STEAM, STEEL AND LIZZIE THE ELEPHANT

- THE STEEL INDUSTRY, TRANSPORT TECHNOLOGY

AND URBAN DEVELOPMENT IN SHEFFIELD, 1800 – 1914

Dr Richard Simmons

Lizzie Ward, a circus elephant employed for carting by
T.W. Ward & Co. during the dray horse shortage in World War I

This is an electronic version of a doctoral thesis submitted to the University of Leicester in January 1995, the doctorate being awarded the same year. Some typographical corrections were made to the text in October 1995. In 1997 a small amount of additional evidence came to light and is referenced in a short addendum to Chapter 10, distinguished by the use of a sans serif typeface different from the rest of the thesis. Technology has moved on since the submission of the thesis. In particular, the figures were mainly hand drawn. Over the years the originals have deteriorated to some extent. They have been scanned for this version, with only a few minimal adjustments to improve legibility. Four MS Excel charts were no longer readable and had to be scanned from a printed copy of the thesis. The reader is asked to make allowances for the fact that the illustrations are, therefore, are not up to 21st century standards.

Dr. Richard Simmons, 11 April 2013

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by

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<u>The Steel Industry, Transport Technology and Urban Development in Sheffield, 1800 - 1914; Abstract of Ph.D. Thesis Submitted by Richard Simmons, BA Hons., BTP, MRTPI, University OF Leicester, January 1995</u>

This thesis examines the relationships between the development of transport systems and manufacturing technology, and the effect of these and other factors on industrial location within cities. To study these relationships in isolation from the effects of state planning, the focus is the evolution of Sheffield's steel industry from 1800-1914, and the consequences for the emerging city.

Industrial location and urban theories are compared, and the psychology underlying decision making is discussed. Variables proposed by these theories as influences on location decisions are reviewed, including accessibility and transport costs; technological and organisational change; urban infrastructure; the influence of land owners and markets on land supply; and topography and environmental issues.

Sheffield's topography, communications, industrial and urban growth are described. The distribution of the steel industry is plotted decennially. Contemporary data suggesting the reasons for location decisions are analysed. There follow examinations of local goods distribution, and how the extension of public transport affected labour mobility. Two case studies explore the development of an industrial suburb by the Dukes of Norfolk, and the establishment of a large steel works.

The thesis concludes that industrialists usually perceived their location decisions to be economically rational - a weighing up of variables including:- balancing the cost and convenience of goods transport within the wider production function; access to labour; the unfettered ability to pollute; availability of large, level sites; and some intangible factors. The scale of a plant was significant in determining whether a company required (or could afford) direct rail access, and railways priced services to discriminate in favour of firms with such access. Landowners co-operated with the industrial land market, but also influenced it, planning for industrial development; controlling land uses; and reserving sites speculatively. This restricted the ability of the steel industry to choose sites freely, and develop rational plant layouts.

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>
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>
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Richard Simmons, Catford, London, 1995

CONVERSION TABLES

The conversion of all the individual figures in this thesis from Imperial to Metric standards would have been a labour of Hercules. The following factors are provided for those who wish to convert the figures for themselves:

20 shillings (s) = £1 = 100 new pence (p)
1 shilling (s) = 12d = 5p approx.
6 old pennies (d) = 2.5p approx.
1 old penny (d) = 0.416p
1 guinea = £1-1s-0d

The smallest unit of old currency available
as a coin was the farthing (= 0.25d).

1 acre (a) = 4,840 sq. yds. = 0.405 hectares
1 rood (r) = 1,210 sq. yds.
1 perch (p) = 30.25 sq. yds.
1 square yard (sq. yd.) = 0.836 square metres

1 mile = 1,760 yards = 1.609 kilometres
1 chain = 22 yards
1 yard =0.91 metre

ABBREVIATIONS

The following standard abbreviations are used throughout the text:

ACM	Arundel Castle Manuscripts in Sheffield City Archives, Sheffield City Libraries
BITA	British Iron Trades Association
BRERO	British Railways Eastern Region Record Office, York
BSC	British Steel Corporation
CBD	Central Business District
EALB	Directors' Letter Books of J. Edgar Allen & Co. in the Sheffield Collection
Ec.H.R.	Economic History Review
F.o.b	Free on board transport pricing
GCR	Great Central Railway
GER	Great Eastern Railway
GNR	Great Northern Railway
HLRO	House of Lords Record Office
JHG	Journal of Historical Geography
JTH	Journal of Transport History
LB	Letter Book
LDECR	Lancashire, Derbyshire and East Coast Railway
LNWR	London and North Western Railway
M. of E./Minutes	Minutes of Evidence of Parliamentary Committees
MR	Midland Railway
MSLR	Manchester, Sheffield and Lincolnshire Railway
NMR	North Midland Railway
OS	Ordnance Survey
PP	Parliamentary Papers
PRO	Public Record Office, Kew
RCFBBS	Royal Commission on Friendly and Benefit Building Societies
S&R	Sheffield & Rotherham Railway
SAMR	Sheffield, Ashton-under-Lyne and Manchester Railway
SC	The Sheffield Collection in Sheffield City Archives, Sheffield City Libraries
SCS&RR	House of Lords Committee on the S&R Bill
SCSDR	House of Lords Committee on the SDR Bill
SCTH	House of Commons Select Committee on Town Holdings
SDR	Sheffield District Railway

SLJR	Sheffield and Lincolnshire Joint Railway
SYR	South Yorkshire Railway
SYRO	South Yorkshire Record Office (records now absorbed by Sheffield City Libraries' Archives)
TIBG	Transactions of the Institute of British Geographers

PREFACE

In 1974 I wrote a BA dissertation in the Department of Economic and Social History at the University of Sheffield on the relationship between the development of the canal system and the location of early cotton mills in Manchester. The study is described in more detail in Chapter 1 of this thesis. In 1975 I was offered one of two SSRC Studentships established in the Department of Town and Regional Planning at Sheffield University specifically to study the urban development of nineteenth century Sheffield, supervised within an analytical framework devised by Dr. Michael Naslas.[1] My colleague Timothy Caulton chose to study the social differentiation of residential areas. It seemed natural for me to pursue further the study of intra-urban industrial location in parallel with Caulton's work. The Sheffield steel industry appeared to be a good candidate for a case study, for reasons set out later in this thesis.

Between 1975 and 1978 I accumulated a good deal of information from primary sources. Industrial location patterns were mapped and field study was undertaken. Unfortunately, however, there were insufficient data to produce conclusive findings in key areas of interest such as the role of landowners, intra-urban transport costs and the motives of location decision makers. Many of the Sheffield steel companies were very secretive and unwilling to give access to information even about their early years. For example, Firth-Brown would not admit me beyond their reception area when they allowed me access to Mark Firth's cash book - the only document from their archive they would let me see. Other organisations simply destroyed their old records. One such was the British Waterways Board, which dumped all the traffic records of the Sheffield Canal on a landfill site shortly after I began my research. In spite of efforts to recover them by myself and the South Yorkshire Record Office, most of the papers were lost. This, combined with personal difficulties, led to my Studentship ending without the completion of a doctoral thesis.

In the early 1980s, Professor Anthony Sutcliffe suggested that I should look at the subject again. It emerged that the Duke of Norfolk's nineteenth century estate records had been deposited with Sheffield Archives. The then archivist, David Postles, obtained permission from the Duke for me to have access to correspondence not normally available for public study. This, combined with the closure of many Sheffield firms (due to recession and industrial restructuring) and the deposition of their records with Sheffield Archives, allowed me to fill the gaps in my research. Under Professor Sutcliffe's guidance I was also able to

[1]Naslas et al, 1976, 1-14

develop my own analytical framework, set out in the first four chapters of this thesis. Having worked on the data in my spare time during the latter half of the 1980s I sought re-admission to the University of Sheffield. As my previous supervisor had left and there was nobody available there with expertise in the field, it was agreed that I should transfer formally to Professor Sutcliffe's supervision and I was admitted as a student at Leicester University in 1992 to complete this thesis.

CHAPTER 1

INTRODUCTION - THE PROCESS OF LOCATION DECISION MAKING

> Once canals were open men built new factories close alongside the waterway with wharves or canal-connected basins where boats could load or unload ... One has only to glance at old plans of such towns as Birmingham or Stoke on Trent to see industry crowding the banks of the ... canals ... or to read contemporary newspapers to note how any sale advertisement for an industrial property told how far it was from a canal ... The siting of industrial enterprises alongside canals went on happening well into the railway age ... Later, businessmen were to choose rail connected sites and later again to look for good road access free from traffic congestion.[1]

This passage from Hadfield's The Canal Age started the chain of thought which led to this thesis. It summarises the view that canals and railways exercised an inevitable pull on the location of industry in the late eighteenth and throughout the nineteenth centuries. Common among modern historians and geographers, it also prevailed among contemporaries of the transport revolutions which were so intimately connected with the creation of the world's first industrial economy. Before the canal age began, Adam Smith observed that 'by means of water carriage a more extensive market is opened to every sort of industry ... so it is ... along the banks of the navigable rivers that industry naturally begins to subdivide and improve itself'.[2] Engels described the Ancoats area of Manchester in 1845: 'In ... Ancoats are to be found the majority and the largest of Manchester's factories. They are situated on canals, and are colossal ...'.[3] Another foreign commentator wrote a year earlier that in Lancashire 'a factory may now be established close to a coal mine or by a canal, which shall convey to it its fuel ...' and in Manchester 'the canals pass under the streets and thread their sinuous way in every direction conveying boatloads of coal to the doors of the manufactories, and even to the very mouths of the furnaces'.[4]

There is some evidence to show that railways and canals could exert a pull on industry. Segal modelled 'structural changes in the economies of areas contiguous to successful canals, prominent among which are shifts from agricultural to non-agricultural activities'. His comparison of the industrial

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[1]Hadfield, 1968, 135-6
[2]Smith, quoted in Mathias, 1971, 108
[3]Engels, 1845 repr. 1971, 68
[4]Faucher, 1844 repr. 1969, 93

structure of the counties close to the Erie Canal with those further away shows that industry tended to be drawn to the canal counties.[5] Warren remarks that early steelworks in Pittsburgh were located to be served by water transport.[6] In England, the Manchester Ship Canal attracted manufacturing industry as well as warehousing and port facilities. A copper smelting works was built next to the canal in Ellesmere Port in 1898 to take advantage of direct transport links, to be followed by grain mills in 1903-6 and the Wolverhampton Corrugated Iron Company in 1905.[7]

Kellett notes the establishment of large factories in new industrial suburbs served by the railways in Manchester, Glasgow and Birmingham. Many were making products for use on the railways.[8] Others, such as BSA at Small Heath, took advantage of railwayside sites for ease of transportation.[9] Some found locations convenient for road access to goods stations but did not have railway sidings - an example being Messrs. Tangye's eleven and a half acre site equidistant from the Great Western and London and North Western Railways in the suburbs of Birmingham.[10]

Urban geographers have found an association at a general level between the development of industry (particularly heavy manufacturing) and its location along transportation corridors. Johnson remarks that:

> The banks of important rivers and canals often attract [industries handling bulk materials] ... In large inland cities the development of heavy industries in association with railway transport facilities provides another example of the same general tendency.[11]

In spite of this evidence, the author's curiosity was aroused when studying Manchester's canal system. The canals in the Manchester/Salford region had been constructed between about 1790 and 1830 (though the River Irwell was a navigation before 1790). The buildings which still lined these canals in the 1970s appeared to date from a much later period in the latter half of the nineteenth and beginning of the twentieth centuries. By and large they turned blank walls to the canals. There were few examples of the loading facilities one would expect if the factories had been drawn by the transportation advantages of

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[5]Segal, 1971, 235-8
[6]Warren, 1973, 138
[7]Porteous, 1977, 174
[8]Kellett, 1969, 346-7
[9]Ibid., 348
[10]Ibid., 347
[11]Johnson, 1969, 158; See also Carter, 1975, 320; Bale, 1976, 70

a canalside situation. Were these buildings just replacements for works which had used the canals for transport, but were later rebuilt without loading bays when canal transport became an anachronism? Or was what actually happened more complicated? In 1974, this formed the subject of a BA dissertation in the Department of Economic History at Sheffield University.[12]

The study compared the location of the early cotton spinning industry as indicated by trade directories with the growth of Manchester's canal network, and looked at urban development shown on maps of the area. The conclusion was that rather than being attracted to locate by the canals the cotton spinning industry showed no inclination to do so before 1830. It had apparently polarized in another part of the town some distance from the canal termini. In such a limited study it was impossible to give detailed consideration to all the influences which might have led to this state of affairs. Topography, rudimentary pollution control, the efficiency of local carting, land ownership, competition from land uses such as merchanting and warehousing, and differences in canal gauges were all candidates for further investigation, as were changes in sources of power for both manufacturing and transport industries.

To illustrate the problem we can consider Kellett's point that Manchester was first and foremost a marketing and distribution centre. Warehousing provided strong competition as a land use even to the powerful railways.[13] Where a town had such a specialised function, even land uses such as manufacturing which might otherwise dominate would tend to be pushed into secondary locations. However, the long period which elapsed before significant amounts of canalside land were shown on early maps to be developed by any land use cast doubts even on this supposition. The dissertation asked more questions than it answered. It did not clarify the decision making process which led entrepreneurs to select particular locations at particular times.

1. Some Historians' and Geographers' Perspectives on Industrial Location

Many historians recognise that more sophisticated processes than simple attraction to transport infrastructure are at work in intra-urban industrial location decision making. Kellett, discussing the emergence of the industrial suburbs of Manchester, the West Midlands, Liverpool and Glasgow, remarks that it is difficult to assign patterns of industrial growth only to transport factors, suggesting a more complicated interplay of forces:

[12] Simmons, 1974
[13] Kellett, 1969, 307-9

> ... the course of industrial history in each great town, its successes in certain fields, and abandonment or failure in others, the extent of diversification in its manufacturing base; these are matters which cannot be linked by any simple causal chain to the coming of the railways. The railways are merely one element in the whole network of external economies which bound together the areas of regional specialisation associated with each great city.[14]

Kellett does consider that more direct locational ties can be seen between industry and canals,[15] both because of the physical evidence of growth of factories along their banks well into the nineteenth century, and because they were better suited than railways for moving single loads from factory to factory.[16] This view was given in evidence to a Parliamentary Select Committee in 1872:

> The canals have been in existence a great many years, and a great many mills and industries of various kinds have been carried on upon the banks ... brought there by the facilities which the canals afforded ... and the traffic to all those places could not be carried so conveniently by rail as it could by canal.[17]

Kellett acknowledges that railways as well as canals must have been a locational factor for industry;[18] but also points out that many of the canals earned substantial revenues from supplying water to industry,[19] which suggests that this too could have been a locational factor. Evidence that other forces could be at work besides the attraction of factories towards transport infrastructure comes from America. Towards the end of the nineteenth and into the early twentieth centuries, the Chicago steel industry experienced a major intra-urban shift in location from North Chicago to large scale plants in locations better served by four railroads. The locational pull of these railways was complemented by the subsequent attraction to the new steel works of two further railroads - an example of manufacturing exerting a pull over the transportation sector.[20] Similarly, when U.S. Steel established their plant in Gary, Indiana in 1905 the company was so powerful that the Baltimore and Ohio, and Lake Shore railways diverted to serve the steelworks.[21]

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[14]Kellett, 1969, 349
[15]Ibid.
[16]Ibid., 350
[17]Ibid.
[18]Ibid., 351
[19]Ibid.
[20]Warren, 1973, 138
[21]Ibid.

In summary, there is evidence that some canals and railways sometimes attracted certain types of manufacturing industry to locate beside or near them. There are also indications such as the length of time it took for urban land alongside some canals to be developed, which show that the magnetism of the new transport corridors is not sufficient on its own to explain patterns of industrial location in urban areas.

It is interesting, then, to find that there are few studies of the relationship between the development of transport infrastructure and the location of manufacturing plants. Intra-urban industrial location has received comparatively less attention from geographers, historians and economists than, say, residential land use patterns. Kellett drew attention to the need for this type of work:

> An assessment of the importance of rail connections to the suburban industrialist must await a more detailed study. It will not be an easy task for although the relative costs of alternative modes of transport for supplies and finished goods must have been carefully considered by entrepreneurs, particularly at the height of the railway rates controversy in the 1880s yet published business histories are disappointingly silent on this point.[22]

Carter considered it 'surprising that there are fewer studies which seek to generalise the pattern of industrial land-use in the city than for most other types of use'. He ascribes this to the concentration of study on regional location patterns but also draws attention to the 'intractable nature of the problem'.[23]

Boyce and Williams state that 'there is still too little understanding of the locational patterns of industry ... in broad form the pattern is fairly clear' but 'a more careful examination ... indicates considerable variation'.[24] Although urban morphologists have begun to look more closely at the pattern of land uses at the micro-locational level, there is still a tendency to concentrate on the central commercial area and residential districts, as in Whitehand's monograph on the development of urban landscapes.[25]

2. A Framework for Study

[22]Ibid., 348
[23]Carter, 1973, 313
[24]Boyce and Williams, 1979, 277-8
[25]Whitehand, 1992, passim

The theoretical background for studying intra-urban industrial location and the forces influencing it - micro-locational factors as they have been termed[26] - straddles the uneasy boundary between urban and industrial location theories. Uneasy because although both sets of theories tend to take as their starting point a surrogate for accessibility (bid rents based on the location of urban sites in relation to their accessibility, and transport cost minimisation respectively) and both have evolved to take account of neo-classical economic concepts such as marginality, utility, optimisation and satisficing, their emphasis on these factors is often very different. For example, industrial location theory tends to be most successful at explaining the national or regional location patterns of industry, where aggregations of firms and whole industry trends can be described,[27] or single product, single plant firms which are a rarity even in early industrial economies.[28]

Factors affecting location decisions within cities tend to be at a grain which is too fine for analysis by many models. Determinants such as site rents are often neglected.[29] In urban theories on the other hand, bid rents are sometimes given a primacy which may not be reflected in empirical studies. Urban models rarely simulate the physical configuration of land use itself[30] and examining industrial location patterns on the ground frequently shows dispersal and a lack of a distinct pattern where urban theories would lead one to expect concentration and a clear grouping.[31] In summary, 'a substantial gap exists between the most precise theoretical formulations of locational behaviour, empirical investigation, and the construction of operational models'.[32]

Neither group of theories is wholly satisfactory, then, though both will offer pointers to the main reasons why location decisions are made. As Goodall suggests:

> [Although] location theory contributes to an understanding of the factors affecting locational decisions at an inter-urban and inter-regional scale rather than on the intra-urban level ... the same general principles of locational choice apply to the distribution of productive ... activity throughout the urban area although the relative importance of the factors may be very different'.[33]

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[26]Clark quoted in Kellett, 1969, 349
[27]Goodall, 1972, 116
[28]Dicken, 1977, 138
[29]Goodall, 1972, 120
[30]Batty and Longley, 1986, 1143
[31]Bale, 1976, 57-8 & 60-2
[32]Goodall, 1972, 15
[33]Ibid., 13

Empirical study is also an important guide; one which has been at the core of the present study. Isard described his urban land use model as 'one of many possible brews of (1) intuition, (2) logic and analytic principles relating to the interaction of general forces governing land use, and (3) facts. It is not a rigorous theoretical derivation'.[34] The same could be said of this thesis. Bale categorises urban industrial location types according to a pragmatically derived set of classifications such as suburban industries, central business district related industries, waterfront or port industries and so on.[35] According to Carter, 'as in the retail complex further illumination of the whole process by which the industrial land-use pattern is built up will be provided by detailed studies of the locational behaviour of individual firms'.[36]

In the historical context, where the assembly of quantitative data can be difficult, empirical research is especially valuable. Whitehand encourages both empirical study at the 'micro' level, and the use of historical outlines, to illuminate the actions of the 'actors' whose decisions led to the formation of the fine grain of cities which amasses to compose their broader structures.[37] The investigation of the development of industrial location patterns historically is useful for a number of reasons. Firstly, the study of a period when State intervention in the allocation of land uses was less marked than at present allows a more direct insight into the action of market forces.[38] Secondly, most economic and geographic models tend to be static.[39] By looking at the evolution of land use patterns over time, the action of dynamic forces can be studied and, in particular the effects of changes in technology can be charted.[40] Thirdly, the reasons for choice of location of firms found in cities today are often historical, so historical research can illuminate modern land-use patterns.[41] Empirical study is really the only way to examine historical trends and draw conclusions from them. For instance Kellett suggests that ex post analysis of the geographical distribution of industrial works is an effective way of sketching the importance of rail connections to location decisions.[42] A number of studies of industrial location in nineteenth century America have shown that theoretical derivations alone are

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[34]Isard quoted in Bale, 1976, 58
[35]Bale, 1976, Ch.4
[36]Carter, 1973, 324
[37]Whitehand, 1992, vii, 197
[38]Sutcliffe, 1983, 238
[39]Rodriguez-Bachiller, 1986, 92
[40]Moses and Williamson, 1967, 126
[41]Estall and Buchanan, 1980, 28
[42]Kellett, 1969, 348

insufficient to explain the patterns found, and that theory must be complemented by empirical research.[43]

The present study examines the development and location of the steel industry in nineteenth century Sheffield. The choice of this industry allows one to follow the evolution of a new set of technologies for production of new products during a period when new types of transport, urban form and industrial and civic organisation were coming into being. Because of the selection of an historical subject it is, of course, important to bear in mind that much of location and urban theory is based on modern trends and technologies. Care will be taken to ensure that theories are not applied anachronistically, and that effects on theoretical outcomes deriving from an historical context are highlighted.

3. Decision Making

The location decision making process is likely to be susceptible to behavioural factors arising from the interaction of decision making individuals and groups with their environment. The rationality or irrationality of behaviour affects location decisions. Such behaviour can be particularly relevant to industrial location at the level of disaggregation needed to study micro-locational factors.[44] Subjective decision making is often typified as the 'golf course factor' - the idea that once non-discretionary locational criteria such as access to markets and availability of raw materials have been met, the decision about precisely where to locate will be decided arbitrarily by factors of personal importance to the decision maker(s).[45] In the modern context, the proximity of a good golf course could be the deciding factor.[46] A guide published in 1992 by a firm of relocation consultants listed subjective reasons given by directors to explain locational choice, including:

- length of golf club membership waiting lists;
- proximity to the chairman's house;
- presence of a river with swans on it;
- perceived preponderance of pretty girls in the new locality;
- availability of a cheap house for the chairman.[47]

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[43]Brook, 1976
[44]Birkin and Wilson, 1986, 176
[45]Goodall, 1972, 123
[46]Ibid.
[47]The Director's Guide to Relocation Management (Black Horse Relocation Services) quoted in Anon, 1992, 8; Wiltshire, 1992, VIII

Other consultants suggested that the increasing number of firms seeking to locate in the south of France and on the Mediterranean coast of Spain were doing so largely for amenity reasons.[48] Subjective decision making is hard to represent statistically and tends not to appear in locational modelling.[49]

How would subjective factors have affected decisions in innovative manufacturing industries in the nineteenth century? Johnson reminds us that:

> Studies of this kind are always somewhat unsatisfactory: the manager of an established firm does not always know the reasons for its original location and in any case the isolation of a dominant factor is often both difficult and arbitrary.[50]

As a letter to the author from Dunford Hadfields/Brown Bayley Steels put it:

> Such personnel who may have had intimate knowledge of the considerations leading to the decisions made to site our various factories in their present locations are, of course, no longer extant.[51]

It is assumed that firms will tend towards behaving in a way which is economically rational, based on the common sense notion that they are in business mainly to make enough money to satisfy their owners. As a minimum they must aim for equilibrium between costs and income. Economically irrational behaviour would work against this tendency. Harvey believes that the temptation to seek excess profits blinds capitalists to rationality and leads to unsound decision making[52] but another way of looking at this is that what is perceived as rational may vary. Costs must include the marginal profit needed to keep the owner(s) of the organisation satisfied. This may be bare subsistence for a sole trader on the margins of profitability, or a fairly substantial sum for a large multi-national company which can see better ways to deploy its capital - often a matter for subjective risk assessment and management choice. The time over which the books must balance is critical. A firm in a new sector and/or trading from a new location might be willing to bear losses initially to establish its position. Its ability to sustain losses at this or any other period of its development depends not only on its short term production function but also on the information available to its managers, its level of capitalisation and liquidity, cash flow and balances, the relationship between debt and money owed to the

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[48]Wiltshire, 1992, VIII
[49]Birkin and Wilson, 1986, 176
[50]Johnson, 1967, 150
[51]Letter to the author dated 10 March 1977
[52]Harvey, 1985, 136

firm, backing from third party funding sources including individuals and financial institutions prepared to lend money, the view taken by the firm's owners, managers and backers about the future market, and what happens in the economy. Many of these variables depend for their effect on judgements and forecasts. Nevertheless it is reasonable to assume that in the medium term a company will be expected to show an acceptable level of profitability. Even if its owners are so attached to it that they behave irrationally and try to keep the company afloat when it is no longer viable, pressures in the market will generally lead creditors to force the issue.

