
3) Draw up a table as shown in the worked example opposite. Measure accurately the distance from each point to its nearest neighbour ie. the nearest other point to it. Record on the table. It is possible that one point may be the nearest neighbour of several other points – this does not matter.
4) Calculate the mean of these distances ($\bar{D}$) by adding up all the distances (ΣD) and dividing by the total number of points (n)

ie. $\bar{D} = \frac{\Sigma D}{n}$

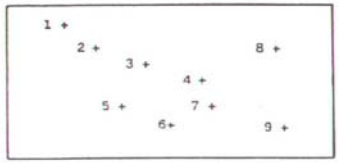
5) Calculate the nearest neighbour index (NNI) using the formula. Take care with units.
6) Relate the answer to the scale of values (see Appendix 6). Does it bear out the initial visual inspection?

Example

Distribution of newsagents in Burnley C.B.D.

The following example is used also in the section Inter-Quartile areas (see page 39).

Fig 10.1 Newsagents in Burnley's C.B.D.



n = 9 A = 36cm²