For most companies, location decisions involve assessing a complex set of variables. The process falls into two stages - the decision to relocate; and the decision about where to relocate. The pressures which lead to the decision to relocate may well influence the type of new location chosen (for example pressure on space would lead to a search for a larger site), but other opportunistic factors less directly related to the original reasons for moving may become important in the location decision.[53]

Lloyd and Dicken show that, for a relatively simple single plant firm rational location decision making involves between twenty and twenty five different stages.[54] Some have to be repeated if, for example, a potential site proves unsuitable. For multi-plant firms the variables are even more numerous because of the relationship between plants.[55]

Investigations of perceptions of space and the mind's ability to handle information and complex decisions show that the choices which have to be made are never likely to be wholly objective. Psychological and behavioural factors which impact on decision making include:

i. Psychological Factors Affecting Decision Making

a. The Decision Maker's Mental Map

Although studies of spatial perception have been limited in scope, there is evidence that people understand their environment at different levels of resolution based on its function and appearance,[56] and may have only a partial understanding of the geography within which they are making

[53]Ashcroft and Taylor, 1979, 47-8
[54]Lloyd and Dicken, 1977, 327
[55]Ibid., Ch.9
[56]E.g. Lynch, 1977, passim

decisions. Recent developments in pschology and neurophysiology suggest that the mind evolved and is adapted best to understand and respond to its immediate surroundings, and that perceptions become more tenuous when trying to comprehend unfamiliar territiory.[57] It is not surprising, then, that modern studies have shown that new companies tend to set up in the home town of their creator because that is the place he or she knows best.[58]

b. Experience

The more experienced the entrepreneur, the more likely it would be that location decisions would be successful and based on rational criteria because experience should have taught the decision maker the advantages and disadvantages of previous locational strategies. This might be made less relevant by changes in technology or the trading environment, but experience is still an important personal factor.[59] Experience need not have been gained as a plant owner of course. Many of the founders of Sheffield steel companies had worked previously for others and would have been in a good position to learn from their employers' mistakes and successes.

c. Information Processing and Preconceptions

Studies of decision making, especially in stressful environments, have shown that where large volumes of data must be understood and there is 'noise' affecting the quality of the information received or confusing the processing of information, irrational decisions can result.[60] In such circumstances there is often a tendency for decision makers to fall back on pre-conceived ideas and ignore relevant and sometimes critical information which conflicts with their world view.[61] The mind is only able to process limited and selected new data from the environment. Most decisions of all types are now thought to be made unconsciously and reactively, and it is only when high order choices have to be made that rational and conscious mental processes come into play.[62] It is, therefore, not unreasonable to

[57]E.g. Ornstein, 1991, 261
[58]Lloyd and Dicken, 1977, 333
[59]Ibid.
[60]Dixon, 1979, 28-32
[61]Ibid., 30
[62]Ornstein, 1991, passim

assume that many decision makers might respond at least in part to 'gut reactions' rather than objective criteria when choosing a location.

Instances of irrational location decision making have been described - for example Leblanc's study of manufacturing in nineteenth century New England.[63] Estall and Buchanan remark that:

> Location patterns are the end result of decisions made by individuals or groups and there are numerous psychological, organisational and other influences that play some part in decision making behaviour. There is little doubt that a fuller understanding of the location problem would be gained by a better understanding of the decision maker ... and the behaviour of the firm in the decision making context.[64]

Nevertheless, they counsel that too much emphasis on non-rational factors such as the golf course can give rise to loose thinking. Their research tends to suggest that this type of consideration would only be important where other factors were equal between alternative sites.

This seems to be borne out by the stated views of the majority of modern new and relocating companies. In spite of the apparent irrationality of some of the criteria referred to above, recent surveys suggest that these play only a limited role in most decisions. Knight, Frank and Rutley (Chartered Surveyors) found that nearly one third of companies planned to move because of the inadequacy of existing space, either because of its quality or size - essentially a geographical/economic motivation. Shedding employees regarded as 'dead wood' is reported as another major factor, as is introducing new working practices with fresh staff.[65] Jones Lang Wootton (Chartered Surveyors) found that the choice of new location was influenced by the following factors in order of importance:

- Accessibility and communications
- Property costs
- Labour availability
- Property availability
- Local environment
- Labour costs
- Image of the company
- Business services available
- Housing costs
- Local housing supply
- Schooling facilities
- Employment for family members

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[63]Brook, 1976, 166
[64]Estall and Buchanan, 1980, 27
[65]Wiltshire, 1992, VIII

- Cultural, entertainment and shopping facilities.[66]

This supports the hypothesis that most modern location decision makers attempt to be rational and that personal factors are of only marginal importance. Decision makers act with what Isard calls bounded rationality - bounded by perceptions about particular locations and the 'psychic income' they can achieve there to complement money income.

ii. Imperfect Information

An important component of decision making is reduction of uncertainty by acquisition and application of knowledge.[67] Location and urban theories often assume perfect knowledge of the market and unconstrained information flows, enabling actors to behave in an optimising fashion.[68]

In reality, decision makers work in a world in which information may not be easily available, for example due to confidentiality or inadequate channels of communication.[69] Inaccuracies can easily creep into communications. Data can become out of date. The SSRC's working committee on industrial geography summarised the issue:

> Organisation theory suggests that intelligence about the uncertain operating environment of production is critical to the survival and prosperity of firms. There are also clearly demonstrated locational influences on the quality of information available to industrial location decision-makers. Spatial variations in business communication costs and opportunities are also important considerations for certain functions.[70]

iii. Costs and Profitability as a Factor in Decision Making

Weberian location theory suggested that firms seek locations where transport costs will be minimised.[71] Isard's introduction of the concept of substitution between factor inputs allowed for greater sophistication in analysis.[72] The extension of this approach recognises that costs associated with a specific location are only one variable in the firm's production function. Thus

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[66]Ibid.
[67]Dixon, 1979, 30
[68]Lloyd and Dicken, 1977, 22; Goodall,1972, 54
[69]Goodall, 1972, 63
[70]Wood, 1979, 255
[71]Lloyd and Dicken, 1977, 121-7
[72]Ibid., 127-30

minimisation of, say, labour costs resulting from a fortuitous choice of location might in theory offset more expensive site rental or transport costs for some types of firm. Isard and Losch proposed profit maximisation as a motive for location decisions,[73] which tends to cope better with the fact that raw materials may come from several sources and many markets may have to be served by a single plant, so that transport cost minimisation may be impossible to achieve for every market. Goodall argues, however, that for industries with a geographically dispersed market several different locations in an urban area may offer equal levels of sales. The location offering minimum costs would then be the site which by definition allowed profit maximisation.[74] Modern business theory holds that firms must aim to make money by seeking to maximise three variables - net profit, return on investment and cash flow. To do this, however, it is possible to accept increased operating costs if the throughput (defined as the rate at which money is generated through sales) of the firm can be increased and inventories (that is money invested in purchasing production inputs) can be reduced.[75] A successful company is not necessarily one which minimises operational expenses. If cutting costs leads to lost sales or increases in inventories (for example because slower transportation loses customers or leads to raw material costs being endured for longer than necessary) cost minimisation is not economically rational behaviour. The truth is closest to the concept of 'spatial margins of profitability' where:

> ... the decision-maker with his own particular motivations, perceptions, skills and information network, need not invest at the point of maximum profitability but somewhere within the broader boundaries set for a barely viable enterprise by the operation of the forces traditionally conceived of as significant for costs. This concept allows for a variety of kinds of sub-optimal behaviour, limited only by the need for sufficient profit to stay in business.[76]

Although one would have to agree with Estall and Buchanan and Losch that this margin is difficult to detect,[77] an interesting part of the present study was the marginal nature of some of the companies studied. This will be considered further in Chapters 6 and 12.

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[73]Estall and Buchanan, 1980, 26
[74]Goodall, 1972, 124
[75]Goldratt & Cox, 1992, 46, 60
[76]Estall and Buchanan, 1980, 27-8
[77]Ibid.

iv. <u>Conclusions About Decision Making</u>

Any empirical study of industrial location must look not only at what actually occurred in the environment under examination, including the economic facts affecting decisions, but also at those factors which are more subjective in nature but which could have affected the perceptions of those making locational choices. It is to these influences that this thesis now turns, under three broad headings:

Accessibility (Chapter 2);

Technological and Organisational Change (Chapter 3);

Land (Chapter 4).

Under these headings there is some overlap (for example technological change in transportation is considered under accessibility). Nevertheless, they are useful categorisations which allow systematic cataloguing of variables.

CHAPTER 2

INFLUENCES ON LOCATION DECISIONS (1) - ACCESSIBILITY

In Chapter 1, evidence of the locational attractiveness of canals and railways was reviewed. The benefits of location beside a transport artery must be perceived to be worthwhile before such a site will be chosen. With the introduction of new transport technologies, decision makers must choose whether to rely on the new technology or look for a location which will give them a choice of transport modes. With the two main technologies available for carrying bulk commodities in the nineteenth century this choice was complicated by indivisibility between track and carrying equipment. Canals and railways had inherent inflexibilities when compared with modern road transport. As a result the credibility of the transport system as a reliable means of communication must have been especially important to decision makers, and could have affected the timing of take-up of sites offering direct connections - the more useful and reliable the system was perceived to be, the more attractive the location opportunity would be.

The main contributors to this credibility could have fallen into the following categories, which borrow loosely from network theory:

1. Channel Capacity:

    i. Infrastructure;
    ii. Carrying Technology;

2. Interchange Capacity, Storage Capacity and Processing Capacity;

3. Control and Pricing.

1. Channel Capacity

i. Infrastructure

The ability of communication channels to transmit raw materials and products depends on a combination of factors:

a. Provision of track, road or navigable water serving the right destinations for customers, either directly or with adequate interchange facilities to allow the desired destinations to be reached over more than one system.

b. The availability of sufficient lines to carry goods without congestion. The more congested the lines, the less effective the ability of the system to deliver goods on time. An example of the problems created by lack of channel capacity at the micro-locational level is cited by Le Guillou. In 1881 the general manager of the Great Western Railway told the Select Committee looking at railway carriage rates that it would not be worthwhile for his company to carry more coal between works in the Black Country because the extra traffic would block the main line. Congestion costs, terminal and handling charges were estimated to add 10% to the price of a ton of iron. Local manufacturers reacted by building a network of private branch railways and tramroads, as well as investigating improvements to the canals.[1]

c. The capacity of the track material to carry sufficient traffic. At the beginning of the railway era, iron rails limited the carrying capacity and speed of trains. The introduction of steel rails from the 1860s improved the ability to carry heavier trains running faster.[2]

d. Control of traffic. One way to avoid or reduce congestion is more efficient utilisation of track through better control of vehicles in transit. This was a particular problem on early railways, with only about one fifth of the railway system fitted with block signalling by 1870.[3]

e. Compatibility of gauges. The ability to move goods without transhipment helps reduce transport costs and speed up journeys. Both canals and railways suffered from incompatibility of gauges, forcing transhipment. On the canals, narrow gauge (7 foot lock width) predominated in the Midlands and broad gauge (generally a 14 foot lock width, with varying lengths) in the South and the North-East.[4] On the railways the problem was less marked, with only the Great Western system (before 1892, when the GWR made the final switch to standard guage) and local narrow gauge railways (often industrial networks) operating different gauges to the majority of mainline railways.[5]

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[1] Le Guillou, 1975-6, 109-12
[2] Pollins, 1971, 63; Dyos and Aldcroft, 1969, 159 & 196
[3] Dyos and Aldcroft, 1969, 159
[4] de Salis, 1904
[5] Robbins, 1965, 83

ii. Carrying Technology

Infrastructure is only one variable in the capacity of communications systems. Also important is the carrying technology making use of the track. This has two aspects:

a. Traction

The only widely available means of hauling goods at the start of the nineteenth century were animals, sail and people. Horse traction prevailed on the canals until near the end of the century. Although steam packets carrying passengers and light goods used the canals from early days, it was not until the 1870s that steam tugs or integral steam engines became common, and after the turn of the century that carriers began to use semi-diesels.[6] On the roads the first practical steam traction engine was marketed in 1860.[7] By the 1870s, traction engines had developed all the main features which were to remain part of this technology until it became obsolete. They had become relatively common, but their use on public roads was heavily restricted by legislation.[8] The horse remained predominant. Carriers such as Pickfords and Chaplin and Horne abandoned most long haul work in favour of local distribution from railway stations,[9] yet Pickfords still had 1,500 horses working in London alone in the 1870s. In 1890 there were 6,000 horses working for the railway companies in London, and nationally there were 600,000 carts and vans, of which about one third were heavy carts of more than 10 tons unladen weight.[10] A 'fast' traction engine could pull between 15 and 25 tons on the flat at 2.75 m.p.h.[11] but given the restrictions and costs associated with road engines, horse power remained popular for much urban goods traffic.

On the railways and industrial tramroads there was early reliance on horse-drawn wagons and stationary engines but the efficiency of locomotives made rapid progress after the Rainhill Trials in 1829. Within 20 years most of the major technological advances had been made to allow the steam locomotive to function efficiently.[12] Already in 1845 George Hudson was able to claim before the Gauge Commission that one

6 Hadfield, 1969, 245
7 Wilkes, 1974, 33
8 Ibid.; Fletcher, 1891, 257
9 Dyos and Aldcroft, 1969, 228; Kellett, 1969, 313-4
10 Thompson, 1976, 66-71
11 Fletcher, 1891, 276
12 Dyos and Aldcroft, 1969, 196

locomotive had hauled 7-800 tons on the York and North Midland Railway.[13] Allowing for a little exaggeration in his statement it is still true that haulage capacity was able to keep pace with demand from industrial loads, except on the steepest gradients, especially because the steam locomotive was flexible enough to allow double heading and banking on heavy trains. The small engine policy on the Midland Railway, for example, almost guaranteed the use of two locomotives on most mainline goods and express passenger services. The Midland Railway's invention of the firebox brick arch in the 1850s allowed coal to replace coke as a higher calorific fuel source by 1870.[14] Thereafter the process was one of refinement and enlargement, with experiments in compound engines and electrification coming to little or nothing before 1914.[15] The railways established themselves as the prime area for investment in the development of transport technology. Only at the very end of the century did road vehicles begin to catch up through the steam lorry and then the internal combustion engine.

b. Carrying Capacity

The ability to carry bulky items forming large unit loads is important to many industries. For firms using bulk commodities in divisible quantities, or smaller manufacturers, the maximum unit load size is less important. If one mode of transport offered advantages in terms of unit load it would tend to be more attractive for large scale firms, other things being equal. The man handled sack and the pack horse and wagon load set a natural limit to carrying capacity until the introduction of canals. For towns without access for seagoing vessels the inland waterways were capable of taking the largest unit loads for most of the nineteenth century, with vessel size being limited by lock dimensions. On the railways the normal units of freight carriage were the eight and ten ton wagon and van though these could be combined in numbers to carry large quantities of divisible materials such as coal. This remained the case until the end of the nineteenth century and into the twentieth[16] though larger trucks did exist for special loads.

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[13]Nock, 1968, 32-3
[14]Ibid., 61; Dyos and Aldcroft, 1969, 196
[15]Ibid.
[16]Aldcroft, 1974, 41-2; Dyos and Aldcroft, 1969, 160; Barker and Savage, 1974, 113

2. Interchange, Storage and Processing Capacity

Much of the attraction of any mode of freight transport depends on how much transhipment is necessary, how long the delays caused by off loading or transhipment are, and the level of terminal costs. Terminal costs will be examined in Section 3 of this chapter. Also important is the ability to store goods within the system or at the destination and the ability of the recipient to process goods on receipt, thus getting them off the transport system. These three types of capacity are not always distinct - for example railway sidings may be used for storage of wagons and for loading or unloading. The main points are:

i. Sidings, Wharves and Goods Stations

The efficiency of public wharves or goods stations in handling freight would be a key factor in determining the attractiveness of the main alternative, the private wharf or siding for the exclusive use of a single firm. Most shipments were concentrated at the large central freight terminals.[17] This could cause heavy congestion.[18] The attraction of private wharves and sidings must have been considerable if companies had to move large volumes of goods.[19] There would also have been advantages for security of goods, given that public wharves and warehouses were susceptible to theft.[20]

ii. Railway Company Sidings and the Organisation of Shunting

The advantages of having a private siding would be reduced if wagons could not be shunted into it easily. However, an equal problem might apply at public stations if goods handling was not done efficiently. Since goods in transit are also sometimes effectively in store (that is, they form part of the firm's inventories), adequate sidings capacity and goods sheds would be needed for shunting and to accommodate items not yet required or called for. There were problems throughout the railway system in the nineteenth century caused both by the lag in keeping sidings and marshalling capacity in step with demand[21] and because of the failure of

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[17] Ibid.
[18] Kellett, 1969, 312
[19] O'Dell and Richards, 1971, 193
[20] E.g. Hadfield, 1971, 101 & 105
[21] Dyos and Aldcroft, 1969, 160

the railway companies to adopt more modern marshalling and freight management techniques.[22]

iii. Carting Practices

The attraction of railway or canalside locations depends to some extent on the efficiency of the alternative of public terminal transhipment and whether it is provided as part of the service offered by the transport undertaking. Where delivery to the factory is included in the service, the only reasons to attract a manufacturer to locate next to a canal or railway would be inability of the transhipment system to cope with the scale of goods involved, any additional cost of such a service, failure to deliver for some exogenous reason such as road traffic congestion, or efficiency benefits - for example delivery of trucks into the heart of a steelworks to integrate the inter-urban transport system into the production process.

iv. Storage and Warehousing Arrangements

The extent to which manufacturing companies were supplied by intermediaries such as coal merchants and iron and steel stockholders rather than storing materials themselves would influence location decisions. For companies (probably smaller firms) depending on intermediary suppliers, accessibility to the warehouse or storage yard would be more important than access to the transport system supplying the intermediary. Warehousing and stockholding operations would tend to gravitate towards the bulk transport systems unless they were also showrooms of the Manchester cotton industry type.[23] In Sheffield this latter category would include finished cutlery and stove grate warehouses[24] but not steel and iron merchants, who would deal in bulk commodities. The effect on the location of customers in the steel industry would thus have been very similar to that which would have prevailed if the customers had been attracted to the transport system itself.

3. Pricing and Managerial Control

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[22]Ibid.; Aldcroft, 1974, 41-2
[23]Kellett, 1969, 16
[24]See for example the illustration of Steel and Garland's stove grate showrooms in Pawson & Brailsford, 1879, 284 and the photograph of the Division Street headquarters of J.G.Graves' mail order cutlery business in Binfield et al (eds.), 1993, Vol.III, 30

Transport costs are bound to play a part in the calculations of location decision makers. Parkinson and Imaco, examining the effects of modern investment in transport infrastructure found:

> ... that as transport costs are a small proportion of total production costs and as the changes which transport investments are able to make to transport costs are themselves a small proportion of transport costs ... on the evidence available on location decision-making by industry, transport investments are unlikely to have a major impact on distribution of economic activity.[25]

They acknowledge, however, that there is evidence that improvements in accessibility have an effect at the level of the individual site.[26] Their general finding can hardly have been true of the nineteenth century, when huge strides were taken to improve transport efficiency. As Alfred Marshall wrote:

> Probably more than three fourths of the ... benefit [England] has derived from the progress of manufactures during the nineteenth century has been through its indirect influences in lowering the cost of transport of men and goods, of water and light, of electricity and news: ... the dominant factor of our own age is the development not of the manufacturing, but of the transport industries.[27]

Although inter-urban transport costs are not likely to be a critical factor in intra-urban location decisions, Pred and Stefaniak suggest that industries serving regional or national markets tend to locate in areas away from the centre of the city and oriented towards their market.[28] However, the most critical factors affecting costs of raw materials are the need to break bulk and the system of freight charges, rather than distance travelled.[29] Similarly, the ease with which finished goods can be moved from plant to transport interchange and the structure of carriage charges are important. Thus proximity to a break of bulk point could make it more attractive in theory to locate on the opposite side of a town from a regional or national market if no break of bulk point were available on the 'right' side of town. It is true that terminal costs will make up a smaller proportion of cost per ton mile on longer journeys.[30] However, for companies competing for sites in a single urban location this would not be a significant factor since all those buying raw materials and selling in the same markets

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[25]Hurdle, 1992, 9
[26]Ibid., 8
[27]Quoted in Offer, 1980, 248
[28]Carter, 1973, 322; Goodall, 1972, 124; Bale, 1976, 69
[29]Estall and Buchanan, 1980, 46 & 229
[30]Lloyd and Dicken, 1977, 166

would be sending goods over roughly the same distances as each other and could be expected to face comparable inter-urban transport costs.

Moses and Williamson consider many discrepancies between location theory and actual development patterns can be accounted for by the cost of intra-urban goods transport arising from the lag between the development of local distribution technologies when compared with inter-urban transportation and with people moving systems such as tramways:

> The cost of moving goods was ... high relative to the cost of moving people. This ... relationship played a crucial role in the emergence of the core dominated city. The lower transport costs associated with the location in the core exceeded the reduction in cost possible from lower wages and rents at sites in the satellite area. A prerequisite of decentralisation was the breaking of the transport tie to the core. Only after technological changes was the attraction of a non-core location strongly felt. The major change was the introduction of the truck which reduced the cost of moving goods within cities.[31]

The key factor for location decision makers to consider would be the comparative costs of a location giving direct access to one part of the transport system, as against a situation which did not have a direct connection but might give less good access to several different parts of the system. The variables would include:

a. The money cost of providing fixed connections such as sidings or branch canals, and who paid for them to be built and maintained. If railway companies paid the cost of building private sidings, this could have acted as an incentive to choose a site with direct connections. If sidings were expensive for manufacturers to build, they would only be available to firms above a given marginal size.

b. The money costs of local carting and terminal charges at public wharves and stations, whether these were properly accounted for, and whether owners of private sidings could in effect discount these costs as unnecessary. Where a specific charge was made by the inter-urban transport system for breaking bulk at a wharf or station, carting, handling goods, demurrage, wharfage, warehousing and so on, this would undoubtedly be taken into account when a company was assessing its potential transport costs. Similarly, if independent local carters were employed to distribute goods from termini, they would charge for the service and this could be accounted for. Where manufacturers used their

[31]Moses and Williamson, 1967, 126

own carts, the company would have needed a detailed system of internal accounting if the marginal cost of carting were not to become buried in more general costs. Victorian entrepreneurs were not always notable for their systematic accounting methods,[32] and so it is of interest to discover who provided terminal and carting services and how important these costs were in the overall production function - were they important enough to be identifiable as a cost of marginal significance in intra-urban location decisions? Was there a clear additional cost if goods had to be transhipped and carted instead of delivered direct to a private wharf or siding? Did carrying companies offer reduced rates to encourage manufacturers to use private sidings, or compel them contractually to use only their lines and charge monopoly rates for the privilege? The issue of railway rates is discussed in more depth in Appendix 1. The result of the complexity of the railway rates system and its relationship with railway company carting services was considerable difficulty for location decision makers in identifying the marginal costs associated with local distribution of goods. A further implication is the need to examine the circumstances prevailing in each location, and possibly for each firm, rather than making broad generalisations about the effect of carting charges from termini on production costs.

c. The question of who paid transport costs is also relevant. Most location theory assumes producers use a system of free on board (f.o.b.) pricing where the customer pays a standard price for goods at the factory gate and then meets delivery costs.[33] The effect is to allow the friction of distance to play its full part in establishing the boundaries of a firm's potential market.[34] However, it is open to firms to use discriminatory pricing to extend their market. By absorbing some or all of the cost of transporting goods to customers, the aim is to take more market share or increase gross revenues by offering a more competitive all-round price.[35] A variant is to offer delivered prices based on delivery zones, which sets a flat transport cost over what may be quite a wide area.[36] The system of charging railway carting rates by zone rather than to specific stations would be a good example. Neither f.o.b. pricing nor discriminatory pricing necessarily remove the incentive to choose a least transport cost location. The potential for profits to be maximised under either approach will arise

[32] Kellett, 1969, 25
[33] Estall and Buchanan, 1980, 47
[34] Lloyd and Dicken, 1977, 183-4
[35] Ibid.
[36] Estall and Buchanan, 1980, 47

where costs are lowest. Goodall considers the question of who pays for transport will be of negligible importance to firms with a national or international market when they come to make intra-urban location decisions. Unlike firms serving a local market, where the ability to save on delivery charges by collecting goods from the factory is real, firms with a wider market know the cost of delivery must add to the product's cost whether it is paid by the producer or borne by the customer.[37] However, where customers paid for transport from the factory gate, or suppliers of raw materials habitually paid delivery costs to the point of production, transport costs might be perceived as less significant as a factor in location decisions, especially because their marginal impact on total costs might be less easy to quantify and take into account in decision making. Under a delivery zone pricing system, the marginal cost difference between locations within the zone would be nil and so marginal factors such as local transport costs could not figure as a significant issue in decision making. One must, of course, add the caveat that for multi-product firms using a wide range of raw materials, the chances of all the inputs and outputs in the production process (or even the most significant of them) falling under the same type of pricing system would be less than even.

[37]Goodall, 1972,118

CHAPTER 3

INFLUENCES ON LOCATION DECISIONS (2) - TECHNOLOGICAL AND ORGANISATIONAL CHANGE

Following Schumpeter and Pred, the importance of technical innovation for urban growth is generally acknowledged.[1] In this section, the effects of technological development are considered together with organisational change. The two are inextricably linked. Duverger describes organisational and political change as transformations in social technology.[2] Schumpeter believes that the way technology is organised for production is influenced by the cultural and behavioural attributes of society;[3] but there is undoubtedly feedback between the adoption of new technologies, social and industrial organisation and the propensity to develop further technological advances. Also linked to technological change is capital formation and the control of capital distribution.[4] The effects of technological change are described below under four headings:

1. Cyclical Movements in the Economy;

2. Production Technologies;

3. The Scale and Organisation of Production;

4. Urban Technologies.

1. Cyclical Movements in the Economy

The observation that industrial, economic and urban development tend to take place in cycles of growth and decline is well established. The links between the initiation of long waves in the economy, technological innovation and urbanisation are summarised by Barras:

> Each long wave is assumed to start with the emergence of a related cluster of fundamental new technologies which act as the driving force for widespread innovation in new products and the establishment of wholly new branches of industry, opening up new markets and creating a sustained upswing in economic growth; then as these industries mature, innovation becomes

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[1]Robson, 1973, 132; Lloyd and Dicken, 1977, 231 et seq. & 409 et seq.; Whitehand, 1987, 61-7; Goodall, 1979, 119; Harvey, 1985, Ch.1
[2]Duverger, 1972, 54
[3]Lloyd and Dicken, 1977, 410
[4]Harvey, 1985, 7-8

> more incremental, and markets become saturated, leading to a period of recession and depression until the next 'technological revolution' begins ... Each long wave in turn generates one or more long swings of building activity, combining to create a new wave of urban development which is typically associated with the construction of new transport infrastructure networks ... and with major population movements ... and may be further reinforced by speculative financial booms based on cheap credit.[5]

Whitehand places economic fluctuation and the adoption of innovation alongside land value theory as the three legs of his theoretical framework to explain the evolution of urban landscapes. He links the creation and modification of urban elements to pressures on land over time and space, mediated by the price of land. In his schema, rapid outward growth takes the form of high density housing during periods of relatively high land values associated with housebuilding booms. Each boom also features rapid adoption of its own admixture of innovations in the urban landscape. Conversely, periods of slow outward growth coincide with housebuilding slumps, lower values and the development of low density extensive land uses, including public and institutional projects.[6]

Economic waves of different frequencies and lengths have been described. Three long (Kondratieff) waves associated with fundamental changes in the structure of the industrial economy have been identified as affecting the period under consideration:[7]

a. c.1780-c.1845 - deriving from the introduction of steam power and the establishment of the textile industry. Characterised by the growth of the canal system and early railways, and the first stages of industrially stimulated urbanisation.

b. c.1845-c.1895 - founded on coal, iron and steel. Railways were the main mode of transportation. Rapid urbanisation led the majority of the population to become town and city dwellers.

c. c.1895 onwards - the development of more sophisticated chemical and electrical industries and the growing importance of motor transport were associated with the evolution of new forms of urban technology and increasing suburbanisation.

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[5]Barras, 1987, 7
[6]Whitehand, 1992, 3
[7]Ibid., 7-8

Shorter cycles of about 15-20 years (Kuznets cycles) have been reported,[8] although study by Barras and others of detailed data relating to gross domestic fixed capital formation in building in Britain from 1856-1982 revealed an average medium term cycle closer to 28 years.[9] Short swings (Juglar cycles) of anything between four and ten years have also been estimated in the business and building sectors.[10] The Kuznets cycle in particular seems to be associated with waves of investment in the built environment.[11]

These fluctuations in economic activity are not necessarily uniform in effect across different sectors. Whitehand cites data from the US, UK and Australia which suggest that non-residential building is less susceptible to fluctuation than residential, and that at the intra-national level there tends to be a switch in capital between residential and non-residential building as one sectoral cycle matures and the other commences.[12] It has been proposed also that there is a substitution effect between investment in industry and urban capital[13] or at least that investment in city building is only feasible once surplus capital is available over and above that needed for industrial investment.[14]

There does not appear to be a consensus about the relationship between residential and non-residential building. Barras and his colleagues found that since 1850, cycles in residential and non-residential building have moved broadly in phase, with the severity of the two swings being similar. Non-residential building did peak rather later than residential at the end of the nineteenth century and tends to show manifestations of shorter but more pronounced booms, reflecting at least in part the way in which speculative investment takes place in commercial development.[15] Cyclical effects also vary locally,[16] and one would expect that at the micro-economic level (whether geographically or sectorally) there would be a good deal of variance from macro-economic trends. This would arise not just for statistical reasons but because of the way innovation occurs. There is

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[8] Harvey, 1985, 19; Gottlieb, 1976, 192
[9] Barras, 1986, 12
[10] Ibid., 6; Harvey, 1985, 19; Gottlieb, 1976
[11] Gottlieb, 1976, 192; Harvey, 1985, 19
[12] Whitehand, 1987, 17 & 27
[13] Briggs, 1971, 18
[14] Harvey, 1985, 16 et seq.
[15] Ibid., 12
[16] Whitehand, 1987, 14-5

considerable evidence that the diffusion of innovations is subject to neighbourhood and hierarchical effects.[17] Every technological 'era' also contains the seeds of the next technological revolution at the micro-economic level of the individual entrepreneurs and inventors who originate it. As is apparent from the case of innovators such as Sir Robert Hadfield who first applied the principles of metallurgy to develop manganese steels[18] or Bessemer, who had to set up his own factory to demonstrate the effectiveness of his steel convertor,[19] the individual firm's demands for space may be driven by influences which are in advance of general industry trends or even counter-cyclical to the general trade or building cycle.

Whitehand acknowledges that building cycles and morphological periods are not necessarily synonymous even though they are inter-related.[20] He now advocates detailed study of local circumstances to enable integration of theory with experience.[21] Daunton has gone so far as to propose that for localities, only detailed study of each area is really worthwhile because the effects of building cycles cannot be shown to be universal at that level.[22] Nevertheless, one may expect to see phenomena associated with cyclical change which will affect industrial location. These are likely to fall into the following categories:

i. <u>Capital Fluctuations</u>

An important element in cyclical change is the movement of capital and the availability of finance for investment.[23] In the past, economic historians gave primacy to the instability of financial systems in explaining trade cycles.[24] Although technological changes may now be seen as the root of cycles, the financial system is still critical in mediating booms and slumps. 'The growth or expansion of enterprise in different locations is affected by marked differences in the availability of capital'.[25] The increasing sophistication of financial markets in the nineteenth century assisted the expansion of industry

[17]Whitehand, 1987, 66; Robson, 1973, Ch.5; Lloyd and Dicken, 1977, 112-4
[18]Tweedale, 1986, 42
[19]Walton, 1948, 192
[20]Whitehand, 1987, 65
[21]Whitehand, 1993, vii
[22]Daunton, 1978, 179
[23]Whitehand, 1987, 29
[24]E.g. Court, 1967, 104
[25]Estall, quoted in Lloyd and Dicken, 1977, 231

and provided funds for enterprises in new locations. For the individual firm though, large scale shifts in investment either geographically or between sectors may be less important than the competitive edge of the firm as perceived by investors, views about the market's future, the firm's own security in assets and reserves and the entrepreneur's persistence (in the case of firms which are innovating). Trends may be discernible when strong tides of boom or recession are running. These may favour investment in particular locations. It is doubtful whether these trends would be perceptible in the choice of sites within the urban area. There would be indifference at the margin (at least as considered by investors) between the various sites in a town which could meet the locational criteria for firms serving a wider than local market.

ii. Timing of Location Decisions and Competition for Space

Allowing for the innovator's need to be ahead of the field, the willingness of most firms to set up or relocate will be influenced by their view of the market and whereabouts in the business cycle the firm expects to find itself during the period for which investment is planned. The propensity to invest must be greater where there is optimism about the future. We have observed that innovations tend to be seized upon by more and more firms as the business cycle picks up, and that there is a tendency towards saturation of markets in the medium term. In a town which is favoured by a particular industrial sector growing in the course of an upswing in the trade cycle, there will be increasing competition for space to accommodate production units for that industry. This may coincide with increases in demand by other expanding industries. Alternatively it might happen concurrently with the decline of another industry at the tail end of a cycle of its own, in which case there might exist the possibility of substitution of space between the industries, if this were physically feasible. As Whitehand points out, land value is essentially a surrogate expression of pressure on space.[26] One might therefore expect more competition for suitable sites as an upswing proceeded, with increases in land values and/or a squeezing of the size of sites to compensate for the effect of higher land costs on the overall production function. Land and premises costs can be important

[26]Ibid., 138

factors in overall costs[27] and it is reasonable to assume that a business will not acquire more land than it believes it will need for its activities - though it may speculate by purchasing or leasing more than its immediate requirement to allow for future expansion. Nonetheless, when calculating how much land should be acquired, land prices will be one of the variables taken into account. Whitehand found that

> ... even for extensive urban areas the correlation between land values and distance from the city centre, though substantial, may be both lower and subject to greater inter-area variation than the correlation between land values and fluctuations in building activity over time.[28]

This means that at least some space extensive uses tend to be counter cyclical to the residential building cycle, or not cyclical at all.[29] The implication for manufacturing industry is that it ought to be easier and cheaper to assemble sites for large scale production at the bottom of a building cycle. Conversely, sites should be more expensive and thus smaller in a boom. The complication in this relatively simple model arises in circumstances where it may be acceptable to pay higher marginal land costs in order to maximise profits by maintaining a competitive edge or increase the scale of production;[30] this could also apply where a firm would be prepared to see land costs rise if it allowed another variable such as transport costs to be reduced.

2. Production Technologies

Changes in production technology are a potential source of pressure to find new locations. Firms exploiting new forms of production need sites which meet physical criteria which allow the new technology to function. For established companies, existing premises may be inadequate and a new location may be sought.

The main production technology related factors which affect location (excluding transport technology, which has already been dealt with) are:

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[27]Lloyd and Dicken, 1977, 202 et seq.
[28]Whitehand, 1975, 224
[29]Whitehand, 1987, 19-20
[30]Harvey, 1985, 136

i. Power Supply;

ii. Production Techniques and Equipment;

iii. Environmental Effects;

iv. Labour Force.

i. Power Supply

The essence of manufacturing industry is the use of energy to convert raw materials into products. The source of power is therefore a critical factor in any industrial location decision. At the start of the industrial era, the choice of mechanical energy was limited to water to drive machinery and wood and coal to supply heat. Wind and human or animal power were supplementary energy sources, but not significant for this study. As mechanisation increased from the last quarter of the eighteenth century, water power was vital to the success of industries such as textiles manufacturing.[31] The same is true of metalworking in areas such as Sheffield, where water powered tilts and forges clustered in the river valleys above the town.[32] Dependence on a good head of water was one of the major inflexibilities of water power. This led to limitations on the choice of locations for mechanised industry. In 1781, James Watt patented the rotary motion which would allow power from steam engines (previously used mainly for pumping water) to drive manufacturing machinery.[33] Steam power had a tremendous liberating effect on industrial location decisions, though it was by no means instantaneous and did not lead to complete ubiquity of power supply.[34] Initially there were obstacles to using steam power, including unreliability of equipment, the unwillingness of Watt to release his patents and his hostility to the introduction of rotary motion (overcome only by pressure from his partner Boulton) and high pressure steam engines.[35] Estimates of the pace of extension of steam power into manufacturing vary somewhat, but there was a rapid growth after the expiry of Watt's patents in 1800. Between 1775

[31] Court, 1967, 59
[32] Roy Davey, c.1975
[33] Court, 1967, 56
[34] Lloyd and Dicken, 1977, 146; Harvey, 1985, 40
[35] Mathias, 1971, 136; Odle, 1966, 70

and that date, Boulton and Watt had supplied 496 engines,[36] with a total horse power of 7,500. As the nineteenth century progressed, horse power from stationary steam engines rose as shown in Table 3.1.

Widespread adoption of steam power enhanced the mobility of industry considerably, enabling abandonment of relatively inaccessible upland river valleys in favour of lowland towns and cities. Nonetheless, industry remained tied to a good water supply, even though head of water was no longer critical.

The ability to obtain coal in quantity was also vital. Although the canals and railways could ensure adequate fuel supplies, steam powered industry was a creature of the coalfield.[37] Steam remained the dominant motive power throughout the nineteenth century, but from the 1860s other energy sources began to increase in importance. From 1866, a two stroke non-compression atmospheric gas engine began to come onto the market.[38] The four stroke gasoline (also known as the gas oil or Silent Otto) engine - smaller, lighter and less powerful than the steam engine but also more flexible and ideal for small manufacturers or light machines in large factories - began to be introduced in the late 1870s and early 1880s, following its development by Otto in 1876.[39] Electricity also started to become significant as a prime mover, and offered exceptional flexibility of plant location.[40]

Although a similar process of evolution took place in the development of primary heat sources for the steel industry in the nineteenth century, it probably had less locational significance during the study period than the unfettering of motive power, except insofar as the scale of plant was concerned. For the larger part of the century, steel plants needed access to plentiful supplies of coal and coke, whether for small scale cementation and crucible manufacturing, the larger volume Bessemer converters or the Siemens open hearth process, introduced after 1865. Although the latter system was fired by producer gas, this gas is generated by passing a blast of air and steam

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[36]Odle, 1966, 66
[37]Lloyd and Dicken, 1977, 146
[38]Developed by the German Nikolaus Otto from princples established by the Frenchman Lenoir - Hounshell, 1993
[39]Ibid.; Court, 1967, 217
[40]Lloyd and Dicken, 1977, 147

through a deep bed of red hot coal.[41] Towards the end of the nineteenth century and into the early twentieth, electric arc and town gas furnaces came in (see Chapter 5) but nineteenth century industry was coal fired except at the margins.

ii. Production Techniques and Equipment

The evolution of steel making technology will be considered in Chapter 5. Here, we note simply that the physical conformation of equipment used for production and the juxtaposition of the pieces of plant necessary to complex industrial processes may impose disciplines on the choice of site. To take an example from the steel industry, the cementation furnace is a brick cone which may be a freestanding structure or form part of a group - essentially a building in its own right.[42] The Bessemer converter, on the other hand, is a piece of semi-mobile mechanical plant, housed in a substantial building, with the equipment necessary to serve it.[43] Other facilities such as repair workshops are needed to run mechanical plant of this type. Both in terms of scale and physical characteristics the two types of process are likely to have different minimum requirements for their siting.

iii. Environmental Effects

The importance of coal based technologies for nineteenth century industrial growth had its corollary - industrial pollution. So far as industrial location at city level is concerned, the most significant factor identified by most writers is air pollution, though water pollution and noise could also be considerations.[44] Rex captures the essence of the proposition that air pollution and location are inter-related:

> Our starting point is the sort of industrial settlement ... which grew up in England in the nineteenth century. At this stage one sees the first segregation of residential areas determined by position in relation to factories, civic buildings and prevailing winds ... one has the homes of the upper middle classes - the captains of industry with good access to central facilities ... yet avoiding contact with industrial dirt.[45]

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[41]Brandt, 1953, 120-31
[42]E.g. Barraclough, 1976, 22 et seq.
[43]Ibid., 73
[44]Bale, 1976, 69
[45]Rex, 1968, 212-3

Without a State planning system to guide industrial location, one must assume that any tendency for elite residential areas to gravitate upwind of industry derives, as Carter suggests, from the natural repulsion of residential districts by basic processing industries (though he believes this tendency is less clear for working class suburbs).[46] Given the prevailing south-westerly and westerly winds across most of England, the tendency would be for polluting industry to predominate on the east side of town, with suburbs growing up in the cleaner air to the west. Cannadine invokes this hypothesis as one of the explanations for the differences in the quality of development between the various aristocratic estates he studied.[47]

iv. Labour Force Issues

The availability of an appropriately skilled labour force in sufficient numbers is critical to location decisions.[48] There are several well known examples of industrialists establishing villages near their factories to ensure an adequate pool of labour - for example Samuel Gregg's textile mill at Styal in Cheshire.[49] For factories in towns, the problems of labour supply would have been less serious, though industries such as cutlery and special steels which needed skilled labour would still have to take account of the accessibility of their works to suitable housing areas, or make their own housing provision. Lloyd and Dicken believe that for small handicraft manufacturers, whose premises and transport costs tend to consume a relatively small proportion of the production function, the availability of labour at the right price and with the right skills will be far more important than the price of land or goods conveyance as a locational factor.[50]

Labour Relations

The Marxist writer Hill considers that the root of the sudden dispersal of central city factories in America around 1900 lay in the increasing labour relations problems which beset these firms in the 1880s and 1890s. Hill quotes employers' evidence to the U.S. Industrial

[46]Carter, 1975, 317
[47]Cannadine, 1980, 405
[48]Carter, F.W., 1975, 69
[49]SCAct for the Regulation of Mills and Factories, M of E and Report, 1840, Vol.X, Cmnd.203
[50]Ibid., 205

Commission (1900-2), and a study in 1915 to show there was a desire to relocate plants away from areas where the labour force was well organised and unionised.[51] Massey and Meegan considered this to be significant among the reasons for plant relocations in modern cases.[52] This is not a purely Marxist pre-occupation. A modern manual written to assist professional managers making location decisions advises:

> To the majority of businesses the most important characteristic of any location will be the availability of skilled labour at an acceptable cost. Only a minority of location choices are predominantly based on ... physical factors ... For many businesses labour problems at their existing location are one of the major reasons for moving. It is not surprising therefore that avoidance of the same problems is desired in future and that the availability of labour is considered more important than considerations of site, transfer costs etc.[53]

Similar influences might arise from excessive control over trading practices or entry into the market exercised by the trade organisations which existed in many British towns in the nineteenth century,[54] the Sheffield Cutlers' Company being the most relevant example. It seems likely, though, that influences of this type would be more important for inter-urban relocations than for those within cities, since it would be difficult to avoid labour problems or trade restraints without a complete change in circumstances involving a move to another town.

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[51]Hill, 1978, 49-50
[52]Massey and Meegan, 1978, 275
[53]Haines, 1970, 29
[54]Court, 1967, 214-5

3. The Scale and Organisation of Production

i. Scale

The effects of the scale of production on location decisions arise from physical technology and organisation. Changes in the physical scale of production technology - for example through introduction of new plant and machinery - may well lead to the need to relocate to find premises big enough to accommodate new equipment. In the nineteenth century the introduction of steam power, with its ability to drive larger and more machines is a good example of such a change. As Lloyd and Dicken point out, it was when the steam engine replaced water power and steel replaced wood that the first effective economies of scale at the plant level were realised, revolutionising unit production costs.[55] However, it is not necessary to adopt new physical technologies to stimulate demand for larger facilities. The introduction of the factory system could change the locational criteria for an industry which still depended on unmechanised craftwork.[56] More sophisticated organisation of work may also affect the spatial requirements of firms. For instance continuous flow production line methods require a site which is capable of rational organisation. These methods are seldom suited to old buildings, usually requiring new construction rather than adaptation of premises.[57]

Studies of modern location decision making have found that a major proportion of moves are a direct consequence of constraints on productive capacity at existing locations, and that decisions to invest in new production technologies are an important determinant of industrial movement.[58] There is no reason to think that similar factors would be absent from nineteenth century decision making. Scale would be an important factor in defining the ideal location. Because the balance of factor mixes is different for different sizes of firm, we would expect small companies to have very different requirements from industrial giants.[59] Although firms will always tend to be attracted to locations where they see that other companies

[55] Ibid., 273-4
[56] Harvey, 1985, 40
[57] Goodall, 1979, 131
[58] Ashcroft and Taylor, 1979, 48
[59] Lloyd and Dicken, 1977, 285

are successful,[60] there are economies of agglomeration which are particularly applicable to small companies in industries where there is a lot of interdependency between firms. This may arise in sectors with a high degree of division of labour within a fragmented industry structure (e.g. Sheffield cutlery) or where clustering of similar undertakings in a well known quarter increases the attraction of customers for all firms. Some of the advantages include the ability to share economies of scale between firms (for example shared distribution facilities), the ability to gain market intelligence and exchange technical information, reduced transport costs and greater time savings in transferring goods between firms engaged in different stages of the production process, reduced premises costs through multiple occupation of buildings, reduced need for stockpiles of materials because of ease of access to suppliers and the ability to obtain raw materials in small quantities, and access to a trained labour pool which may be shared on a contract basis allowing part-time working, avoiding the need to employ idle workers when demand is low. Such groupings of industry are often associated with areas close to city centres with easy access to their markets.[61]

With growth in size and greater vertical integration, firms become less reliant on external economies of scale and seek instead to internalise these economies. Although co-location may still occur it is less important. Other factors such as large site areas and access to the means to move large volumes of raw materials and the output of mass production become more critical.[62]

Although small firms closer to central areas may pay higher unit prices for land, they demand less of it and can often spread costs by sharing premises.[63] For large firms, suburban sites may have a lower unit cost, but much more land tends to be consumed in relation to the value of the product,[64] so a balance has to be struck between 'the production economies derived from serving a wider market and the space costs which must be overcome to obtain access to such a market'.[65]

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[60]Goodall, 1979, 121
[61]Goodall, 1979, 127; Bale, 1976, 62; Johnson, 1969, 152
[62]Goodall, 1979, 128; Boyce and Williams, 1979, 279; Johnson, 1969, 154
[63]Bale, 1976, 63
[64]Ibid., 69
[65]Lloyd and Dicken, 1977, 285

ii. Organisational Factors

a. Mergers and Takeovers

Apart from the adoption of factory production methods, other organisational factors may affect decisions about location. Studies of modern firms[66] have shown a connection between company mergers or internal reorganisations and the closure of uncompetitive urban plants. It has been suggested that companies merging and/or rationalising prefer setting up plants in new locations to managing the changeover and redundancies that result from the conversion of existing plant.[67] Though this departs from the proposition that firms prefer to remain on an existing site, there is probably a difference between location decisions arising from expansion and those deriving from rationalisation.

Growth by merger seems to be a particularly important way for medium sized companies to expand into very large enterprises. In the US, there was a peak of merger activity at the turn of the nineteenth and twentieth centuries, often with substantial locational effects - the establishment of U.S. Steel in 1901 being an example.[68] In Britain in the same period the evidence on mergers is less clear[69] though there was a marked trend towards increased scale and vertical integration before 1914, with producer companies taking over raw materials suppliers.[70] Mergers were used by companies in chemicals, textiles and tobacco to attempt to establish monopolistic control of industrial or product sectors.[71]

b. Multi-Plant Firms

Another organisational factor affecting location is the creation of multi-plant enterprises. As firms grow or diversify, their initial premises may no longer be big enough, or may be unsuitable in some other way. It may be that new areas of business are better located elsewhere, where conditions are more favourable for a different type of

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[66] E.g. Massey and Meegan, 1978; Leigh and North, 1976; Dennis, 1980, 51-5
[67] Canning Town Community Development Project, 1975, 39
[68] Lloyd and Dicken, 1977, 360
[69] Ibid.
[70] Pollard, 1969, 10
[71] Ibid., 12

undertaking. The company may separate elements of production in different plants or managerial offices from production centres.[72] Location decisions for multi-plant firms are complicated by the need to maintain control and production linkages between plants.[73] The more advanced the available communications technology, the greater the freedom to site branch plants at longer distances from headquarters.

c. Company Structure and Control

Factors related to scale are the structure and management of companies. The basic form of production unit is a self-employed person in a single plant enterprise. They are likely to have simple locational needs and may best fit the model of craft industries described earlier. As businesses grow in size, managerial control becomes more complex. An employer with an apprentice or a few employees may need to exercise managerial control but the main decisions remain his or hers. Once production starts to grow or more capital is needed, it may be necessary to form a partnership, with partners becoming involved in decisions, including location. Decisions become complicated by the politics of relationships between partners and the potential for conflicting opinions.

The partnership may develop into a private or public company controlled by a board of directors which may be answerable to shareholders. There may be increasing delegation of management decisions. In the modern context, control may be exercised by professional executive management on behalf of the board.[74] Decision making becomes corporate, with greater emphasis on planning and rational judgements rather than the instinct of the entrepreneur.

- Nineteenth Century Corporate Structures

Nineteenth century management techniques and corporate structures developed in parallel with (and often in response to) changes in production technology. Legislation made it easier to establish corporate entities following the success of joint-stock companies in promoting railway development. In 1837 it became possible to use

[72]Lloyd and Dicken, 1977, 368-74
[73]Ibid., 374-5
[74]Ibid., 367

letters patent to set up a company with corporate characteristics. The Registration Act of 1844 simplified company formation, with limited liability available to all registered companies except banks from 1856. This led to a rapid growth in the number of public companies. In the 1850s and 1860s there was a movement for private companies to go public, albeit with a strong element of control remaining with the previous owners in many cases. Coal, iron and steel, and engineering were at the forefront of this trend.[75] As shareholdings became more widespread, there was a tendency for the main decisions about the day to day running of firms to become the responsibility of salaried managers.[76]

It is important not to overestimate the effects of this movement in the last third of the nineteenth century. Although Pollard suggests that by 1914 joint stock companies were the typical form of large firm organisation in British industry, some three-quarters of all firms remained private, many registered under an Act of 1907 which made provision for private companies.[77] Private companies were by then mostly small concerns, however, with the public issue of capital being the normal method of financing large enterprises.[78] The locational effects of increasing delegation of management responsibility are considered in the case study in Chapter 12.

e. <u>Other Organisational Factors</u>

Two other factors which may impact on location should be mentioned briefly, although they are more relevant to macro-location decisions at international, national and regional level than to intra-urban considerations.

The first is the development of wider national and international markets and corresponding changes in marketing techniques. In an industry serving a wider than local market, changes in markets could impact adversely on a company which was not well located to serve the new markets. The key issue would be the relationship with the external market, not the local siting of the company. Similarly, selling

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[75] Court, 1967, 174
[76] Ibid., 175
[77] Pollard, 1969, 10
[78] Ibid.

methods undoubtedly became more sophisticated in the nineteenth century, aided by the burgeoning communications industries. However, this would not have been important for location locally. For instance, Sheffield's main asset was the reputation of the town for producing high quality metal products.[79] 'Made in Brightside' would have added little to the attractiveness of a product when it was the town's name which carried the cachet.

The second issue - the supply of capital - was considered earlier.

4. Urban Technologies

Whitehand observes that two sorts of innovation are important for urban development - those which require accommodation (such as the changes in industrial technology discussed earlier in this thesis) and those which affect the form of development.[80] Innovations in the ways people, commodities and information are conveyed are of major significance because they increase accessibility.[81]

Innovations which affect the form of development (including industrial location) are characterised here as urban technologies. Technologies affecting the distribution of commodities have already been discussed in Chapter 2. Here we review construction technologies, the movement of people and information, and the question of paying for urban technology.

i. Construction Technologies

The ability to build buildings which can accommodate production technology is a prerequisite of any location decision and ought not to be particularly sensitive between intra-urban locations. There may be topographical or other local factors which limit the use of certain building technologies. These are discussed in Chapter 4, but three other aspects of construction technology may be relevant:

a. During the nineteenth century, mass production and distribution of building materials became feasible, particularly

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[79]Tweedale, 1992, 14; Pollard, 1969, 159
[80]Whitehand, 1987, 66-7
[81]Ibid.

because the railways enabled their transport in bulk between regions.[82] However, it remained economic to produce bricks locally well into the latter part of the century,[83] so the ability to use clay from the building site or nearby brickfields might have been an attraction.

b. To build in low lying areas with poor, marshy ground conditions it would be necessary to be able to stabilise and reclaim land, and move materials in bulk for landfill, although this might be more a question of mobilising labour than technological advance. New building materials did allow lighter weight construction. Cast iron frames for buildings were becoming well established by the mid-century, to be followed by wrought iron and steel.[84] Corrugated iron as a cladding material became widely used from the 1850s.[85] The enormous ranges of transit sheds for the Royal Albert Dock opened in London in 1880 were of corrugated iron on wrought iron frames.[86]

c. The building sector would have to be organised to build on the scale necessary to accommodate industry's needs, or industry would have to organise building itself. During the nineteenth century, most building enterprises remained very small in scale[87] but by the time large scale steel production became practicable there was enough experience of constructing large engineering structures and factories in the military field, public works, railways and other industries to ensure there would be no shortage of expertise to meet the demands of Sheffield's manufacturers.

ii. Moving People

It was stated earlier in this chapter that access to a suitable workforce is a fundamental locational criterion, but that this is more likely to be significant at an inter-urban scale. Nevertheless, the growing industrial city faces a problem as workplace and home become separated with the growth of factory production.[88] Large numbers of workers have to be accommodated and moved from homes located

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[82]Burke, 1980, 10-2
[83]Ibid.
[84]Ibid., 72-6
[85]White, 1965, 15-6
[86]Tucker, 1988, 29; observation by the author
[87]Aspinall, 1977, 1-5
[88]Harvey, 1985, 15

throughout the city, to factories and offices. Only limited studies of nineteenth century journeys to work have been possible because of the scarcity of records correlating residence and place of work. They do not give a clear picture. F.W. Carter's study of C-K-D workers in Prague showed that transport innovations did lead to a gradual shift in the relationship between where people lived and their workplace[89] but that there was less evidence than expected of a weakening of the bond between work and residence. Transport innovations were less important in the changes that did occur than a widening of the labour market.[90] In Liverpool, the type of work available seems to have been influential in ensuring that some residences continued to be found close to the workplace. Dockers dependent on casual employment tended to live close to the docks. Better paid shipbuilders, in more stable employment, avoided the poorest dockside housing. Similar differences were found between dockers and ship and office workers, and between office workers and all manual workers.[91]

Schnore sees the process of industrial/commercial/residential segregation as the result of competitive forces:

> At least three variables seem to be involved (1) city growth, (2) local transportation technology, (3) 'social power' ... If growth is accompanied by commercial and industrial development there may well be new competitors for centrally located sites; in the face of this competition, residential areas may be abandoned to more intensive land uses. At the same time the encroachment of business and factory uses, together with the traffic they generate, may render central areas undesirable for residence. For the elite to abandon the centre, however, technological conditions must allow them to maintain relatively easy access to the centre and its vital institutions.[92]

Thus a demand for accessibility and a desire for 'time-space convergence' (or saving in time lost to travelling) is created.[93] Beyond the point at which walking becomes inconvenient or consumes too much travelling time, there is an opening for new forms of transport technology.

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[89]Carter, F.W., 1975, 96
[90]Ibid., 88
[91]Lawton, 1979, 216
[92]Schnore, 1976, 202
[93]Lloyd and Dicken, 1977, 186-7

Studies of residential segregation in nineteenth century towns show that although segregated patterns may have been evolving, there continued to be a complex mix of industry and housing for most social classes.[94] When affordable technological solutions became available, this would encourage development of a network of intra-urban transportation to link a wide range of workplaces and residences.

Transport technologies not only meet existing demand. They sometimes create supplies of newly accessible suburban land which meet suppressed demand at lower cost than central land. Brown found after complex linear programme modelling that, of the possible causes of housing decentralisation, 'only transportation innovation unambiguously motivates people to live farther from city centres'.[95] Simpson, studying Glasgow from 1830-1914 found that road building stimulated suburban growth, though he concluded that trams and railways had only been pursuing demand from existing development.[96]

The ability of new people-moving transportation methods to open up suburban sites was variable, and depended very much on the routes served and the fares charged. The development of railways connecting local suburban stations with city centres is difficult to link conclusively with suburban residential development. Sutcliffe comments that the steam railway was unable significantly to ease passenger movements between the suburbs and central areas except in London.[97] Kellett observed that many residents in suburbs also worked there, so the role of the commuter could be exaggerated.[98] In the mid-nineteenth century, rail travellers into the City of London were outnumbered almost 10:1 by those going to work on foot.[99] Fares remained too high to encourage working class commuting throughout most of the century.[100]

The same kind of problem applies to horse omnibuses, which came to operate in many towns and cities after their introduction in London in

[94]e.g Roy Lewis's study of Cardiff (Roy Lewis, 1979, 149-50), Shaw's research in Wolverhampton (Shaw, 1979, 211), and Ward's work on Leeds (Ward, 1980, 158)
[95]Brown, 1985, 41
[96]Simpson, 1971-2, 146-59
[97]Sutcliffe, 1983, 258
[98]Kellett, 1969, 367-9
[99]Ibid., 365
[100]Ibid., 367 and 371-2

1829,[101] but which may have been necessary rather than sufficient for the development of inner suburbs. This is true of horse drawn and steam drawn trams as well. After some unsuccessful experiments in the 1860s[102] horse trams spread rapidly from the 1870s but were hampered in their potential by the failure of private operators to invest in electrification, under the threat of municipalisation after twenty-one years of private operation built into the Tramways Act, 1870.[103] Municipalisation in the 1880s and 1890s generally enabled electrification, with consequent improvements in speed and efficiency and reductions in fares.[104] The electric tram was linked to a new wave of suburban development which lasted into the early years of the twentieth century.[105] Increased personal mobility following the appearance of the mass produced bicycle in the 1890s[106] and (for the wealthier citizen) the first motor cars at around the same time[107] would have had little impact during the study period.

iii. Communicating Information

Mention has already been made of the importance of access to information to enable decision makers to choose an optimum location; to allow companies to communicate with their markets and suppliers; and to control branch plants. The ability to achieve remote communication reduces the need for agglomeration of firms and allows branch plants to be situated much further from the parent factory or head office.

Postal communications were the first to be regularised and put on a national footing. The Penny Post introduced in 1840 became an instant vehicle for mass communication.[108] The need for rapid transmission of information by the railway companies was instrumental in the development of the electric telegraph. By 1849 it was possible to telegraph between 208 towns and cities on the railway network.[109]

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[101]Dyos and Aldcroft, 1969, 234
[102]Ibid., 235
[103]Barker and Savage, 1974, 130
[104]Ibid., 133
[105]Sutcliffe, 1983, 258
[106]Barker and Savage, 1974, 134
[107]Ibid., 135-6
[108]Briggs, 1970, 317-8
[109]Head, 1849, 113-33

The greatest advance was the telephone. The manufacturer was able to speak to suppliers, distributors, customers and subsidiaries instantly without the involvement of a telegrapher. From its introduction in the late 1870s it spread rapidly. In 1881 the 23 largest towns and cities in England and Wales had one or more exchanges. By 1886, 137 towns were served. This rose to 269 by 1892. It was to commerce and manufacturing that the early private telephone companies looked for customers. Businesses were quick to use the new technology. One of the earliest private lines connected Colman's mustard factory in Norwich with their offices in London. In Glasgow there were exchanges for medical, legal, commercial and manufacturing business in the early 1880s. Just as important as local exchanges, the trunk network began to evolve in the mid-1880s. All main towns and cities were connected to it by 1891.[110]

iv. Other Infrastructure Issues

a. Roads and Drains

The quality of roads (and to a lesser extent drainage) is important to manufacturing industry. Firm road surfaces are necessary to carry industrial loads. A reasonable road network is required to allow contact with other manufacturers, suppliers and markets. The nineteenth century saw progressive improvements in the standards of urban infrastructure. Innovations in road building and drainage were probably less pronounced than the increasingly consistent application of good standards of construction throughout the study period. There were two main catalysts.

The first, national and local government intervention seeking higher standards of maintenance of turnpike roads and town streets, resulted in attempts to codify the law and clarify responsibilities such as the General Highways Act, 1835,[111] reinforced by the work of reformers such as Chadwick which led to the Public Health Act, 1848.[112] The process of municipal improvement was patchy and sometimes slow. Much of the responsibility for road maintenance

[110]Robson, 1973, 165-77
[111]Dyos and Aldcroft, 1974, 240
[112]Court, 1967, 260

remained with parish vestries and similar bodies.[113] It took until the 1880s to bring the majority of turnpike roads under local authority control.[114] Some towns and cities were more effective at appointing Improvement Commissioners than others. There was a natural desire to concentrate on older central areas where congestion and the legacy of obsolescent buildings and land uses had the greatest negative impact on a town's image.[115] While improvements to the central road network benefited all commercial activities, they would not necessarily do much to enhance suburban locations from the industrialist's point of view.

The other main actors in street improvements were the large scale owners and developers of land. Prominent among these were the railways, for whom access to terminal facilities was vital[116] and those landed estates which imposed standards on infrastructure through development leases. Not all street improvements which benefited the railways were carried out by the companies themselves[117] but their presence actuated local authorities to cut new streets and improve existing ones to serve their termini. The quality of new street development on landed estates was variable, even between different parts of the same landowner's property. Nevertheless it would have been in the landowner's interest to ensure that new streetworks were of sufficient quality to maintain or enhance the value of the estate and allow adoption by the local authority.

b. Local Taxation

The new infrastructure was costly by previous standards. The cutting of streets by railway companies through older central areas was particularly expensive.[118] The railways had to bear such costs out of revenues, but local authorities and landowners could recover expenditure directly from land users through rates, rents and premiums. The rising cost of urban infrastructure, especially in the latter years of the nineteenth century, is indicated by the fact that between 1870 and 1885 the share of national income taken by urban

[113]Dyos and Aldcroft, 1974, 240
[114]Ibid., 240
[115]Ibid., 241-6
[116]Ibid., 245
[117]Ibid.
[118]Kellett, 1969, 287

rents rose considerably, then remained more or less constant from 1886-96. The cost of occupation continued to rise into the twentieth century. The increment was taken not by landowners but by local authorities.[119] For the location decision maker, two questions were important:

a. Were there differences in local taxation between different potential sites? This would almost certainly have been an imponderable variable because the English rating system depended on the combination of a rateable value with a rate in the pound. The rateable value was determined to a large extent by what the industrialist did with the site in terms of buildings and scale of operation, and rates in the pound were a moveable feast. The problem was compounded because of the proliferation of rating authorities in most Victorian towns, and the variety of different bases for setting the rates. Briggs reports the Town Clerk of Bristol telling the Government he could not advise it of the city's rate in the pound because six different authorities levied rates, each according to its own system.[120] He goes on to point out the difficulty even of making year on year comparisons of rates in any city because the assessments changed so frequently.[121] Although there may have been some local variation it is considered that the difficulty of assessing the effects of future rating on individual factories would have led to rates being accepted as a burden to be borne universally across all new sites. There might, of course, have been more effect on firms taking over premises where the rateable value had been assessed, but since it is assumed that most firms would have had to adapt such properties to their own needs leading to changed assessments, it is probable that other factors were more significant because they were more predictable.

b. Was it necessary to pay a premium to cover the cost of new streets and drainage before undeveloped sites could be acquired? This would increase the initial cost of moving to a new location. It might act as a 'tax' on firms wishing to relocate to green field sites, creating a marginal level of

[119]Offer, 1980, 248
[120]Briggs, 1971, 39-40
[121]Ibid.

capitalisation below which new sites could not be chosen by certain firms.

Table 3.1

Adoption of Steam Engines 1840 - 1907[122]

Year	Horse Power Nationally (Approx.)
1840	350,000
1850	500,000
1860	700,000
1880	2,000,000
1896	2,300,000
1907	9,650,000

[122]Ibid., 57; Pollard and Crossley, 1968, 190

CHAPTER 4

INFLUENCES ON LOCATION DECISIONS (3) - LAND

This chapter considers the extent to which industrialists have a free choice between sites, and how the land market affects location decisions. The following topics are covered:

1. Land prices and competition for land;

2. State intervention in the land market;

3. The supply of land and the role of the landowner;

4. Topographical factors.

1. Land Prices and Competition for Land

Studies of American cities tend to support the proposition that:

> Market forces result in a structure of site values with the highest value occurring at the location with maximum market accessibility or lowest transportation costs. Thus accessibility tends to centralise site values in a directional sense so that value declines with decreased accessibility at a measurable rate.[1]

Accessibility is not the only factor affecting site values. For example bad neighbour uses may devalue what would otherwise be high value locations. Generally, however, the land value surface for any city will be a complex structure, with peaks and troughs representing different levels of accessibility to the various nodal points throughout the city. We may expect a fall off from high values around the central business district (CBD), but values may rise again if there are other important centres outside the CBD.[2] Location decision makers seek to maximise utility for their business at any particular location within a budget constraint set by the overall production function and a process of competition with other bidding land users mediated by a market mechanism.[3] This involves a trade-off between land costs and transport costs,[4] balanced against other

[1]Seyfried, quoted in Lloyd and Dicken, 1977, 104
[2]Ibid.
[3]Rodriguez-Bachiller, 1986, 82-3
[4]Goodall, 1979, 86

spatially critical costs.[5] This balance will determine the rent which an undertaking can bid for a site. Factors such as scale and the marginality of the firm's cost curve will be important elements in the equation. Depending on their degree of marginality, firms needing large sites may be compelled to seek areas where the unit cost of land is comparatively low to enable them to keep total rent levels under control. Firms gaining a high degree of profitability from accessibility to the CBD may be able to bid higher, but have to trade from smaller premises because of higher unit rents.

The author does not assign particular significance to the term rent. Some academics (notably the Marxist) attach considerable mystique to different concepts of rent. This thesis assumes that only one thing is important for decision making - the price a firm has to pay (or, where information is imperfect, believes it will have to pay) for the site it wants. To the industrialist there may be long term disadvantages in paying ground rent for a lease as against paying a premium for a freehold. Similarly, taking a sub-lease or under-lease may be less desirable than a head-lease. However, the ground rent for a head-lease will be just as significant for decision making as the rent for a finished building or the premium for a freehold if it is what the firm will be expected to pay for the right to occupy a site (taking as read the need to allow for building costs in the calculation). In the remainder of this thesis, the term 'purchase' is used to describe acquisition of a freehold interest. To 'rent' or 'lease' is used to describe the taking of a leasehold or lesser interest. 'Acquire' is used neutrally for all transactions. 'Rent' or 'rental' is the payment to a landlord for the use of land or premises. A 'premium' is a single payment or finite number of capital payments for an interest in land.

i. Inertia

City building creates inertia in the form of building stock which inhibits future redevelopment.[6] Capital locked up in buildings and plant represents a fixed cost to the firm and tends to lead to a degree of permanence in the built fabric and large scale plant.[7] As cycles of boom and slump take place, some premises come up for recycling, but many remain in uses better suited to previous modes of production or held vacant speculatively because the costs of re-use or redevelopment are not

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[5]Ibid., 83
[6]Ball, 1985, 519
[7]Harvey, 1985, 19

perceived to be justified. Over time the city expands and inertial forces may reduce the choice of sites or prevent the assembly of large sites from groups of smaller ones. This tends to limit locational choice in future upturns and adds to pressures for suburbanisation. Once a location decision has been made the firm may be limited in its choices in subsequent periods of expansion:

> Inertial forces such as sunk costs in immobile factors bind an activity to a given site. Geographical inertia may, therefore, be an important factor explaining the presence of an industry in a particular ... part of an urban area, although the locations ... are ... not the best ones today. Initial advantage is tremendously important in this context, for businessmen are most willing to expand at existing locations ... [8]

Dynamic models of urban development suggest suburban growth may be accompanied by waves of demolition and re-allocation of land for new uses throughout a town, as the anticipated economic benefits of redevelopment begin to outweigh the hope value of redundant stock. However, the effect of this may be disjointed spatially and temporally.[9] Whitehand considers that changes of use and user will occur more frequently than new building.[10] Factors such as the mutual attraction of similar land uses, and various economic and social forces (including town planning in the modern era), predispose against radical change once the structure of the urban landscape is established.[11] For the location decision maker the problem is to find an area where redevelopment is viable and land assembly feasible. In the modern era this function is often (though not exclusively) fulfilled by the developer[12] or by local or national government. In the nineteenth century, large scale industrial development was almost wholly the province of the industrialist. For big enterprises the inertial effect of existing buildings and ownership patterns must have been a strong factor in favour of developing new sites or taking over existing purpose built premises rather than trying to redevelop areas of traditional buildings.

ii. The Pattern of Land Values in the Nineteenth Century

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[8]Goodall, 1979, 121
[9]Rodriguez-Bachiller, 1986, 94
[10]Ibid., 141
[11]Whitehand, 1992, 3
[12]Barras, 1987, 14

It is difficult to find out what was paid for nineteenth century industrial sites, and how this compared with the price of land for other uses. 'Reliable land value data are hard to obtain ... achieving direct comparability of prices over time and space is difficult'.[13] Whitehand believes that what evidence there is points overwhelmingly to an inverse relationship between land value and distance from the town centre.[14] This is analagous in many ways with the views of Hoyt and the Chicago school. Within Whitehand's model, development is uneven but produces a roughly annular urban landscape, with 'zones of different character ... deeply etched within the city's internal structure'.[15] Kellett found that within the general land value trends already described, there was a steep rise in values in the area between railway termini and the most favoured street intersections of the CBD.[16] However, there were also contrary tendencies - for example the drift of the commercial sector of Manchester's CBD away from the railway termini with associated depreciations in values near main line stations.[17] As Kellett remarks, little more can be said without further work to illuminate the complexities of site use and value in Victorian cities.[18]

2. The Operation of the Industrial Land Market - Free Markets and State Intervention

Consistent sources of data on land values over time are rare. Although records of estate management practices on the landed estates are available in some areas, they are not preserved consistently. The nature of individual land transactions not within the purview of the great estates is even harder to discover. In all cases, the complexities of tenure make it more difficult to determine precisely what was the relationship between landowners and industrial land users. As Offer points out:

> The ubiquity of tenure presents serious problems of measurement. Formal tenures are not all-pervasive and leave gaps where assets are not explicitly owned... Even where tenurial arrangements are explicit they are seldom exclusive or absolute, i.e. vested unconditionally in a single proprietor.[19]

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[13]Whitehand, 1987, 33
[14]Ibid., 34
[15]Whitehand, 1987, 33; Whitehand, 1992, 3
[16]Kellett, 1969, 323
[17]Ibid., 307
[18]Ibid., 323
[19]Offer, 1981, 6

Offer found that industrial and commercial property was a significant part of urban real estate at the end of the period of study, with 30.7% of the aggregate rateable value of leading industrial towns accounted for in 1906 by premises occupied by corporations, joint stock and other companies.[20] Much of this property was not owned by these companies. The Select Committee on Town Holdings (SCTH) found that firms preferred to hold property on an annual basis or on leases of less than 25 years.[21] Past president of the Royal Institution of Chartered Surveyors Edward Ryde explained that this was because businesses which were unsure of their future preferred not to be bound to a property.[22] This contemporary view that companies preferred not to own real property is not borne out by all modern research. Kellett observed that in relation to land taken for railway schemes:

> ...with certain exceptions, the large estates tended to favour residential land uses. On the whole, industry and commerce were less proportionately represented on the great proprietors' land, either as a consequence of estate policy, or because the larger industrial and commercial users themselves preferred to purchase freehold. The objection to using rented premises was not so marked in trade and commerce, but the Books of Reference suggest that most manufacturers preferred to become proprietors of their own sites.[23]

The distinction to be drawn may be one of scale. In Birmingham 'except for ... public houses and ... larger factories, ... owner-occupied property was relatively unusual'.[24] Small companies (the vast majority of manufacturers) lacked capital to buy property and had little imperative to do so to achieve economies of scale. Larger enterprises were in a different position in the property and capital markets. Not only did they need bigger sites (which could in any case be purchased more readily than workshops forming part only of a building), they had the incentive that an estate in land or property could be mortgaged to raise the capital to finance large production units. Industrial land was thus an increasingly important part of the land market and also of the capital market throughout the century. Borrowing accounted for much of the capital sunk into dwellings and business premises and a '...form of mortgage, often a less binding

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[20]Ibid., 108
[21]SCTH, Report, PP1889XV, 10
[22]SCTH, M. of E., PP1886XII, Q.8069
[23]Kellett, 1969, 333-4
[24]Ibid., 125

'equitable mortgage' was the revolving credit provided by banks to manufacturers and traders on the collateral of plant and premises'.[25]

i. The Freedom of the Market and the Tradeability of Land

There has been some debate about the extent to which a market existed in real property in the nineteenth century, and the degree of sophistication of this market. Markets are not of the ideal form envisaged by economic theorists. This is recognised by most writers on urban economics and location theory.[26] Landowner behaviour, lack of information, legislation and taxation, secrecy, and inertia reduce the tendency to perfection.[27]

The tradeability of land is fundamental to the fluidity of the market. This has changed over time, influenced by economic circumstances and government action. Offer, through the history of the role of the legal profession, shows that the property market was growing in sophistication during the latter part of the nineteenth century. It was also growing in size, with a turnover rising from around £230 million in 1894 to £385 million in 1900.[28] Earlier in the century, however, there were perceptions that the market in real property was subject to undue restriction, and radical reformers sought to do away with traditional obstacles to the acquisition of property rights on the landed estates. Appendix 2 describes how the reformers gradually pressurised the landed elite into increasing the availability of tradeable interests in land. This has particular importance for the role of the Duke of Norfolk in the history of Sheffield's steel industry - see Chapters 9 and 10.

ii. Controls Over Development

Apart from laws defining interests in land, three other forms of State intervention in the land market exist:

i. Local taxation has already been discussed above.

ii. Control over the form of development and land uses. As pointed out in Chapter 1, significant State controls over land use did not exist during the study period. There were increasing controls over

[25]Offer, 1981, 141
[26]E.g. Goodall, 1972, 65-6; Lloyd and Dicken, 1977, 6
[27]Ibid.
[28]Offer, 1981, 66

the form of building, however, in response to jerry building and poor environmental quality. Often, statutory controls aimed to improve housing standards - for example the Artisans and Labourers Dwellings Act 1868. Others affected all classes of development and followed the example of the London Building Acts which began in 1846 to bring in basic standards of construction and fire safety. A parallel movement in the Factories Acts sought to regulate working conditions.[29]

iii. Direct engagement of municipalities in public works and (at the end of the century) public housing.[30]

Only the direct involvement of public authorities in developing sites for public uses should have been significant for intra-urban industrial location. Controls on building and working conditions should have been even in their geographical effect across the town. Municipal land uses such as depots for tramways or cleansing could have been competitors for industrial land. In the case of street improvements, creation of parks, public housing, or other municipal uses, the clearance of industrial premises might be required and the quality of an area raised to an extent which would make future industrial development unattractive.

3. The Supply of Land and the Role of the Landowner

Neo-classical urban theories and modelling of land uses tend to concentrate on the demand for land rather than its supply.[31] In general, they assume homogeneity of land supply as part of the simplification necessary to produce workable models which can identify the underlying principles of demand which guide land uses.[32] Goodall summarises the main supply assumptions made by urban economists' models of the real property market as follows:

> There are a given number of buyers and sellers, with perfect knowledge of market conditions; Real property units are homogeneous and ... the number of sales is sufficient to establish a continuous market through time ... Any person will engage in a transaction that yields him gain ... All real property interests are unencumbered freeholds.[33]

[29]Court, 1967, 126-8; 262-3
[30]Ibid., 263; Briggs, 1971, passim
[31]Wiltshaw, 1985, 49
[32]Rodriguez-Bachiller, 1986
[33]Goodall, 1972, 53

Where land is included as a factor input in industrial location theory, it also tends to be implicit that it is freely available at its bid rent.[34]

Nevertheless, speculation may lead landowners to withhold land from the market during periods when it could be brought into beneficial use. Reasons include the desire in a falling market to wait to recoup the cost of land purchased in a boom, imperfect knowledge of prices available and expectation that property values may rise at a later date.[35]

One of the main difficulties in reflecting landlord behaviour in economic models is that the majority of models tend to be static.[36] This means decisions to hold on to land over time are not easy to handle. A small group of models have attempted to introduce temporal dynamics.[37] These tend to explain discontinuities in the city's structure by assuming that landowners have differing expectations of the future value of their land, and so permit changes of use at different rates.[38] Wilson recognises the difficulty of combining these types of behavioural problem (especially the impact of many different landowner decisions) with conventional modelling techniques and suggests that:

> The best we can often hope to do is take insights from the general theory, generate a detailed historical account of development in a particular place within the framework and outline some of the likely possibilities for future development.[39]

We have already noted Whitehand's espousal of the need for empirical historical understanding of urban morphology. He applies this especially to the role of property owners, developers and designers.[40] We now turn to some examples of empirical research to gain a deeper understanding of landlord behaviour and in particular the extent to which landowners are subject to the influences of the market.

Evans suggests that landlords are likely to be profit maximisers and behave in an economically rational manner. Wiltshaw commenting on this assumption found it difficult to believe that:

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[34]Birkin and Wilson, 1986, 176; Lloyd and Dicken, 1977, 200 et seq.
[35]Goodall, 1972, 64-5 & 220
[36]Rodriguez-Bachiller, 1986, 83
[37]Ibid., 92
[38]Ibid., 94-97 & 100
[39]Wilson, 1985, 14
[40]Whitehand, 1993, vii

> ... even non-occupying landlords ... are simple land traders. I suspect that even at some relative financial loss, there might be many who prefer to exercise their landlord function with respect to a rural as against an urban estate ... In short a hypothetical case can be made out that they are utility maximisers.[41]

Landlords' subjective preferences may thus be added to the list of reasons why they might choose not to put land to the market.[42]

Kellett concluded from thoroughgoing research into the development of urban railway systems that:

> ... the underlying pattern formed by units of land ownership is one of the critical factors in explaining the routes cut through Victorian cities by the railway builders and the choice of site for the termini and yards. One might legitimately go further to say that the ground plan formed by property titles can serve as the key to explaining the whole course of development of certain types of urban area, and the emergence of characteristic residential and industrial zones in each city. For example the establishment of successful, high-class residential areas like Belgravia in London, Kelvinside in Glasgow or Edgbaston in Birmingham depended upon the ownership of very large units and the pursuance of a policy of lease or sale under restrictive covenants forbidding the introduction of non-residential land uses or unduly crowded house building. In other areas like Saltley in East Birmingham, Somers Town and Camden Town in North London, or Tradeston in South Glasgow the landowners might hold equally large units, but for reasons best known to themselves, they were prepared to break up their estates and allow mixed industrial and residential uses ... in many ways landowners were the most important single agents of change; ... the landowners profited at all stages of railway building and probably exercised the greatest single influence upon the selection of central sites, upon the location and character of suburbs ... [43]

Kellett expands on the particular benefits for the railway companies of being able to negotiate with owners who held land in large units[44] - a topic returned to later in this thesis. In the special case of the railways, where problems of land ownership could be resolved by compulsory purchase, the attitude of landowners was important mainly where they were rich and powerful enough to take on the railways. In such cases there is evidence

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[41]Wiltshaw, 1985, 52
[42]Ibid., 55-6
[43]Kellett, 1969, 125 & 421
[44]Ibid., 125

that owners sometimes used their power to secure substantial compensation payments.[45] On the other hand the railway companies' ability to deal as landlords with their surplus land was influenced by market considerations as well as legislative controls.[46]

Rowley, looking at the influence of the Fitzwilliam estate in nineteenth century Sheffield,[47] and Ward studying Leeds[48] concluded that theoreticians had underestimated the role of the landlord in modifying the operation of the land market, and that patterns of ownership could and did affect patterns of urbanisation. Gottlieb, examining long swings in urban development cycles comments that although the value of urban land is:

> ... an emergent from a competitive price process involving an interplay of utility and cost forces reaching equilibrium through adjustment of marginal values, it is also affected by a special force which involves the withholding of urban land from the market for the sake of capital gains.[49]

Landowners consider not only the capitalisation of current use value but also the potential for longer term growth. While it is difficult to calculate the exact role of this speculative component in landowner behaviour, Gottlieb's assessment is that 'in terms of market behaviour the volume of resources invested during most of the nineteenth century in vacant land held for purposes of speculative gain probably exceeded idle cash balances witheld by fear of capital loss'.[50]

There are convincing examples of land being witheld from the market. Kellett found landlords speculating to obtain improved ground rents[51] and resisting development from other subjective motives.[52] Many large firms and charitable bodies followed the lead of the major landowners, waiting for the right time to sell land and increasing the effect of the latter class of owners on market behaviour.[53] The Scottish system of landownership was an influential factor in the development of high status housing in Edinburgh, with owners able to select the moment of release of land to

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[45]Spring, 1971, 23; Kellett, 1969, 64, 414 etc.
[46]Kellett, 1969, 393
[47]Rowley, 1974-7, 200-10
[48]Ward, 1962, 150-66
[49]Gottlieb, 1976, 140
[50]Ibid.
[51]Ibid., 413-4
[52]Ibid., 416-7
[53]Ibid.

maximise income and control the nature of development through the terms of the feu charter.[54]

Although landlords were influential in the land markets they were not immune from more general economic influences. The evidence suggests that their power was strictly limited by the action of the market. Even the largest landowners were unable to insulate themselves totally from movements in the economy. During the last quarter of the nineteenth century, for example, declining land values and agricultural rents affected many estates.[55] Estates which relied on exploitation of primary resources such as coal could also suffer in depressions.[56]

Offer found that 'the supply of land was not fixed ... but ... elastic in response to ... demand for farms and building sites and ... the development of transport technology'.[57] Daunton points out that while larger landowners such as Calthorpe in Edgbaston might have been able to control the quality and pace of development, they could not insist on the provision of large detached villas where the only demand was for workers' cottages.[58] Whitehand, responding to Daunton's otherwise critical article remarked that:

> ... although the development strategies of large landowners may on average have been longer term, there is no basis for assuming either that large landowners were generally any less concerned with deriving the maximum return from their land than small landowners or that the imperfections of the land market were associated with developments inconsistent with [Whitehand's] theory. Even in exceptional cases where a condition resembling a land monopoly may have existed, variations in land values and intensities of use over space and time would have occurred, although the general level of land values and hence land use intensities may well have been higher. Accessibility costs per unit of land would have remained a crucial factor, although it may be more meaningful to envisage uses having been 'allocated' to, rather than competing for sites on this basis.[59]

Whitehand goes on to say that on the Calthorpe estate accessible sites close to the built-up area and on main roads were on average developed more intensively than less accessible sites,[60] although he has suggested

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[54]Gordon, 1979, 184
[55]Thompson, 1977, 24
[56]Spring, 1971, 35 & 49
[57]Offer, 1981, 105
[58]Daunton, 1978, 179
[59]Whitehand, 1978,188
[60]Ibid.

more recently that the concentration of decision making about the formation of urban areas in the hands of a few individuals or bodies can yield greater uniformity than a completely free market.[61] Olsen explains that the largely working class and industrial character of the Norfolk Estate in Sheffield and the Chalcots Estate in Hampstead arose because the landlords co-operated with social and economic realities rather than opposing them[62] and suggests that more complex interests than ground ownership alone were at work shaping Victorian cities.[63]

Studying the impact of large aristocratic landholdings on urban development, Cannadine found that factors other than landownership such as topography played a key role in determining the form of development.[64] Cannadine provides the best explanation for the paradox that landowners appear to have some degree of monopoly power and yet are subject to market forces. He suggests that landowners could only modify a particular market situation[65]:

> Accordingly, while at the level of the particular the impact of these great aristocratic families on urban evolution may have been large, at a more general level it should not be overstated. All the evidence ... suggests that London and the great provincial cities would have developed essentially as they did whether they boasted aristocratic owners or not because identical patterns of urban zoning can be seen to exist when there are diametrically opposite structures of landownership.[66]

Smaller and less powerful landowners must have been even more susceptible to the market, with no wider estate interest or family tradition to protect and less ability to sustain the short run opportunity cost of withholding land from the market:

> In the short run, institutional factors such as estate holdings and trustee owners affect the marketability of tracts of land. The landowner may thus either facilitate or hinder the process of land conversion depending on his decision to hold or sell land ... Some present owners may have ample capital for which they seek investment outlets, others can have a pressing need for capital they can raise by the sale of their land. Some owners

[61]Whitehand, 1993, 5
[62]Olsen, 1973, 352-3
[63]Olsen, 1976, 13-4
[64]Cannadine, 1980, 405
[65]Ibid., 393
[66]Ibid., 416

> may be optimistic about future increases in the value of their land, others are more cautious.[67]

So, although market forces have an important influence on bringing forward sites for industrial building there are behavioural factors which modify the action of the market. For this reason, it is important to examine the attitude of landowners to industrial land uses, albeit that evidence about the pattern of landownership and the attitude of landowners is often scarce.[68] In Chapters 9, 10 and 11 the evidence from Sheffield is reviewed.

4. <u>Topography</u>

Although the isotropic plain of location theory[69] is a useful simplification to clarify basic locational forces, important variations in the effect of these forces can be expected to result from variations in physical geography.[70] These variations may be categorised thus:

i. <u>Spatial Variations in Resource Quality and Availability</u>

While variations in resource availability and quality are bound to be less important at the intra-urban level than at the regional, national or international level,[71] there may be factors which make particular parts of a city more attractive to industry. An example might be the ability of a large coal consumer to locate near a coalmine.

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[67]Goodall, 1972, 6
[68]Spring, 1977, 2
[69]Lloyd and Dicken, 1977, 21
[70]Ibid., 118
[71]Ibid.

ii. Availability of Phsically Suitable Development Land

The influence of relief on housing site choice in the nineteenth century is widely recognised.[72] Similarly, landform is critical to finding suitable manufacturing sites, though different physical attributes may be important to industrialists. For industries relying on a geographically limiting power source such as the waterwheel, this might mean a site adjacent to a good water supply. For large scale plant using a more mobile power source the key factor might be sufficient areas of level land to enable the plant to be laid down and operated efficiently.

iii. Relative Levels of Transport Systems and Industrial Sites

Related to the previous factor is the need to ensure that transport systems are accessible within technically acceptable gradients between the track and production plant, especially for firms needing direct access from the railway or canal. Where such systems have to be built on viaduct, embankment or in deep cutting or tunnel, opportunities for direct connections may be limited.

iv. Ground Conditions

The need to have sites where ground conditions are acceptable was touched on in the last chapter. Sites in flood plains may be problematical because of regular flooding.[73] Marshy ground may require extensive drainage and land reclamation before it can be developed.

[72]Shaw, 1979, 194
[73]E.g. ibid., 1979, 194

CHAPTER 5

SHEFFIELD - TOPOGRAPHY, TRANSPORT, URBAN GROWTH AND INDUSTRIAL DEVELOPMENT IN THE NINETEENTH CENTURY

In this Chapter the local context for the study is described under the following headings:

1. Topography, Drainage and Natural Resources.

2. Communications.

3. Industrial Development.

4. Urban Growth.

1. Topography, Drainage and Natural Resources

The topography of Sheffield is described in detail in Linton (ed.), 1956. The city stands on the River Don at its confluence with several minor rivers. During the study period it grew to be one of the principal settlements of the West Riding of Yorkshire, though it is often claimed also as a northern outpost of the East Midlands. It lies on the eastern slopes of the Pennine hills. The rivers which meet in the city have carved steep sided valleys out of the prevailing millstone grit and other sandstones. These five rivers - the Don, Sheaf, Porter, Loxley and Rivelin, together with the Blackburn Brook, have created a landform and hydrology which has been of critical importance to the physical and economic development of Sheffield (see Figure 5.1).

The Don runs south eastwards through Wadsley Bridge and Neepsend in a valley which is relatively flat bottomed for this locality. Steeper slopes close in on the river near the town centre, where it turns round the prominence of Spital Hill and flows north eastwards through a broader, low lying vale. Here, the land to the north rises rapidly to the heights of Pitsmoor and Wincobank, a climb of over 300 ft. (91.4m) in about 700 yds. (640m) at the steepest point. The valley itself is about 1,640 yards wide (1,500m) at its broadest and falls from a height of some 160 ft. (49m) at Lady's Bridge to 89 ft. (27m) at Tinsley, 3 miles (5km) to the north east. The longest standing bridging point at Lady's Bridge is generally taken as the dividing line between the Upper Don Valley to the north west and Lower Don Valley to the north east.

A radial pattern of ridges and valleys underlies the rest of the city. A broader and slightly more gentle ridge than Pitsmoor/Wincobank lies to the south of the Lower Don and east of the River Sheaf. This is Park Hill, named after the parkland surrounding the Duke of Norfolk's Sheffield residences. The Sheaf flows north eastwards to meet the Don a little below Lady's Bridge. Although the land rises quite steeply on either side, the Sheaf Valley's floor has some relatively level and low lying areas such as the Ponds and Highfield/Lowfield. The complex contours of another ridge, Nether Edge, separate the Sheaf from the steeply sloping Porter Valley, which grows more level as it converges with the Sheaf. This river flows into the Sheaf just south of the town centre.

To the north of the Porter is yet another broad ridge rising to over 800 ft. (243.8m) in the Crookes district and falling steeply towards the Upper Don Valley and the River Rivelin. The Rivelin joins the Loxley before it meets the Don. Both rivers have narrow, steep sided valleys. The sixth watercourse mentioned above lies some distance to the north east of the others. The Blackburn Brook runs along the eastern flank of Wincobank and joins the Don at Tinsley. Its valley is narrow but just north of the Don it proved level enough to provide a communications corridor and building land.

- Natural Resources

The fast flowing rivers which form the Don's tributaries, and the slower Don itself, provided an excellent source of power for early industry. Records of water mills in the Sheffield area occur from about the thirteenth century,[1] around the same time as the first references to smithies of more than local importance.[2] Over the ensuing centuries the local rivers were dammed and diverted to provide power for numerous water wheels, many of which were used to drive tilt and forge hammers or grinding wheels. There is evidence for the existence of over 140 mills, grinding wheels, tilts and forges on Sheffield's rivers. Many operated over several centuries.[3]

In the pre-industrial era Sheffield was well provided with locally available iron ore, and wood for charcoal burning - essential for early iron smelting.[4] As the utility of pit coal came to be appreciated in the late eighteenth century, advantage could be taken of Sheffield's location on the South Yorkshire coalfield. Clays for brick making and crucible manufacturing, ganister and other refractory

[1]Roy Davey, 10
[2]Ibid.
[3]Ibid.
[4]Barraclough, 1976, 8

materials and millstone grit of textures suitable for grinding wheels were abundant.[5] As the importance of local iron ore began to decline from the 1750s, the availability of these other natural resources helped sustain Sheffield's importance as a metalworking centre.[6]

2. Communications

Sheffield's transport system was late in acquiring some innovations compared with other industrial towns. This arose in part from difficult topography, partly from the small scale of the town's industrial base in the late eighteenth and early nineteenth centuries, and partly because of the desire of the most powerful landowners in Sheffield, the Dukes of Norfolk, to protect their near monopoly of coal supply. Here we examine the four aspects of goods transport which were significant in the nineteenth century:

i. Inter-Urban Roads;
ii. The Sheffield Canal;
iii. The Railways;
iv. The Town Streets.

i. Inter-Urban Roads

Unlike Manchester, Birmingham and Leeds, Sheffield did not have direct access to navigable waterways at the start of the study period. All raw materials had to arrive in Sheffield and finished products leave for their markets by road, even if they were later transhipped onto navigations. Traditionally, Sheffield's wares had been exported in pack horse trains to Bawtry on the River Idle for shipping via the Trent and Humber to London and the east coast ports[7]. By 1821, however, the town was served by ten turnpike roads giving access ultimately to west and east coasts, the Midlands and West Yorkshire:

Destination	Date of Turnpike Act[8]
Chesterfield, Duffield and Derby	1756
Wakefield	1758
Chapel-en-le-Frith and Buxton	1758
Tinsley	1759
Worksop	1764

[5]Ibid., 8-9
[6]Ibid.
[7]Barraclough, 1976, 12
[8]Walton, 1948, 129

Penistone 1777	
Gander Lane near Eckington	1779
Baslow	1803
Langsett	1805
Glossop	1821

Their routes in Sheffield are shown in Figure 5.2.

Not all these trusts were adequately supplied with capital - for example the Gander Lane trustees found it difficult to raise funds for projected improvements in 1788.[9] Although this route was used by coal traffic from Mosboro',[10] turnpikes could be expensive for long hauls. The journey from Sheffield to Manchester involved Pickfords in tolls of £21-12-0 per week per waggon for the daily return journey in 1835.[11]

Some idea of the volume of traffic in waggons is given by a report on the roads between Sheffield and Manchester prepared to support the SAMR's Bill in Parliament.[12] Based on traffic counts in November 1836 and February 1837 at points on the three routes, the following numbers of carts were observed:

	Waggons/Carts	Tons Weekly	Tons p.a.
Castleton	53	149.16.0	7,789.12.0
Oughtibridge	36	129.10.0	6,734. 0.0
Stoney Middleton	33	97. 6.0	5,059.12.0
Total	122	376.12.0	19,583. 4.0

One assumes this was a count of traffic in both directions. In the 1790s the road from Tinsley to Sheffield was carrying some 13,000 tons of goods per annum transhipped at the wharf for forwarding to the town.[13]

What a horse could carry or a team of horses could pull imposed limitations on the size of loads. An average Pickfords pack horse would bear about 700 lbs.[14] The type of four horse waggon which the company used on the Sheffield - Manchester service could probably have carried up

[9]Copeland, 1968, 25
[10]Ibid., 44
[11]Ibid., 67
[12]PRO/RAIL 1075/69
[13]Barraclough, 1976, 12
[14]Copeland, 1968, 66

to seven tons.[15] Larger waggons were available. Eight, ten and twelve ton waggons and drays were used commonly by railway companies for local distribution from goods depots.[16] However, evidence from the late 1830s suggests that long distance waggons were not always working at full capacity. An average of between three and five tons was the normal load on routes out of London during this decade.[17] On the roads between Ashton and Manchester, the SAMR's observers found average loadings for cotton and wool as follows:[18]

In 90 x one	horse	carts	1.5 tons average
" 53 x two	"	"	2.5 tons average
" 31 x three	"	"	3 tons average
" 3 x three	"	waggons	4 tons average
" 2 x five	"	"	5 tons average
Glossop to Manchester			
" 4 x six	"	"	6 tons average

These restrictions on capacity and the slow speed of road traffic meant that by the time Sheffield's major industrial expansion began in the 1850s, railway competition had turned the toll roads from an asset into a nuisance, charging residents of the growing suburbs for the privilege of travelling into the town centre. The Town Council nevertheless took some years to secure their removal, beginning in 1875 with the Chesterfield and Langsett Roads. By 1884 all the turnpike roads had become public highways.[19] During their existence, the turnpikes (following natural valley routes) established the main road corridors into central Sheffield. These did not alter significantly in later years.

ii. <u>The Sheffield Canal</u>

The Sheffield Canal was not opened until 1819, 50 years after the metalworking centre of Birmingham opened its first navigation.[20] Water transport was available on the Don (or Dun) Navigation at Rotherham by 1740.[21] In 1751 the navigation was brought to Tinsley. A proper road from Sheffield to Tinsley was not made until 1755. It was another four years before this was turnpiked.[22] The tardiness in building a road

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[15]Arnold, 1979, 107
[16]Ibid., 111-22
[17]Copeland, 1968, 73
[18]PRO/RAIL 1075/69, Appendix F
[19]Walton, 1948, 207-8
[20]Hadfield, 1972, 211; Broadridge, 1974, 19
[21]Hadfield, 1972, 73
[22]Ibid.

suggests the traditional system of factoring, merchanting and packhorse transportation was under no immediate pressure for change.

The navigation was subject to water supply problems. Navigable depths could not always be guaranteed as far as Tinsley.[23] Nevertheless, trade at Tinsley had increased considerably by 1787.[24] In 1792 a public meeting in the Cutlers Hall favoured extending the navigation from Tinsley to Sheffield. Objections from the Chesterfield Canal Company, the financial demands of the Duke of Norfolk (a major landowner on the route) and difficult economic conditions killed the project.[25] It was revived in 1801 by the Cutlers Company but the Duke of Norfolk was anxious about the effect of competition from imported coal on his central Sheffield collieries. He opposed the Bill and it made no headway.

Various schemes were mooted over the next ten years. In 1813 the Cutlers Company was again the prime mover in promoting a canal. This time the project met with success. A route was chosen and an Act passed in June 1815. Work began in 1816 and the 3.875 mile canal was opened in February 1819. It included 12 locks and a branch to the Duke of Norfolk's tramroad serving Handsworth colliery. A number of other colliery tramroads were soon connected to the canal.[26] Most vessels using the canal were Humber keels or sloops, forms of sailing barge common throughout the Yorkshire broad canals and river navigations. Documentary and photographic evidence shows that these vessels worked up to Sheffield under sail until the end of the study period.

On its opening the canal effected a considerable reduction in transport costs. The packhorse rate to Doncaster had been 27/7d per ton mile and the rate by cart was 13/8d. The canal in 1831 charged 2d per ton mile for coal, 3d for pig iron and 4d for bar iron.[27] In 1834, some 216,356 tons of goods were carried, including 159,000 tons of coal and 10,152 tons of bar iron, compared with about 3,000 tons of iron per annum by road in the 1790s.[28] The maximum craft size up to 1834 was 64 tons, though improvements to the Don navigation allowed this to rise to 70 soon

[23]Ibid., 77-80
[24]Ibid., 80
[25]Ibid., 266-7
[26]Ibid., 269-72
[27]Priestley, 1831 repr.1969
[28]Hadfield, 1973, 275; Barraclough, 1976, 12

afterwards. Navigation of the canal took 3-4 hours for fly-boats and 5-6 hours for sloops.[29]

The canal traded profitably until after the opening of the Sheffield and Rotherham Railway, when takings at Sheffield fell from £6,428 in 1840/41 to £3,776 by 1843/44. In 1845 there were, nevertheless, two direct services without transhipment to London and fly-boats to Thorne for onward staging to Hull, Goole and London. The Humber Union Steam Company ran thrice weekly fly-boats to Hull.[30] The canal company was eventually taken over by the MSLR in 1848, after promises not to interfere with navigation had been given to the town council.[31]

Figure 5.3 shows the network of broad navigations open to vessels from Sheffield. Although gauge differences prevented direct passage from Sheffield onto the narrow waterways, Sheffield manufacturers used the canal system (with transhipment) to reach places such as Birmingham (see Chapter 7). It is difficult to piece together a complete picture of trading patterns. A unique collection of waybills and instructions to the masters of keels trading to and from R.C. Clarke's Silkstone collieries on the Barnsley Canal near Sheffield[32] shows there was a wide distribution of trips across the Yorkshire waterway system between 1833 and 1846. The trip ends are shown on Figure 5.4. The frequency of trips has not been estimated since the records are fragmentary and not capable of more systematic analysis. It is noticeable, however, that under the pressure of railway competition the number of destinations declined until the only significant trip end in 1846 was Louth in Lincolnshire.[33]

The South Yorkshire navigations were able to hold their own throughout the nineteenth century thanks to the MSLR's willingness to go on operating them, and their capacity to move commodities such as coal in bulk. The Sheffield Canal was uniquely suited for bringing Swedish and German bar iron from Hull. Sheffield's requirement for high quality iron to produce special steels remained a factor throughout the century. Photographs dating from 1887 show the canal basin packed with vessels and bar iron.[34] A number of companies had their own iron wharves and warehouses on

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[29]Ibid.
[30]Hadfield, 1972, 278
[31]Ibid.
[32]Destinations of coal from R.C. Clarke's Silkstone Collieries by canal, from randomly surviving Bills of Lading and boatmens' orders 1833-46 - SC CR 135-40, 142-4, 149-51
[33]Ibid.
[34]Binfield et al (eds.), 1993, Vol.III, 18

the canal - see Chapter 6. Barraclough includes photographs of Firth's and Jessop's canal warehouses in 1900.[35] The nature of this trade caused problems for the canal's owners. By 1892, 90% of traffic was long distance towards Sheffield. Most craft ran back empty.[36] Dissatisfaction with railway and canal tolls led to the promotion of a ship canal project in 1888 to connect Sheffield, Rotherham and Doncaster to the sea. Although this led to the setting up of the Sheffield and South Yorkshire Navigation Company which bought out the MSLR in 1895, and to expansion of the navigations downriver, the improvements did not reach Sheffield. The ship canal was never built and the keel remained the standard trading boat.[37]

In 1896 traffic on the Navigation reached 1,039,425 tons. This was an increase of 121,876 tons over the average annual traffic for the five years 1888-92. Takings rose by £5,689 and profits were £8,201. The confidence of the new management was sufficient to lead to expenditure of £7,453 on construction of a new grain warehouse in Sheffield Basin, followed in 1901 by a four storey warehouse straddling the basin and a new wharf in Effingham Road. New offices, an ice shed and weighing machines were built in 1902 and 1903, a timber warehouse in 1905 and open sheds in 1911. This flurry of investment at the end of the nineteenth century shows that the canal, after a difficult period in the mid-century, held its own as a transport system able to fill a special niche in the needs of the industrial community.[38]

Physically, the canal rose on a flight of locks at Tinsley and then ran level along the Lower Don Valley south of the river to a basin at the foot of Park Hill by Exchange Street, near the Sheffield Colliery and the town markets. Although the valley was relatively level, the canal had to be built in part on embankments and partly in a deep cutting through Attercliffe.[39] This meant that not all canalside land was suitable for development, and opportunities for the provision of wharves were limited.

iii. <u>The Railways</u>

[35] Barraclough, 1976, 30-3
[36] Hadfield, 1972, 415
[37] Ibid., 415 et seq.
[38] PRO/RAIL 1112/58 and 59; 1110/512 and 206
[39] Hadfield, 1972, 269

Except where stated, factual information on the development of Sheffield's railways is derived from Stephen Batty's very detailed book[40] and A Railway Chronology of the Sheffield Area.[41]

One of the main disadvantages of the waterway system was its eastward facing aspect. To serve the growing American market it was necessary to export westwards through Liverpool. Liverpool was almost a fortnight away by the broad canal system via Swinton, Barnsley, Wakefield and the Rochdale and Bridgewater canals.[42]

As the Case in Support of the abortive Sheffield and Manchester Railway Bill in 1830-1 expressed it:

> A large proportion of the Manufacture of Sheffield is consumed in Lancashire or exported from Liverpool: and there is no other way of transporting this Merchandise than by horse and cart over the mountains of Derbyshire, which is very expensive, or by the circuitous route of ninety miles in length through the Yorkshire Canals which is scarcely less expensive; and both lines of conveyance occasion an extraordinary sacrifice of time.[43]

The same document included the forecast time and cost savings which provided the incentive to support the introduction of rail transport:

[40]Batty, 1984
[41]Proctor, 1975
[42]Abell, 1977, 51
[43]PRO/RAIL 410/909, 73

Table of the saving in Time and Expense that will be effected by this railway.

From	To	By Canal	By Horse and Cart	By Railway
Sheffield	Manchester	8 days	2 days	4 hours
Sheffield	Stockport	9 days	2 days	4 hours
Sheffield	Liverpool	11 days	3 days	6 hours
Manchester	Hull*	8 days	-	3 days
Stockport	Hull*	9 days	-	3 days
* By canal from Sheffield				
In expense per ton				
Sheffield	Manchester	28/-	34/-	20/-
Sheffield	Stockport	32/-	30/-	18/-
Sheffield	Liverpool	44/-	44/-	30/-
Manchester	Hull	40/-	-	35/-
Stockport	Hull	40/-	-	35/-

An early priority for railway connection was thus a route across the Pennines to Manchester and Liverpool. However, doubts about the ability of steam locomotives to cope with the gradients involved meant it was an eastward facing route which opened first - the Sheffield and Rotherham Railway (S&R). The main railway developments in Sheffield are dealt with chronologically below. A chronological plan and plan of goods facilities are at Figures 5.5 and 5.6. Passenger stations are shown in Figure 5.7.

a. <u>Sheffield and Rotherham Railway (later Midland Railway) 1838</u>

Sheffield did not lag so far behind the rest of Britain in railway development as it did in canals. Sheffield's railway system grew contemporaneously with that of West and South Yorkshire and the North Midlands, and with towns such as Cardiff,[44] Bristol and even London.[45] The S&R was promoted as a branch railway to connect with the North Midland Railway (NMR) at Rotherham, after the NMR's engineer George Stephenson refused to allow the main line to pass on a direct line through Sheffield to Chesterfield because he believed the gradients would be too severe. The compromise was an independent railway beginning at the Wicker and running north of the Don as far as the NMR at Rotherham Masboro'. The S&R received Parliamentary approval in July 1836. Work began in January 1837 and the line was opened by Earl Fitzwilliam in October 1838.

[44]Roy Lewis, 1979, 132
[45]Dyos and Aldcroft, 1969, 126

Physically the route was undemanding. There were some embankments (up to 18 feet high in places) and a 41 foot deep cutting. Nevertheless, allowing for the land fill which had to precede the construction of most large works in the Lower Don Valley there were few barriers to direct connection to the railway in Sheffield. Five locomotives were provided initially. Passenger and goods stations were built at the Wicker. At first the railway was isolated, for the NMR from Derby did not open until May 1840 and its connection to Leeds was not finished until July.

In spite of the S&R's isolation, it was able quickly to steal traffic from the canal by means of a railway branch from Holmes to the Greasbrough Canal, a short branch canal originally built from the Don Navigation to connect with Earl Fitzwilliam's colliery tramways. Transhipment from the shortened branch canal's new terminus at Parkgate enabled the railway not only to take the Earl's coal traffic but also to intercept goods which came up the Don for Sheffield. The railway branch opened in August 1839 for coal traffic, and the canal wharf in the following February.[46]

The S&R began to accept through running NMR trains from April 1840. After the opening of the NMR to Derby, direct services to London became feasible, though the first passenger train to undertake the trip took two days to reach the Capital. Services to Hull also became possible with the opening of the Hull and Selby, and York and North Midland Railways in 1840.

The S&R was profitable only for a few years before the depression in trade of 1841-2 brought revenues down below operating costs. With the recovery of 1843 and renewed railway speculation, the company sought refuge in amalgamation. Negotiations concluded with the absorption of the line into the Midland Railway in July 1845. Thereafter, some improvements were made. The Wicker Station site was extended in 1853[47] and again in 1860.[48] In the same year land was leased to build 13 acres of sidings and engine sheds in New Hall Road.[49]

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[46]Hadfield, 1973, 275
[47]ACM/LB/C/105
[48]ACM/S612
[49]ACM/LB/E/664-7

b. <u>The Sheffield, Ashton-under-Lyne and Manchester Railway (later Manchester, Sheffield and Lincolnshire Railway and then Great Central Railway), 1845-1900</u>

The outcome of much local debate and several abortive schemes to connect to Manchester in the late 1820s and early 1830s was the decision to promote and build the Sheffield, Ashton-under-Lyne and Manchester Railway (SAMR). The railway was to run from a terminus at Bridgehouses west of Spital Hill, up the Upper Don Valley via Oughtibridge and Penistone and thence through twin tunnels under the Pennines to Manchester.

The engineering of this line was altogether more ambitious than the S&R. The tunnels at Woodhead were the third longest mainline railway tunnels constructed in Britain at 3 miles 950 yards.[50] There were huge earthworks.[51] From half a mile west of central Sheffield there was a continuous ascent to Woodhead of 18.75 miles on gradients between 1:100 and 1:135.[52] Throughout the study period, assistance from banking engines was essential for the heavy freight trains which used this route.

The SAMR's Act passed in May 1837. Lord Wharncliffe cut the first sod in October 1838. The line opened between Sheffield and Dunford (just east of the Woodhead tunnels) in July 1845. The tunnels were not opened until December. Manchester services ran from Bridgehouses Station, which dealt with freight as well as passengers.

From 1836 a number of schemes were proposed to extend the SAMR. The options considered included a direct line to Chesterfield and a connection to the NMR at Beighton south east of Sheffield. Thanks in large measure to the support of the Duke of Norfolk, concerned as usual to protect his coal interests from competition, the winning proposition was the Sheffield and Lincolnshire Junction Railway (SLJR). This line was intended to open up the markets of Lincolnshire to Sheffield coal and steel and Pennine limestone, and connect to the port of Gainsborough. The SLJR Bill was passed in August 1846 and work began in October. On 1st January 1847 the SAMR and SLJR

[50]Nock, 1970, 69
[51]E.g.100,000 cu. yds. were moved at Wortley and 30,000 cu. yds. at Wharncliffe Wood
[52]Ibid., 66

merged with the Great Grimsby and Sheffield Junction Railway to form the Manchester, Sheffield and Lincolnshire Railway (MSLR), creating a continuous line across country from Manchester to Grimsby. Alternative routes to London were provided by junctions with the NMR at Beighton and connections to the Great Northern further east.

As part of this eastern extension it was decided to construct a new passenger station east of the Wicker, spanning the Don. The eastern route opened to Beighton in February 1849. Sheffield Victoria Station did not open until September 1851. The passenger station at Bridgehouses was then refitted as a goods depot. Considerable engineering works were needed to bring the new line through Sheffield. The original SAMR emerged from cuttings through Old Park Wood to rise onto a viaduct as Bridgehouses Station was reached. A new 700 yard viaduct for the SLJR was built across the Wicker, the Don and the canal. Victoria Station itself was positioned on the viaduct, 40 feet above the river. It stood on a podium reached by ramps from street level, and stairs from the Wicker. East of Victoria the railway continued on viaduct as far as Sheffield Colliery by the canal. It remained on embankment at least as far as Bacon Lane.[53] The 1855 O.S. map shows a short branch or sidings to Sheffield Colliery by Blast Lane but otherwise the railway offered little scope for direct sidings connections because of its elevation above the town. Bridgehouses Goods Station made use of the substantial arches which supported it for storage. Large engineering structures or landfill were to be a feature of all new goods stations on the MSLR in Sheffield.

By 1855 the MSLR needed additional goods handling capacity and a quarter mile branch was built to a site just north of the canal basin. A goods depot was not built at the end of the branch until 1865. The Park Goods Station was a massive structure built on stone arches with the ability to transfer goods from wagons at viaduct level to carts below, or into store under the arches. The other substantial goods facility on the MSLR was Bernard Road Sidings which lay between Lumley Street and the MSLR main line north of the Park. Acquisition of land from the Norfolk Estate to allow widening of the MSLR lines and construction of the sidings began in 1865.[54] Although they do

[53] O.S. 6":1 Mile Map, 1850, Sheet 294
[54] ACM/LB/H/347-9

not appear on White's plan of Sheffield for 1873 they had grown to cover an extensive area by 1905.[55] The 1905 O.S. map shows that the sidings had been built on embankments involving substantial earthworks.[56]

In 1868 the MSLR opened a line to Rotherham, duplicating the Midland route. Increases in MSLR track capacity took place in 1875 in response to complaints that the railway was offering a poor service. New lines were opened southwards to avoid the connection to the Midland at Beighton in 1889. This formed the first stage of the company's extension to London and transformation into the Great Central Railway (GCR). The extra traffic produced by the London extension put considerable pressure on track capacity when Marylebone services started in 1899. Victoria Station had to be rebuilt during 1900 with new goods lines to by-pass the passenger platforms, and Handsworth Tunnel was opened up and converted to four tracks in 1912/13 to remove the last bottleneck on the line.

c. <u>South Yorkshire Railway, 1854-64</u>

The Midland and MSLR had effectively divided Sheffield's traffic between them. The history of the rest of Sheffield's railways centres on the desire of other companies to penetrate the town in the fight for market share. The South Yorkshire Railway (SYR) was promoted mainly to open the Sheffield market to South Yorkshire coal. Although supported by the SAMR it ran at first only from Doncaster to Swinton, with a branch to Barnsley. From there the SYR had running powers into the Midland Station, Wicker. This route opened in 1849. In 1851 the SYR began to build a line from Barnsley down the Blackburn Valley to a junction with the old S&R at Meadow Hall near Tinsley. Services began in September 1854, but there were complaints about the inability of the Wicker Station to cope with the extra traffic, which led to a nine month delay in opening.

In the early 1850s the Great Northern Railway (GNR) took a quarter share in the SYR with the intention of using it to gain access to Sheffield. In 1860 the SYR began to promote a line from Meadow Hall into central Sheffield. However, it was the MSLR rather than the GNR

[55] O.S. 1:2500 Map, 1905, Sheet CCXIV.11
[56] Ibid.

which now moved to exploit the lucrative traffic carried by the SYR. Work on the SYR's Sheffield extension began in 1861. The MSLR took over the SYR on the day it opened in August 1864. The line ran on the north western bank of the canal for much of its length and in cutting or on embankment for most of its northern section. Nevertheless it included some level lengths which permitted works to connect on its north western side. A goods station was built at Broughton Lane in Carbrook. The line joined the main west-east MSLR east of Sheffield at Darnall.

d. Extensions to the Midland Railway, 1870-1900

In 1843, 1845, and 1854 schemes were proposed to build a direct line from Sheffield to Chesterfield.[57] These came to nothing but by 1862 the residents and manufacturers of Sheffield had grown frustrated with the inadequacies of the Wicker Station, and with being merely on a branch of the Midland Railway. The Midland responded with a Bill to build a line from the S&R southwards through the Ponds, up the Sheaf Valley and on to join the Midland main line at Chesterfield. The scheme was supported by manufacturers such as Charles Cammell, who wanted passenger traffic taken off the line to the Wicker to ease congestion and speed up the movement of goods.[58] The plan was to build a new Midland Station in the Ponds and convert the Wicker into a goods only station.[59] There was opposition in the form of a Bill for an alternative railway to Staffordshire supported by John Brown, the Mayor and manufacturer, and from Earl Fitzwilliam[60] who feared the effect of the railway on his Ecclesall Estate. In spite of this, the Bill was enacted in July 1864. Work began one year later.[61]

The line was difficult to build. 1,000 houses had to be demolished. A planned tunnel from the Ponds area to Attercliffe had to be replaced by a cutting and bridges because of abandoned mine workings. A long tunnel was needed at Bradway. Although the line did not provide much opportunity for direct connection to works through central Sheffield because of cuttings, the land levelled out somewhat in Highfield/Lowfield. By Heeley, however, the line was on viaduct. The

[57] Dunstan, 1970, 3-4
[58] HLRO, Evidence, MR (Chesterfield to Sheffield) Bill, HL 1864, Vol.19, 28
[59] Ibid.
[60] Ibid., 143
[61] Dunstan, 1970, 14

engineering complexities delayed opening until February 1870. Sheffield now had a direct passenger route to London. A new goods station was built at Ponds just south west of the new Midland passenger station. A connection was also provided to the MSLR at Nunnery coal yard, involving a back-shunt to get from one line to the other. Spital Hill tunnel had not been a popular route for cross company traffic because the line was steep at 1 in 36, difficult to operate and could only accommodate loads of 17 mineral or 20 other wagons in good weather, and less in bad. The Nunnery connection proved little better. The existing main line connection between the two systems at Beighton was, in any case, the usual place for exchange of traffic.[62]

During the 1870s the Midland had to extend its goods facilities again. Brightside Sidings were built on 17 acres of land bought from the Norfolk Estate in 1870. In 1875, under pressure from local businesses, the MR carried out improvements to the Wicker Goods Station. It was not until the 1890s that the next major railway developments took place. In 1892, the MR built a new depot for timber, stone, coal and bricks at the Wicker. In the same year a new goods station was opened in Queen's Road just to the south of the Ponds Goods Station. In 1893 a line to Manchester was opened, connecting to the Sheffield-Chesterfield route at Dore and Totley. 1893 also saw the opening of a new goods line up the Blackburn Valley parallel to the SYR. Initially built to serve Thorncliffe Iron Works, the track was extended to Barnsley in 1897 in direct competition for MSLR coal traffic.

The final relevant improvement was the widening of the Chesterfield line south of Pond Street, completed in 1902. This was a response to congestion caused by coal traffic coming down the Blackburn Valley line and going south towards Chesterfield. Simultaneously Pond Street passenger station was rebuilt and re-opened in 1905.

e. The London and North Western Railway, 1895-1903

New companies were still fighting for access to Sheffield. The London and North Western Railway (LNWR) attempted to reach Sheffield in 1867 with a proposed route from Chapel-en-le-Frith. This foundered

[62]HLRO, Evidence, MR (Chesterfield to Sheffield) Bill, HL 1864, Vol.19, 107

in Parliament but in May 1895 the company took advantage of running powers over the MSLR to open a goods station (City Goods) in Bernard Road, close to the Nunnery coal yard and just across the MSLR main line from that company's Bernard Road sidings. This rather inaccessible site was insufficient. In February 1903 the LNWR opened a 0.75 mile extension westwards, tunnelling under the Nunnery Colliery Railway to a new depot near the canal wharf in Broad Street. This 94,260 sq. ft. building was constructed on three floors, with a basement connected to the rail lines by hydraulic wagon lifts. The depot was able to handle 10 ton wagons. It was named City Goods and the older LNWR goods station, renamed Nunnery Goods, was retained to deal with heavier loads up to 40 tons.

f. Sheffield District Railway, 1900

The last of Sheffield's railways started life as part of a much larger project to connect Warrington to the east coast, with a branch to Beighton to link up with coal traffic on the MSLR. This Lancashire, Derbyshire and East Coast Railway (LDECR) was under capitalised, so the Great Eastern Railway (GER) took effective control and built only the Lincoln-Chesterfield and Langwith-Beighton sections, opening in 1897. These lines improved GER penetration of the South Yorkshire and Dukeries coalfields. Against hostility from the MSLR, the LDECR/GER's next step was to gain a foothold in Sheffield itself. The MR was less hostile than its main rival and offered running powers over the old NMR from Treeton and the S&R from Brightside to Attercliffe. Under an Act of August 1896 the Sheffield District Railway was built from Treeton to Brightside, with a branch from the old S&R to a substantial new goods depot in Attercliffe. There was a second goods station at West Tinsley.

The SDR opened in May 1900. The line was dependent on large engineering structures to bring it into Sheffield. After the nine arch Catcliffe viaduct and deep Brinsworth cutting the line passed on a relatively level stretch through Tinsley before mounting a massive six span viaduct in Brightside to cross the Don and Meadow Hall Road. To build Attercliffe Goods Yard the Don had to be diverted and the river and Royd's Mill Head Goit bridged. The whole site had to be raised 10-15 feet with 250,000 cubic yards of spoil. A two storey goods depot was provided, together with a 400 wagon yard and craneage capable of moving up to 35 tons. The line was unable to cover its building costs from revenues. Neither the GNR nor the GER were interested in rescuing it. In 1907 it passed into the hands of the GCR.

iv. <u>The Growth of the Transport System</u>

Traffic data for Sheffield's canal and railways through the nineteenth century are scarce. The growth in traffic, especially on the railways, can be traced through the increase in facilities and the rise in the number of railway employees living in the town. The Census shows a growth in the number of canal employees, though fluctuations between 1851, 1861 and 1871 suggest that the figures may be affected by the number of vessels (and thus crews) in the canal basin on census night.

Appendix 3 shows that railway employment grew from six employees on the S&R in 1841 to 185 on the Midland and MSLR in 1851. Thereafter the only decade which did not see a doubling or near doubling of employment was 1881-1891. Even then there was a significant increase in staff. In 1901, 3,753 workers served on Sheffield's railways.

The MSLR's <u>Staff Register</u> for 1869-92[63] records 28 staff working in the Park Goods Station in 1870 and 40 in 1872. The <u>Register</u> observes that the Park Station was receiving an average of 70 wagons of coal a day in 1871. The Midland Railway's establishment for its Sheffield goods stations was the fifth largest of that company's freight facilities by 1912 (see Table 5.1). This did not include the staff employed at suburban stations such as Heeley, where 15 people dealt with goods traffic.[64] The range of goods handled was that of any large industrial city: Ale, Blooms, Billetts and Ingots, Boilers, Bones, Cinders, Creosote, Flour, Gannister, Hides, Iron, Machinery, Manure, Paper, Pitch, Railway Springs, Railway Wagons and Wagon Work, Roadstone etc., Sulphate of Ammonia, Vinegar, Cutlery, Coal.[65]

The expansion of the transport sector can also be demonstrated by the growth in the amount of land it consumed directly and through its associated depots. Figure 5.10 shows the area consumed by

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[63]PRO/RAIL 463/249, 59-62; 69-70
[64]PRO/RAIL 491/1066
[65]Ibid.

transport facilities, gas works and coal yards (including those associated with the Duke of Norfolk's collieries) from the 1850 OS 6"=1 Mile Map. Figure 5.11 gives the same information from the 1903 map. These areas are compared with an approximation of the size of the areas dominated by industrial land uses. The extension of industry along the railways in the Lower Don Valley is graphically illustrated, but so is the continuation of the ring of industries round the town centre (see Chapters 5 and 6 below), and the significant enlargement of the area of land devoted to the movement and storage of goods. These maps illustrate very clearly both the necessity of servicing large scale industry with large scale transport facilities, and also the way in which the transport sector came to be a competitor for land in Sheffield's most level river valleys.

3. Sheffield's Industrial Development

By the third quarter of the nineteenth century, Sheffield had developed a complex industrial base centred on metalworking. The trades at the heart of this complex tend to be grouped by economic historians into two or three categories. Pollard distinguishes between the light trades[66] and the heavy trades - iron and steel, railway equipment, engineering and armaments.[67]

Lloyd Jones and Lewis divide the Sheffield industries into basic producers of iron and steel, cutlery producers and tool/engineering companies.[68] The distinctions between light and heavy trades were real enough,[69] but are not always easy to draw at the micro-economic level. In 1862 only Jessop's manufactured steel exclusively.[70] All the big steel producers were involved in engineering - for example John Brown and Co. and Cammells began their expansion in the 1850s as a result of the manufacture of railway springs and, in the case of Brown's, the invention of a patent railway buffer.[71] At Abbeydale just outside Sheffield, a scythe works produced its own raw steel.[72] This type of integration was common throughout the Sheffield industries.

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[66]'Those making goods of iron and steel such as cutlery, joiners' tools, files, engineers' tools, saws, skates, pins and needles, agricultural implements and fenders; the silver, silver-plate and allied trades; and a varied group of ancillary trades, such as the making of handles and cabinet cases' - Pollard, 1969, 50

[67]Ibid., 224

[68]Lloyd Jones and Lewis, 1983

[69]For example the light trades were probably more dependent on the craft of the skilled individual worker - Pollard, 1969, 51

[70]Pawson & Brailsford, 1862, 134

[71]Erickson, 1986, 144-5; Tweedale, 1986, 14

[72]Barraclough, 1976, 108-9

Nevertheless, it is possible to identify a group of trades centred on the production of iron and particularly steel, which advanced during the nineteenth century in technology, organisation and scale to form the dominant industrial sector. Broadly these were what Pollard describes as the heavy trades, but also included certain aspects of tool manufacturing which grew initially from the large scale organisation of production by firms such as Spear and Jackson and later from the invention of special tool steels. At the core of all these firms was the business of steel converting and refining. Each of the major companies grew its own areas of specialisation as the century wore on.

i. The Evolution of the Steel Industry

We now turn to an overview of the development of the steel industry and its place in the wider industrial economy of Sheffield. A much more detailed history of technological developments can be found in Barraclough's work if required.[73] He divides the history of Sheffield's steel industry into five eras before 1914, based on changes in technology and increases in scale:[74]

a. Up to 1750, production of iron from local ores; steel imported;

b. 1750-1800, development of the 'Sheffield methods' of steel production: blister steel made in cementation furnaces; crucible steel produced by the Huntsman process;

c. 1800-65, growth in steelmaking capacity based on these two methods;

d. 1865-80, a mixed economy using bulk steel production methods (Bessemer and Siemens-Martin Open Hearth) to meet the demand for steel rails, while the older methods continued to make higher quality products;

e. 1880 onwards, increasing reliance on special steels to meet the demand for ordnance and technically demanding heavy engineering, in response also to flooding of the market by cheap foreign steel produced using the Gilchrist-Thomas process.

With some refinement this is a fair description of the evolution of Sheffield steelmaking and corresponds closely to Tweedale's description of the industry.[75]

[73]Barraclough, 1984 (2 Vols.); Barraclough, 1990
[74]Barraclough, 1976, 8
[75]Tweedale, 1993, 142-66

ii. The Steel Industry 1800-1850

At the start of the study period around 1800, three methods of steel manufacture were used in Sheffield:

a. Cementation or Blister Steel

Blister steel (so called because of blisters on the surface of the converted steel) was being produced in Sheffield on a small scale in the early years of the eighteenth century. The characteristic conical cementation furnaces in which haematite bar iron (usually high grade iron from Sweden or Spain, but also from Russia, Germany and Norway) was combined with charcoal remained common throughout the nineteenth century. Unrefined blister steel was not workable but provided the raw material for more malleable steels suited to use in the Sheffield tool and cutlery trades.[76]

b. Shear Steel

Produced by welding bundles of heated blister steel bars under a hammer, shear steel was flexible and capable of holding a good edge. Repeating the process to form double-shear steel produced an even finer product, excellent for cutlery and edge tools.[77]

c. Crucible Steel

To the metallurgist, blister and shear steel are more properly forms of cemented or re-carburised iron.[78] In 1751 the Doncaster clockmaker, Benjamin Huntsman, searching for a better steel for clock springs, perfected a technique for refining blister steel fragments in a ceramic vessel called a crucible, heated to melting point in a high temperature coke furnace. Crucible or cast steel was a high quality metal which was quickly applied to the making of tools, razors, wire and sheet. Crucibles made the refining of large quantities of high grade steel economic, albeit that bulk products had to be made by combining the contents of many crucibles. Initially, crucibles could make 8-10lbs of steel and Huntsman was able to produce about 10 tons of steel per annum. By the 1880s crucibles of 60-70lbs capacity were in use, though a limit on size was imposed by the practice of man-handling to pour the cast steel from the crucible into

[76] Barraclough, 1976, 13
[77] Ibid.
[78] Brandt, 1953, 93

moulds.[79] Crucibles remained an important source of high quality carbon steels, and later special alloy steels, until the end of the nineteenth century and into the twentieth.[80]

The steel industry up to the 1850s progressed not so much in technical innovation as in the scale of production. Because of the small unit size of the cementation and crucible furnaces, increases had to be achieved by multiplication of the number of furnaces.[81] There were but a handful of cementation furnaces in Sheffield in 1800, each with a capacity of 3-4 tons in a single melt. In 1835 Samuel Wingfield, a clerk with Naylor Hutchinson, undertook a survey of furnaces for the Lords' Committee on the S&R Railway Bill. He found 56 converting (cementation) furnaces in Sheffield and 62 establishments equipped with crucible furnaces, with a total of 554 crucible melting holes.[82]

Over 200 cementation furnaces were constructed between 1800 and 1850, some able to convert 40 tons of steel at a time.[83] There was a similar expansion in the production of cast steel. Table 5.2 shows blister steel output from 1835-63. In 1843 the town produced 90% of total British steel output and almost 50% of the European total.[84] Production was around 20,000 tons per annum.[85] By the early 1860s 80,000 tons of blister steel were being made.[86] To make large ingots such as the 'monster' weighing 24 cwts cast by Turton's for the Great Exhibition[87] demanded considerable teamwork as many crucibles were brought from the furnace and 'teemed' into the mould. In making a large bell for the Paris International Exhibition of 1855 Naylor, Vickers used 176 crucibles.[88] The refinement of large scale crucible steel casting continued after the 1850s. By 1869 Vickers could make a 25 ton ingot using 672 crucibles.[89] The number of melting holes rose from 1,333 in 1851 to 2,437 in 1862, an increase of over 80%.[90]

d. Steam Power

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[79]Barraclough, 1976, 13
[80]Brandt, 1953, 95; Tweedale, 1987, 27; Pollard, 1969, 159
[81]Pollard, 1969, 160
[82]PRO/RAIL 1067/10, 6
[83]Barraclough, 1976, 12
[84]Ibid., 12-3
[85]Tweedale, 1993, 146
[86]Tweedale, 1993, 149
[87]Pollard, 1969, 160
[88]Pawson and Brailsford, 1862, 122
[89]Pollard, 1969, 160
[90]Tweedale, 1993, 149

If manufacture of the raw material for Sheffield's staple products continued to depend on traditional methods, innovations did take place in other aspects of the Sheffield trades. In particular, the introduction of steam power led to a decline in the importance of water as a driving force. In 1770, 133 grinders' wheels were driven by water and none by steam. The first steam engine entered service at Proctors' works on the Sheaf in 1786. By 1822 '... the agency of water [had] been in great measure superseded in the large manufactories by the use of that much more certain and efficient power - steam'.[91] By 1857 only 16 large water driven wheels were left, while 80 were powered by steam. By 1865 there were 132 steam powered wheels.[92] Samuel Wingfield told the SCS&RR that there were 76 steam engines at work in Sheffield in 1835 and two under construction. These were relatively small machines with an average of 18.25 H.P. each[93]. A census of steam engines in 1854 showed 109 to be in use in the cutlery trades.[94]

e. Factory Production Methods

The use of steam power did not necessarily lead to advantages of scale as it had done in the cotton industry in Lancashire.[95] The system of 'little mesters' occupying small workshops or hiring space in public wheels, working to order from merchanting factors, continued to dominate cutlery production well into the 1860s.[96] Nevertheless, the factory system began to make inroads. The first cutlery factory is usually taken to be Greaves' Sheaf Works, built on a canalside site in 1823, not long after the canal opened in 1819.[97] By 1850 there were about a dozen such factories,[98] the largest being Wostenholm's Washington Works in the Rockingham Street area to the west of the town centre and Rodgers and Sons' Norfolk Street Works in Alsop Fields.[99]

Factory organisation did not necessarily imply mass production techniques, however. In Wostenholm's works, individual workers and their apprentices had their own workshops with little inter-communication.[100] Long runs were unusual; outworking was common; there was a strong division of labour between

[91]Baines, 1822, 287
[92]Pollard, 1969, 53
[93]Ibid.
[94]Ibid., 54
[95]Ibid.
[96]Ibid., 55
[97]Ibid.
[98]Ibid.
[99]Tweedale, 1986, 77-8
[100]Ibid., 80

crafts.[101] Pollard considers that the difference between the light and heavy trades was not marked in the mid nineteenth century.[102] Even so there were signs of large scale organisation and a separation of the steel, engineering and tool sectors emerging before 1850. For example, before 1837 Spear and Jackson set up a substantial factory on a site next to where the S&R was being built in Brightside. Johnson, Cammell and Co. built a steelworks covering four acres nearby which was working by 1845.[103]

These and other works such as Jessop's in Brightside, which were big by contemporary standards, were precursors of the giant steel and tool producers which emerged after 1850. The transformation of Sheffield's steel industry began through an increase in the scale of production and the multiplication of productive units under the control of industrial entrepreneurs rather than merchanting factors, mediated by the adoption of factory production methods, albeit that these were mainly centred on the organisation of craft work rather than techniques of genuine mass production - steel production remained a handicraft dependent on the skill and judgement of the melter.[104]

[101] Pollard, 1969, Ch.2; Tweedale, 1987, 2
[102] Ibid., 78-9
[103] Barraclough, 1976, 61; Pawson and Brailsford, 1869, 126
[104] Pollard, 1969, 81-2

f. Demand for Steel

The growth in the number and scale of producers is accounted for both by a rise in domestic demand and the extension of overseas trade, especially with America.[105] The process of colonisation led to a huge demand for Sheffield products, particularly agricultural implements such as scythes, knives and cutlery. In the late 1820s Sheffield found it hard to meet American orders because of their size.[106] In the 1830s and 1840s firms such as Wostenholm's, Firth's and Butcher's built up an enormous trade and amassed considerable fortunes on the strength of American business.[107] Wostenholm's, Sanderson's, Butcher's, Firth's and others became directly involved in merchanting and manufacturing in the US.[108] At home the building of the railways from the mid-1820s combined with growing affluence among the burgeoning middle classes to create demand for goods such as cutlery and engineering products and tools to produce other goods. During the next thirty years the importance of the American market declined, but the increasing sophistication of the industrial economy and the military machine supplanted it as the engine for Sheffield's growth.

iii. Expansion of the Steel and Engineering Sectors 1850-1880

The 1850s-70s saw radical innovation in steel production technology and products:

a. Puddled Steel and Iron

The first major innovation in steel technology was in some ways a throwback to earlier times. John Brown invented a conical steel spring railway buffer in 1848. By 1853 he was selling 150 sets a week to most of the main railway companies.[109] After 1850 he moved into carriage springs.[110] Brown turned to the puddling process to make cheaper steel. It had been developed in Germany and first tried in Britain in 1851.[111] Similar to the production of wrought iron, it involved the smelting of pig iron using a coal hearth but adding manganese, salt, sulphuric acid and clay.[112] In wrought iron, puddling involves almost total

[105]Tweedale, 1987, 5
[106]Tweedale, 1986, 21
[107]Ibid., passim
[108]Ibid., 25-7 & 77; Tweedale, 1987, 14 & 51
[109]Tweedale, 1986, 14
[110]Erickson, 1986, 144-5
[111]Tweedale, 1986, 15
[112]Ibid.; Pollard, 1969, 81-2

decarburisation and exclusion of manganese, silicon and phosphorous.[113] Brown installed six puddling furnaces in 1857.[114] The product was more resilient than wrought iron. In the marketplace it was also known as special mild steel, steel-iron or homogeneous iron.[115] Although it was lower in quality than crucible steel it proved ideal for machinery beds, railway carriage springs and buffers.[116] The iron puddling process was also used by Brown to make wrought iron for rolling into armour plate (from 1859) and rails (from 1857).[117] From six furnaces in 1857, Brown's eventually expanded to 72 to produce boiler and bridge plates.[118] Cammell's also began to produce puddled steel and wrought iron at around this time, rolling rails in 1861 and armour plate in 1863.[119] Production accounted for 50% of non-Bessemer finished steel output in Sheffield in 1859/60, at about 25-30,000 tons per annum (see Tables 5.2 and 5.3). Puddling furnaces still operated in 1895; Firth's produced puddled steel and wrought iron at their Whittington Works from 1858-87.[120] Cooke's of Tinsley also advertised puddled steel in Pawson and Brailsford's guidebook for 1879.[121]

b. Bessemer Steel

In 1855, Henry Bessemer succeeded in refining steel from pig iron without the intervening cementation process, using a blast of air over a puddling furnace while attempting to improve the production of wrought iron.[122] He went on to evolve the Bessemer converter, a moveable vessel mounted on trunnions with tuyeres in the base to conduct into the molten metal a blast of air produced by a steam engine.[123] Bessemer originally conceived his process to produce iron. An initial rush by iron makers to purchase licences led to disappointment and failure because the casting of ingots was made difficult by the generation of oxygen in the furnace and carbon monoxide gas in the molten metal which stopped it from settling in the mould. Bessemer had been fortunate in using haematite pig irons in his experiments. Their chemical composition prevented the problem. Other manufacturers were less lucky. Considerable mistrust built up. Most steelmakers and their customers were not prepared to risk the

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[113]Brandt, 1959, 89
[114]Tweedale, 1986, 15
[115]Pawson and Brailsford, 1879, 233; Tweedale, 1993, 150
[116]Ibid.
[117]Erickson, 1986, 144-5
[118]Tweedale, 1986, 15
[119]Ibid.
[120]Barraclough, 1976, 62
[121]Pawson and Brailsford, 1879, Advts. 24
[122]Brandt, 1959, 97-9
[123]Ibid.

Bessemer process. The War Office refused to sanction Bessemer steel until 1863 and the Admiralty until 1875.[124]

Robert Mushet, who had a small steelworks and early metallurgical laboratory at Coleford in the Forest of Dean,[125] had been adding a manganese compound called 'spiegeleisen' since 1848 to remove excess oxygen when refining steel. Working with the Ebbw Vale Iron and Steel Company, Mushet found that manganese could achieve the same effect in the Bessemer converter, making it practicable to refine steel from most non-phosphoric pig irons.[126] These unlicensed experiments did not continue, but Bessemer himself took up the idea. After two years of experimentation he was able to make commercially viable steel.[127] The quality was less good than crucible steel but Bessemer steel was £10-£12 per ton cheaper.[128]

To prove his process after its early failures, Bessemer set up his own works in 1859 immediately next to John Brown's in Brightside, Sheffield[129]. His stated intention was to convince other manufacturers of the effectiveness of the converter.[130] His primary business strategy always remained the licensing of the process. His own company never went in for large scale expansion.[131]

Bessemer had a novel locational strategy, using location as a marketing tool. After a year of observing Bessemer's success, John Brown realised he could apply the process to his products. Bessemer's converter offered considerable time savings over cementation/crucible refining and puddling. Cementation would take seven to eight days to convert between three and 40 tons of iron into steel, with a further half day for crucible refining. The Bessemer converter could melt 25 tons of refined steel in half an hour.[132]

Brown's quickly applied Bessemer's process to make steel rails. In 1860-1 Brown's laid down four 24 ton converters.[133] By 1865 the company was supplying about half of Britain's rail requirements, using around 75% of its total production tonnage.[134] The other substantial volume steel producer in

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[124]Ibid.
[125]Tweedale, 1986, 57
[126]Erickson, 1986, 142
[127]Ibid.
[128]Brandt, 1959, 99
[129]Tweedale, 1993, 151
[130]Ibid.
[131]Erickson, 1986, 143
[132]Barraclough, 1976, 14
[133]Pollard, 1969, 160
[134]Tweedale, 1986, 16

Brightside, Chas. Cammell, also Bessemerised in the early 1860s.[135] These firms were followed by Sam'l Fox at Stocksbridge (1862) and the Owen's Patent Wheel, Tyre and Axle Co. of Rotherham (1864).[136] Of the first ten Bessemer companies in Britain, seven were based in the Sheffield area.[137]

Bessemer steel enabled the economic replacement of iron in most branches of engineering by the mid-1870s.[138] Yet technological progress was to introduce other forms of steel production which were to alter the structure of Sheffield's steel industry again in the last thirty years of the nineteenth century.

c. The Siemens-Martin Open Hearth Process

The production of steel by the open hearth process was preceded in 1857 by Siemens' adaptation of the regenerative principle to recycle heat from the furnace, effecting a fuel saving of 70-80%.[139] This principle was quickly adopted by crucible steel makers in Sheffield.[140] To create his new type of furnace Siemens had to solve the problem of clogging of the regenerator bricks by ash. This was achieved in 1861 with the invention of the gas producer, which enabled a gas fired open hearth to be developed. The flame from the gas passed over the top of a bath of molten iron and a jet of air enabled converting and refining to take place in a single melt, but in much larger quantities and more fuel efficiently than in a Bessemer converter. Blast furnace gas could also be used in an integrated iron and steel works, although the calorific value of town gas was generally insufficient for steel melting.[141] Open hearth furnaces in Sheffield reached capacities of up to 100 tons by the end of the century.[142] A typical melt took 10-12 hours. Taken together with fuel savings and the propensity of the furnace to consume scrap steel this made the Siemens-Martin process very economical by comparison with other methods.

Siemens experienced initial failures experimenting with his new technique in Sheffield. By 1866, however, he was able to go into commercial production at his own works in Birmingham.[143] The process was taken up widely. Vickers adopted it in the early 1870s.[144] Other firms in Sheffield held back, only coming

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[135]Erickson, 1986, 144-5
[136]Ibid., 145-6
[137]Pollard, 1969, 160
[138]Odle, 1966, 142
[139]Brandt, 1959, 120
[140]Pollard, 1969, 160
[141]Brandt, 1959, Ch.18 and 19
[142]Barraclough, 1976, 14
[143]Erickson, 1986, 156
[144]Tweedale, 1993, 152

in during the late 1870s.[145] Barraclough suggests this may have been because of an insistence on continuing the use of high quality Swedish iron to make the best steels, to sustain specialisation in the upper end of the steel markets.[146] In part the reason may also lie in the heavy investment which had been made in Bessemer technology by the time of the boom in the early 1870s, combined with the deep recession which hit Sheffield steel manufacturers between 1874 and 1879. The high profits made in the early 1870s may have disguised the higher relative cost of Bessemer converters and crucible methods. The fact that nearly half Sheffield's furnaces stood idle from April 1874[147] could hardly have encouraged investment.

When trade began to pick up in 1879, Sheffield manufacturers were quick to build open hearth furnaces. In 1879, Brown's were operating puddling, crucible, Bessemer and Siemens furnaces.[148] In 1880 there were 19 Siemens-Martin furnaces in three Sheffield works.[149] By 1881 Sheffield was the third largest open hearth production area in Britain.[150] Firth's built their first open hearth in 1883.[151] The development of Siemens-Martin furnaces catalogued by the British Iron Trades Association is shown in Table 5.4. Firms previously devoted to crucibles such as Vickers and Osborn's added the open hearth to their repertoire. Another large scale crucible company, Jessop's, also used open hearths by 1910.[152] Even the Bessemer company eventually had to submit to the trend.

d. Basic Steel Production

Another reason for Sheffield companies to seize on a cheaper means of steelmaking lay in the advance of the Gilchrist-Thomas basic steel process. By using a dolomite furnace lining, Gilchrist and Thomas showed in 1878 that it was possible to make steel from phosphoric iron ores using both the Bessemer and open hearth methods.[153] The consequence was not only that it became economic to use the phosphoric iron ores of Cleveland, Lincolnshire and Northamptonshire in new works local to those areas, but that American and then German producers overtook Britain in total steel production by 1900 using their huge reserves of phosphoric ores.[154]

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[145]Ibid.
[146]Ibid.
[147]Pollard, 1969, 164
[148]Pawson and Brailsford, 1879, 233; Firth-Brown, 1954
[149]BITA, 1883, 45
[150]Erickson, 1986, 162
[151]BITA, 1884, 41
[152]Barraclough, 1976, 66
[153]Brandt, 1959, 125-6; Barraclough, 1976, 14
[154]Ibid.

iv. Changes in the Balance of Sheffield's Industries After 1850

The thirty years after the mid-century saw the birth and death of more than one ephemeral but temporarily profitable sector of the steel industry. In a sense the adjustments needed to cope with competition from Gilchrist-Thomas steel were simply another step in a constant process of change which was essential to enable Sheffield steel companies to remain in business.

Employment in the heavy trades increased by some 300% between 1851-91, compared with growth of only 50% in the light trades.[155] The ratio between employment in the light and heavy trades changed from 4:1 (c. 21,350:5,200 employees) to 1.5:1 (c. 32,100:21,384 employees) in the same period.[156] Newton found rather different ratios - 13,796:11,709 employees in 1851 and 33,288:16,508 in 1881, but accounts for this by her use of different definitions of trades and the difference in cut-off dates.[157] This seems reasonable bearing in mind that 1881 came soon after one of the most serious recessions of the century. If we take Pollard's figures as representative of the position after a further decade of industrial change (including the consolidation of the Siemens-Martin process), then the secular trend in steel was one of substantial growth. By contrast the light trades began to lose some of their comparative advantages after 1865, while employment in the sector started to grow more slowly. Traditional markets began to close to Sheffield goods.[158] Sheffield's ability to market its products well in America began to decline rapidly after 1851. Sheffield firms clung to anachronistic marketing techniques, relying on representatives when mass communications were increasing the power of advertisement. They failed to keep adequate stocks in the U.S. and had difficulty in maintaining contact with customers.[159] U.S. steel companies began to innovate and compete effectively well before native phosphoric ores could be exploited - for example inventing graphite crucibles in the 1850s.[160] The American Civil War also caused a setback.[161] The introduction of machine made cutlery, files and other tools of lower quality but also lower price than Sheffield wares caused changes of allegiance by customers which were often difficult for quality conscious Sheffield cutlers to understand.[162] The McKinley Tarriff of 1890 virtually ended the

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[155]Pollard, 1969, 15 & 93
[156]Pollard, 1993, 269
[157]Newton, 1993, 352-3
[158]Ibid., 123
[159]Tweedale, 1987, 166-71
[160]Ibid., 15
[161]Tweedale, 1986, 80
[162]Ibid.; Taylor, 1993, 195

American trade.[163] Continued, though slower, growth was possible because of rising demand in domestic and newly opened Continental markets. Nevertheless, by 1911 there were more employees in the heavy trades (c. 38,379) than in the light (c. 34,800).[164] The staple products remained the same before 1900, although a number of larger firms diversified into tools and files - one or two even abandoned cutlery in favour of these heavier products.[165] Mechanisation slowly encroached on craft work and, even by the late 1870s, increasing division of labour meant that fewer and fewer cutlers possessed the old skills which would enable them to carry out the whole process of producing a piece of cutlery single handed.[166] Heavy tool making, saw making, cheap cutlery and file cutting all succumbed to machine methods by the 1880s.[167] In 1858 cheap knife blades were being stamped from sheet metal rather than forged individually but it was not until 1892 that the mechanised grinding of scissor blades came in,[168] even though the bulk scissor trade had been lost to Germany by 1870.[169]

Cutlery firms stayed organised around outworking and independent contractors renting space in their factories. By the 1890s the most notable firms - Rodgers, Thomas Ellin, Mappin & Webb, Needham, Veall & Tyzack, Hides, Deakin and Sellars - had large works but with the exception of Wostenholm's at 5,000 sq.yds. and some half dozen intermediate firms at 500-2,000 sq.yds., the scale of these premises did not compete with the upper end of the steel industry. These few larger factories made up a very small proportion of the stock of cutlery premises - in 1887 there were 3,110 cutlery factories and a further 1,242 individual workshops, as well as 3-400 steam grinding wheels counted in 1889.[170] Rodgers and many others expanded existing works between 1890 and 1910. These factories generally remained multi-storey affairs with many small workshops. Even at this late date these were often let to 'little mesters'.[171] Rented rooms in such factories had almost replaced public wheels as the bases for self-employed craft workers by 1908, taking power from the works supply[172] or from gas engines in their workshops. Although these 'little mesters' remained 'very numerous' they were observed to be subject to 'a tendency ... to disappear altogether'.[173]

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[163]Pollard, 1969, 125
[164]Pollard, 1993, 270
[165]Taylor, 1993, 199
[166]Ibid., 205
[167]Pollard, 1969, 127
[168]Ibid., 129
[169]Walton, 1948, 200
[170]Taylor, 1993, 196-7
[171]Ibid., 197-9
[172]Ibid.
[173]Board of Trade, 1908, 408

While the cutlery and small tool trades made slow headway, certain sectors of steel manufacturing behaved far more dramatically. Bessemer steel rail rolling, for example, boomed during the 1860s and early 1870s. However, the economics of exporting steel rails for the rapidly expanding overseas market soon made it unrealistic to transport raw materials to Sheffield and rails back to the coast. Brown's closed their rail mill in 1874. Cammell's moved theirs from Dronfield to a coastal site at Workington in 1882.[174] The depression in the 1870s forced firms such as Brown's to focus on more refined products with the potential to generate greater added value.[175] The dictates of fashion caused a similar fluctuation in wire making, another important local branch of the steel industry. From 1855-68 several firms made crinoline wire for the home market and steel cuffs and collars for South America. By 1870, changes in modes killed both trades.[176] Underlying these movements were fundamental changes in production technology. Table 5.5 gives an idea of the scale of some leading firms in 1852. Table 5.2 illustrates the comparative output from Bessemer and Siemens-Martin furnaces from available data. Table 5.6 shows the comparative decline of the Bessemer converter in Sheffield after 1880. Although there was a recovery in Sheffield's Bessemer steel production at the end of the nineteenth century, there was an underlying trend for open hearth production to overtake the Bessemer process both locally and nationally.

v. Other Technological Developments 1850-80

a. Rolling and Forging

Traditionally forge and tilt hammers had been driven by water. Nasmyth's steam hammer, invented in 1842, was probably not introduced to Sheffield until 1855 at the Sheaf Works,[177] although Walton believes Firth's used a Nasmyth hammer in 1849.[178] By 1865, Brown's had installed Nasmyth hammers of ten and twenty five tons.[179] Firth's purchased a three and a five ton hammer before the end of the 1850s and two 25 ton hammers in 1863.[180] Sanderson Bros. had a machine of at least ten tons in 1862.[181] Davy Brothers, plant manufacturers of the Park Iron Works, supplied a

[174] Pollard, 1969, 161
[175] Burn, 1940, 28
[176] Pollard, 1969, 161
[177] Pollard, 1969, 80
[178] Walton, 1948, 182
[179] Barraclough, 1976, 83
[180] Tweedale, 1986, 33
[181] Pawson and Brailsford, 1862, 118

comprehensive range of hammers from 10 cwt to 25 tons.[182] This forging technology enabled firms such as Firth's to compete successfully to produce guns for the army and navy.

Firth's could cast gun ingots of between 240 and 600 crucible size by 1867, and in the 1860s and 1870s their boring and forging capabilities enabled them to cast ever larger weapons - the 'Woolwich Infant' of 35 tons in 1871 and an 80 ton gun in 1875. Armstrong's and the Government depended on Firth's for big gun and Enfield rifle barrels.[183] Hydraulic presses for forging were introduced in Sheffield around 1865.[184] Even where tilt hammers were retained they might be powered by steam, as at Sanderson Brothers' Attercliffe Forge Works in 1862.[185]

Rolling mills also saw advances from the water powered variety used before 1850. Steam power and the ability to make larger rollers led to the rolling of thicker and wider plates. John Brown developed the technique of welding iron plates by rolling[186] and Brown's and Cammell's were engaged in upgrading armour plate for the rest of the century, in competition with companies such as Firth's who were forging and casting more powerful and accurate heavy guns to counter improvements in armour.[187] By 1867, Brown's were supplying three quarters of the armour for the British Navy's ironclads. Plates up to 6.5" thick and 21 feet long could be rolled by Brown's in iron in 1862.[188] This had been raised to 12" thickness by 1863.[189] By 1879, Cammell's could make plates of over 18" thickness and composite steel/iron plates could be rolled.[190]

b. Steel Castings

The production of steel castings was problematical because steel shrinks on cooling in a mould. In 1824 a British patent for steel casting was taken out but not commercially exploited. The Germans Fischer, Mayer and Krupp discovered and patented methods suitable for routine production in the 1840s. In 1854 Naylor, Vickers acquired the patent for the German

182 Pawson & Brailsford, 1879, Advts. 50
183 Tweedale, 1986, 33-5
184 Barraclough, 1976, 15
185 Ibid., 82
186 Tweedale, 1986, 16
187 Ibid., 18
188 Pawson and Brailsford, 1862, 130
189 Tweedale, 1986, 128
190 Barraclough, 1976, 89; Pollard, 1969, 161

Riepe process, casting crucible steel in clay moulds.[191] They became expert at making steel bells.[192] By 1866 the company was able to cast a marine shaft weighing 22 tons using 672 crucibles.[193] Between 1850 and 1880, Butcher's, Cammell's, Firth's, Shortridge and Howell, Jessop's and Vickers all began to make castings.[194] Robert Hadfield Snr. took over the Continental Works in Bessemer Road, Attercliffe, to develop steel casting methods to a level to match the complexity of castings in brass or iron. There were many tribulations before the process was perfected. It was not until 1872 that Hadfield's could establish itself as the first Sheffield firm to specialise in making castings.[195] Many types of cast product became feasible. Hadfield's learnt to cast steam and hydraulic machinery parts, evolving castings far stronger than iron. Cast steel wheels and engineering pieces were being fabricated by 1879.[196] Large marine and engine castings were also made by Firth's.[197]

c. Power Supply

By 1850 the steam engine had become almost universal as a power source, except in a few works where water power was kept because it did an adequate job cheaply. More typical were medium sized works such as Osborn's in the Wicker, where eleven steam engines drove the rolling mills and steam hammers in the late 1870s and early 1880s.[198] This period saw another innovation in power supply, suited to smaller factories in locations sensitive to air pollution. Gasoline engines were available in 1879 (only three years after Otto patented the technology), when R.F.Drury advertised as agent for 'Crossley Brothers' 'Otto' Silent Gas Engines'.[199] A reference was found to the operation of an Otto engine to power a works in Highfield in 1885.[200] By 1908, the gas engine had become the predominant form of motive power for small manufacturers.[201]

d. Continuation of Traditional Steelmaking Methods

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[191] Tweedale, 1976, 65
[192] Pawson and Brailsford, 1879, 220
[193] Ibid.
[194] Tweedale, 1987, 112-3
[195] Main, 1949, 2-3c, 2-3d & 2-6; Pollard, 1969, 162 - see Chapter 6 below
[196] Ibid.
[197] Ibid.
[198] Tweedale, 1986, 60
[199] Pawson and Brailsford, 1879 Advts. 87
[200] ACM/LB/R/31-8-1885
[201] Board of Trade, 1908, 408

The new methods did not spell the end of traditional Sheffield techniques, though Table 5.2 points to a major decline in crucible steel output from 25-30,000 tons in 1859/60 to 3-4,000 tons by the mid 1870s. Bessemer and Siemens-Martin technology were confined to a small number of large firms. Many more small and medium scale producers expanded their business in the traditional way, multiplying small units of production. This had the advantage of lower capital inputs and greater flexibility, but crucibles also remained the best way to produce the highest grade steel needed for many tools and castings. For this reason the bulk steel producers also retained and extended their crucible furnaces. Some companies such as Vickers and Jessop's grew to giant status on the strength of quality cast steel alone, before they adopted other production methods in the 1870s. Vickers had 300 holes capable of melting 40 tons of bar iron a day by the 1870s[202] compared with 90 in 1852 (see Table 5.5). Jessop's had 120 crucible holes in 1835 and 250 by 1872.[203] Firth's had 80 in 1852 and 360 twenty years later.[204] Many firms continued to produce and advertise shear steel as well.[205] The overall secular growth in Sheffield's steel industry was thus a product both of the introduction of new technologies and the improvement and extension of old ones. However, the effect of overseas competition, notably in the bulk steel sector, was to lead to a further change in emphasis in Sheffield's steel industry after about 1880.

vi. Special Steels and Armaments - 1880-1914

Any prospect of Sheffield remaining a leading force in bulk steel producing was ended by the spread of the Gilchrist-Thomas process at home and overseas during the 1880s. The town was able to cope with this competition by falling back on its traditional strengths of innovation and production of high quality steels for special purposes.[206] This was combined with continued increases in scale and fixed capital in certain big firms and even further concentration on markets such as armaments and tool steels. This process of specialisation really began some years before 1880.

a. Special Steels

[202]Tweedale, 1986, 66
[203]Ibid., 51 & 53
[204]Ibid., 35
[205]Pawson and Brailsford, 1879, Advts. passim
[206]Barraclough, 1976, 14; Pollard, 1969, 225

In 1868 Robert Mushet, experimenting with steel alloys, found that addition of Wolfram ore (tungsten) in the furnace produced a steel which was self-hardening in air. It made a very hard metal without the annealing process usually required to enable grinding of a good cutting edge. Mushet's own company, the Titanic Steel and Iron Co. of Coleford, Gloucs. could not sustain viable production of this steel, which had excellent qualities for toolmaking. In 1870 Mushet was introduced to Samuel Osborn, a Sheffield steel manufacturer with premises at the Clyde Works in the Wicker (see next chapter). An arrangement was quickly reached which involved secret preparation of crucible charges in the Forest of Dean, their transportation to Sheffield by circuitous routes and melting and forging at the Clyde Works. Osborn became overstretched in the U.S. market but brought his company round to profitability, establishing the basis for a new sector of the Sheffield steel industry making alloy steels using the crucible process. Robert Mushet Special Steel (RMS) was developed further by Osborn when it was found that hardening in a blast of air produced an even stronger steel than the self hardening process, and the foundation of modern high speed steel manufacturing was laid.[207]

Mushet's experiments were based as much as anything on trial and error. However, a more scientific basis was being laid for the understanding of metallurgy. In the 1860s Henry Sorby, a Sheffield amateur scientist, had begun examining the microscopic crystalline structure of steel. Although this took time to catch on with practical steelmakers, an appreciation of the importance of the chemistry of steelmaking did begin to take hold in the last quarter of the nineteenth century.[208] Sheffield Technical School taught metallurgy from 1884, and evolved into one of the most advanced steel research centres in the world by the end of the 1890s.[209]

Robert Hadfield Jnr. was the first steelmaker to apply a chemist's training to the invention of new steel alloys. Beginning experimentation in 1878, he was able to patent manganese steels in 1883/4, although it took rather longer to find commercial uses for these tough, non-magnetic, electrically resistant alloys.[210] In 1884 and 1886 he patented silicon steels. Their extremely low electrical conductivity made them especially useful for the cores of electrical transformers and similar uses.[211]

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[207]Tweedale, 1986, 58-61; Tweedale, 1987, 66-7
[208]Tweedale, 1986, 7
[209]Ibid.
[210]Tweedale, 1987, 58-60
[211]Ibid., 62

By the early 1880s, companies such as Sanderson's and Edgar Allen and Co. were copying RMS steel.[212] They followed suit with Hadfield's manganese steels in the 1890s.[213] A description of how Allen's did this is part of the case study in Chapter 12 of this thesis. In the 1890s some U.S. firms began to use tungsten-chromium steel to make tools and in 1901 the Taylor-White heat treatment method was introduced to Sheffield by Seebohm and Diekstahl to make this alloy. Hadfield had also been researching chromium steels.[214] Firth's set up a metallurgical laboratory in 1881.[215] After the company partially merged with John Brown & Co., the Brown-Firth's research laboratory was established in 1908. It was here that Brearley discovered the proportion of chromium needed to make stainless steel in 1912/13.[216] Alloys of vanadium, molybdenum and cobalt were also discovered between 1900 and 1914, several of them in Sheffield.[217]

b. Smelting and Ancillary Equipment

To exploit these new metals commercially there was at first little choice but to rely on crucible melting. However, new methods did begin to come into the industry. Often these were imported from overseas, where innovation had begun to move ahead of Britain. In 1890/1 Edgar Allen's equipped their new Tinsley Works with French Robert Apparatus to replace open hearth furnaces. They finally settled on another French system. In 1891 they switched to Tropenas side blown converters (see Chapter 12 below). These are similar in concept to Bessemer converters except that the blast is swept across the surface of the molten metal from tuyeres in the side of the converter vessel. This results in smaller capacity - only one or two tons per blow. They were, however, well suited to making special steels.[218] Allen's also installed a gas fired crucible shop. With this capability, Allen's were equipped to challenge Hadfield's in all their main markets - for example exporting cast steel tramway track structures to America after 1900.[219]

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[212]Ibid., 68
[213]Ibid.
[214]Ibid., 69; Tweedale, 1993, 161
[215]Marshall and Newbould, 1925, 4
[216]Tweedale, 1986, 8
[217]Pollard, 1969, 225; Tweedale, 1993, 161
[218]Brandt, 1959, 117
[219]Tweedale, 1987, 119-20

Hadfield's had been looking for a more cost effective way of melting special steels and considered electric arc furnaces in 1893 but concluded they were too costly.[220] Although Siemens had built the first practical electric arc furnace in 1878[221] and the first electric furnaces were introduced into the U.S. by Firth-Stirling, an American company owned by a Sheffield firm, it was not until 1910 that Edgar Allen's became the first Sheffield manufacturers to install an electric furnace. This was a 3.5 ton Heroult furnace. In 1911 Firth's and Jessop's followed Edgar Allen's lead. By 1916 Vickers were using Heroult equipment and in the following year Kayser Ellison were operating four electric furnaces including two Greaves-Etchells types designed to meet the special needs of Sheffield quality steel makers.[222] There was a disadvantage for Sheffield in electric smelting: the high price of electricity supplies in the town led a number of firms to site new furnaces in Tyneside where power was cheaper in the 1900s.[223]

Electric furnaces were the first real advance on the crucible process for melting special steels,[224] but other types of furnace also began to change during this period. The Chairman of the Sheffield United Gas-Light Co. extolled the virtues of town gas furnaces for:

> tempering blades, annealing German silver and silver goods, steel tool hardening, Britannia metal work, hardening bayonets, forging files, hardening springs, forging crank shafts and annealing steel.

81 such furnaces were installed in Sheffield in 1910 alone.[225] Hadfield's consumed 13 million cubic feet of town gas for all purposes including furnaces in 1913 and 370 million by 1917. Firth's, Vicker's, Hadfield's, Sanderson Bros. and Newbould, Jonas, Colver and Co., Edgar Allen's and Cammell Laird (as Cammell's had become by then) together used 191,588,000 cu.ft. of town gas in 1913 and 979,552,000 in 1917, suggesting the importance of gas fired furnaces for munitions production.[226]

c. Castings, Rolling and the Arms Trade

The increasing power and sophistication of large scale weaponry and armour was the other source of Sheffield's survival as a steel town. Larger

[220]Ibid., 51
[221]Ibid., 46
[222]Ibid., 46-7 & 51-2
[223]Ibid., 212
[224]Pollard, 1969, 225
[225]Roberts, 1979, 29
[226]Ibid., 31

and more complex castings became commonplace in the 1880s and 1890s. Hadfield's and Vickers' large marine castings kept Britain well ahead of the U.S. between 1880 and 1890, particularly after Hadfield's introduced manganese steel castings.[227] Rolling and forging equipment also allowed the biggest firms to produce stronger plate (especially armour) and guns, and to supply the robust equipment needed for the new electric street tramways. 4,000 ton hydraulic presses were in use in 1890;[228] 8,000 ton by 1898.[229] In 1893 W.T. Flather produced the first bright drawn steel bar.[230] Hardened and harveyised steel armour plate was brought into use in 1891/2 in response to the Admiralty's encouragement to expand armour plate capacity.[231] 18" steel plate was being rolled in Sheffield by 1898.[232]

Vickers entered the munitions field alongside Cammell's, Firth's and Brown's.[233] There was a steady demand for armaments throughout the 1890s, only tailing off after the end of the Boer War in 1902.[234] Vickers had started making armour plate in 1888 and artillery in 1890.[235] In 1884 they became involved with the Maxim Gun Company. During the 1890s the firm concentrated more and more on the arms trade. Acquisition of gun, armour plate and torpedo manufacturers followed.[236] Hadfield's pursued a similar course, with the East Hecla Works opening in 1898 to serve the military market almost exclusively.[237]

Other changes in this period concerned the physical organisation of steelworks. In spite of its relatively high cost in Sheffield, the use of electricity for lighting and powering cranes and other electrical equipment assisted the round-the-clock production methods needed to cover the cost of capital investment in large scale plant.[238] Electric power was available generally in Sheffield from 1892, although the Council did not build its Neepsend power station until 1902-4;[239] but steel companies such as Hadfield's had their own generating plant, working 250 electric overhead

[227]Tweedale, 1987, 117
[228]Pollard,1969, 161
[229]Barraclough, 1976, 84
[230]Lodge, 289.14 1985 (
[231]Pollard, 1969, 161 & 164
[232]Barraclough, 1976, 89
[233]Ibid., 164 & 224
[234]Pollard, 1969, 224
[235]Tweedale, 1986, 68
[236]Ibid.
[237]Pollard, 1969, 224
[238]Ibid., 162
[239]Lodge 294.03 ,1988

cranes in 1888.[240] Davy Brothers and Cammell's lit their works electrically in 1881.[241] This source of motive power became increasingly important for machine tools, rolling mills and mechanical furnace charging equipment after 1900.[242]

By 1880, the layout of new steel works was also beginning to change to allow for through flow production methods, as described by the local guidebook:

> Many of the largest works are intersected from end to end by lines of rails, working on which the locomotive engine and the steam crane do all the internal carrying of fuel, material and manufactured goods, effecting thereby a great saving of cost in labour. For the most part the larger works are so arranged that the raw material is received at one extremity, and is delivered in the shape of finished merchandise at the other extremity - an arrangement by which labour is saved and work facilitated.[243]

This approach to the design of works was refined over the next thirty years as it was in the United States, where the resulting cost savings in internal haulage and heat loss were recognised as matching those which might be derived from a favourable raw material assembly position.[244] Hadfield's Hecla Works had extensive internal railways in 1888[245] even though it was not connected to the main line and was contained within a relatively compact site. By the time Steel, Peach and Tozer's Templeboro' Works was planned in 1916, it was possible to organise a linear chain of mills along half a mile of the main railway from Sheffield to Rotherham, with each of the separate elements[246] connected by carefully routed internal railways.[247]

vii. Fluctuations in Trade During the Nineteenth Century

The Napoleonic Wars had closed Sheffield's European markets by 1800 and there was economic distress in the town at least until 1815.[248] During the 1820s, '30s and '40s there was a rising secular trend in the value of Sheffield's trade - for

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[240]Ibid.
[241]Walton, 1948, 189
[242]Pollard,1969, 225
[243]Pawson and Brailsford, 1879, 217
[244]Warren, 1973, 143
[245]Pollard, 1969, 162
[246]Fourteen 60 ton open hearth furnaces, and cogging and billet mills
[247]OS 1:2500 Map , 1921, Sheet CCLXXXIX.14; Lodge, 1986
[248]Walton, 1948, 147-51

example an increase of £1 million in the value of exports between 1832 and 1842.[249] Yet overlaid on this trend was a cycle of booms and slumps and continuing distress throughout the 1820s and '30s.[250] Recovery took place at the end of the war from 1815-16. Then the cycle moved to slump in 1818-20; 1820, recovery; 1825, boom; 1826-31, slump; 1832-6 recovery.[251] The brief boom in 1835-6 was followed by a decline to the disastrous year 1842 when Sheffield experienced its most catastrophic slump of the century, leading to the collapse of the most prominent bank in the town, Parker and Shore in 1843.[252]

From 1849 to 1861 there was a period of economic upswing and prosperity, broken only by recession in 1855 and a short crisis in 1857. This was the period when the light trades in particular saw the peak of their prosperity, which only began to slow down after 1866. There was a brief slump in 1862 and another crisis in 1866, though the light trades tended to escape more or less unscathed. From 1870-3 a boom brought rapid growth, but the prosperity was short lived. From 1874-9 there was a long and deep recession caused by coal shortages, fluctuations in American trade and the aftermath of the Franco-Prussian War, leading by 1879 to extensive part-time working and the closure of many furnaces. 20 limited companies went into liquidation in 1878 alone. 1880-3 saw a recovery, with another depression from 1883-6. Between 1886 and 1892 trade picked up again, only to see the onset of a decline in 1893.[253]

On the whole the heavy trades were less susceptible to trade fluctuations before 1874 because of their momentum of growth. Thus the shock of 1857 hit some firms dependent on American trade, but companies making railway equipment felt no real anxiety.[254] 1870-3 was a particularly strong period for heavy industry.[255] 1871 saw major expansion at Brown, Bayley & Dixon, Brown's, Cammell's, Sanderson's, Andrews, Jowitt's, Vickers and Craven's.[256] The slump of 1874-9 was thus felt especially hard in this sector. The recovery from 1879-83 continued into 1884 for engineering companies and then turned down. The comeback after the depths of depression in 1885/6 was aided by Admiralty orders for armour plate from 1889, but these could not prevent the heavy trades from falling away again from 1891-4.[257] After this, trade climbed back to a minor

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[249] Ibid., 152-3
[250] Ibid.
[251] Childs, 1993, 10
[252] Ibid.
[253] Tweedale, 1986, 59; Pollard, 1969, 125-6; Main, c.1949, 2-6c
[254] Pollard, 1969, 163
[255] Newton, 1993, 40
[256] Pollard, 1969, 163
[257] Ibid., 163-4

boom in 1900-1, falling in 1902-4, rising again to peak in 1907, receding in 1908-9 and rising again by 1913.[258] Within this cyclical economy, however, armaments manufacturers remained prosperous throughout the 1890s, only suffering recession when the Boer War finished in 1902.[259]

viii. Company Sizes and Survival Rates

The life cycle of firms (and thus their locational propensities) was linked in a relatively complex way to this pattern of boom and slump. Although boom years such as 1871 saw expansion, slumps could also feature the creation of new firms or factory extensions. For example, the Firths founded their company in 1842, the year of the worst ever recession in the Sheffield trades.[260] In 1854 the firm was badly hit when the Crimean War ended the file trade with Russia, yet prosperity returned quickly when new American markets were opened up by John Firth.[261] Between 1835 and 1867 (after which figures become patchy because of missing LB), there was a steady demand for large industrial sites in Brightside on the Norfolk Estate. 1.4 large lettings or proposed lettings per annum seems to have been the average. There was a peak of seven in the prosperous year 1860; but smaller peaks of four also in 1854, as a short recession approached, and the slump year 1862.[262] Vickers moved to the River Don Works in 1863, in the immediate aftermath of this recession. J. Edgar Allen and Co. undertook a massive expansion during a period of slump in the early 1890s, capitalising on the new trade in tramway equipment (see Chapter 12). Hadfield's started up during the prosperous year1872, yet still managed to expand business during the 1874-9 depression.[263] It is true that the more normal course of events was the establishment of firms in boom years which then ran into trouble during subsequent slumps;[264] but diversification (often with related expansion) to attempt to combat recession by finding markets for products new to the company, was a tactic adopted by all five undertakings in

[258] Ibid., 224
[259] Ibid.
[260] Marshall and Newbould, 1925, 1
[261] Ibid., 11
[262] Figures derived from transactions and proposed transactions for large steel and engineering company sites identified in Appendices 4 & 5 and listed as follows: Year/Number of Transactions or Proposed Transactions; 1835/1; 1836/1; 1837/1; 1838-40/0; 1842/1; 1843/0; 1844/1; 1845/1; 1846/3; 1847/0; 1848/1; 1849/1; 1850/3; 1851/2; 1852/0; 1854/4; 1855/0; 1856/2; 1857/2; 1858/0; 1859/2; 1860/7; 1861/1; 1862/4; 1863/2; 1864/2; 1865/2. It should be noted that these figures may be incomplete (e.g. the total ground rent bill payable by Brown's in 1877 exceeded the value of leases for which references were found in the Norfolk Estate Agents' Applications Registeres and LB) but cross referencing between LB plans and OS maps shows that the majority of large leaseholds were picked up
[263] Hadfield's Steel Foundry Co. Ltd., 1905, 5 & 7
[264] Newton, 1993, 370 - the Yorkshire Engine Co. Ltd. being the prime example quoted

Newton's case study of financing Sheffield's heavy industry and was almost certainly common practice.[265]

In spite of fluctuations in trade there was a steady rise in the number of steel companies in Sheffield until the last 20 years of the study period. To trace company development, survival rates (important to assess the balance between new firms and relocatees seeking new premises) and location, decennial analysis was carried out of Sheffield trade directories. Sheffield City Libraries keep a series of directories covering the study period. Before 1837 these were produced by a number of different publishers. Thereafter, White's issued regular editions. Where possible the first year of each decade was selected. Exceptions were made in 1828 and 1879 because of directory availability, and in 1837 and 1841, when a check was made to see if the opening of the S&R had an immediate impact. This unscientific lapse yielded suitably unrewarding results. The directories used[266] were:

Robinson's	1797
Wardle and Bentham's	1814-5
Baines's	1822
Blackwall's	1828
White's	1837
"	1841
"	1852
"	1861
"	1871
"	1879
"	1891
"	1901

The trade category selected for analysis was 'Steel Converters and Refiners'. This was used continuously throughout the directories to describe firms involved in steel production. Because of the degree of integration described above, this also encompassed the major firms in the heavy trades. All the giant and large firms synonymous with Sheffield steel are represented, with the exception of John Brown & Co. in 1891 only. While it is impossible to be sure all the smaller firms were encompassed[267] the numbers of firms listed fit well with the analyses by Lloyd-Jones and Lewis based on the Sheffield Rate Books after 1880.[268] The growth in the number of steel converters and refiners is catalogued in Table 5.7. Only after 1891 does the number fall off.

[265]Ibid., 359
[266]See bibliography for details
[267]See Shaw, 1982, for an assessment of the problems of using trade directories
[268]Lloyd Jones and Lewis, 1983 & 1993

The directories also indicate the rate at which firms survived from one decade to the next. As a convention it was assumed that mergers represented the survival of one firm while a changed owner's initial represented inheritance of a firm by a relation. If company address and initial of owner changed, the firm was not counted as a survivor. The results are set out in Table 5.8.

Lloyd-Jones and Lewis adopted a different approach to categorising firms, dividing them into basic producers of iron and steel, cutlery producers and tool/engineering companies.[269] In developing their work they added a further sub-division for cutlery firms also producing tools.[270] They found that 46% of steel makers and 61% of tool and engineering firms survived from 1880 to 1901, based on a population of 247 firms in 1880 and 226 in 1901.[271] For small firms in all sectors the figure was 59%, rising to 62% for cutlery companies in spite of the volatile nature of their trade. These survival rates are high compared with small firms in other areas.[272] The figure for Sheffield cutlery firms may be an over-estimate. Taylor found a 42% survival rate between 1871-84 and slightly over 50% between 1896-1906, though only 19% survived the whole period from 1871-1906.[273] The problem may rest in uncertainty about the definition of what constituted a firm in the cutlery industry, which is notably difficult to establish.[274] Certainly, Newton found that the average life of Sheffield companies after incorporation[275] was 15-20 years, which is considerably more than the average for most English joint stock companies and suggests stability at least in the large firms sector.[276]

Lloyd-Jones and Lewis also studied the size of firms in 1880, 1900 and 1914. This is something which cannot be done from directories and adds a useful dimension, allowing an understanding of the proportion of firms of different sizes which would need accommodation. The most interesting finding is the persistence of the small firm sector throughout the period, with an overlay of giant producers growing in number up to 1914. For all categories of firm, the size profile was as set out in Table 5.9. For steel and tool/engineering companies between 1880 and 1901 the proportions were as shown in Table 5.10.

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[269]Ibid., 1983, 262-3
[270]Ibid., 1993, 213
[271]Ibid., 1983
[272]Ibid., 1993, 215
[273]Taylor, 1993, 201
[274]Ibid., 200
[275]I.e. their 'legal' rather than actual life, thus excluding the period before conversion to limited liability
[276]Newton, 1993, 185-6

The ratio between sizes was 1(Giant):3(Large):7(Medium):9(Small) for steel producers. For tool/engineering firms the balance was 1:1:3:5. Lloyd-Jones and Lewis consider that up to 1901, upward mobility from a large base of small firms was a critical factor which sustained the larger size categories, with a ratio of 4:1 for upward mobility between categories compared with rates of net entry to the businesses.[277] These figures confirm the impressions of contemporary observers that most of the large and giant steel and cutlery firms were small local companies which expanded as a result of technical innovation and increased demand for more sophisticated metal products.

For the years before 1880 we can assume that the proportion of giant and large firms would be smaller. This is borne out to some extent by Newton, who found that the majority of manufacturing industry remained small in scale before 1881.[278] Her figures are not wholly reliable because, as she points out, she analysed numbers employed against manufacturing categories identified in the trade directories, but did not aggregate employment figures for firms which advertised in more than one category.[279] Because many larger firms produced a wide range of products (see above), they are bound to be under-represented in Newton's analysis, which is better regarded as a breakdown of numbers employed to make different product types than as a surrogate for firm size. Nevertheless, her findings do confirm the essentially craft based and small scale nature of production units before the last twenty years of the nineteenth century, even when these units were sometimes managed within larger company structures.

We can conclude that the improving survival rates shown in Table 5.8 demonstrate that in spite of trade cycles which took a toll at times (for example 1841-52) there was a trend towards sustaining a stable core of robust steel firms. New entrants were also significant. Tweedale quotes a Sheffield metallurgist on this topic:

> The Huntsman process ... appealed to the small man who fancied his chances as a steel manufacturer ... any man willing to risk a few hundred pounds might become a steel manufacturer.[280]

New entrants and smaller firms moving into the larger categories would have created demand for premises, either to begin production or expand. In the last

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[277]Ibid., 1983
[278]Newton, 1993, 354-61
[279]Ibid., 359
[280]Tweedale, 1993, 147

two decades of the study period the largest firms began to develop national and international facilities away from Sheffield. Small companies became a higher proportion of the industrial base again, while the giant producers continued to occupy an important place in the industrial structure and follow a path of expansion locally as well as on a wider canvas.[281] Thus, although the number of firms stabilised, some development sites were still required in the period leading up to World War I.

ix. The Organisation of Steel Companies and the Origins of Their Location Decision Makers

In Chapter 3 the effects of organisational change on industrial location were considered. It was also suggested in Chapter 1 that the experiences of decision makers were likely to influence their attitude to location decisions. In this section the changing nature of company structures and management in the Sheffield steel industry is examined, along with the background of the most influential manufacturers.

[281] Lloyd-Jones and Lewis, 1993, 224

a. Company Structure and Organisation

We remarked earlier in this chapter that it took some time for the factory system to emerge in Sheffield, with a semi-mercantile economic culture remaining prominent in the cutlery industry at least until the 1850s. If it was easy for a skilled worker to progress from the status of apprentice or journeyman to 'little mester' it was due as much as anything to the possibility of working with relatively low levels of capital. It was possible to work at public wheels, from a small lean-to workshop, or in a room in another man's factory,[282] selling work to factors or contracting to supply a proportion of an individual's output to one of the larger firms on an outwork basis.[283] By contrast, steel making involved a minimum capital outlay in melting plant, and permanent premises in which to build furnaces.[284] It seems that as a result of this requirement for capital, the early steel companies were frequently either begun as, or developed into, partnerships or undertakings by several members of a family, even where the driving force behind the firm may have been a single dominant entrepreneurial individual. Out of 112 steel converters and refiners listed in White's 1852 Directory, 44 (39.29%) can be identified by suffixes such as Bros. or & Sons as companies which were or which originated as family firms. 51 (45.54%) had the suffix & Co., suggesting involvement in ownership of others as well as the individuals named in the Directory. 40 (35.71%) were or had originated as partnerships, either having one or more partners named in the Directory or being identifiable as partnerships from other sources (see below). Some of the firms in each category also fell into one or more of the other categories - for example Sanderson Bros. & Co., Parkin Bros. & Hodgson. Although this level of detail does not permit one to know how many family firms were run by more than one member of the family, or how many partners in partnerships were active at the time when location decisions were made, there must have been a significant minority of undertakings where decisions rested with more than one person. These companies included most, if not all, of the large producers who were most significant in terms of the amount of land consumed as a result of location decisions. Examples include:

> John Brown & Co. Although set up as a sole trading company by Brown in 1844, he went into partnership in 1854 (or 1859[285]) with William Bragge and John Ellis of Birmingham, with a partnership capital of £14,000. After Brown was removed from the Chairmanship in 1871, Bragge stayed a

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[282]Pollard, 1969, 55; Tweedale, 1986, 80
[283]Ibid.
[284]See quote from Tweedale in preceding section of this chapter
[285]Sources vary, though the former date is more likely as it precedes the move to Brightside

partner until his death in 1884. Ellis continued to chair the company until at least 1903.[286]

Firth and Sons. Established by brothers Mark and Thomas Firth Jnr. in 1842, they were then joined by their father and brother John. The latter two died in 1850 and 1869 respectively and Thomas Firth Jnr. died in 1858. However, two other brothers, Edward and Charles Henry, joined Mark to keep the family concern going.[287]

Vickers. Vickers began as Naylor Sanderson, a partnership which divided into Sanderson Bros. & Co. and Naylor, Hutchinson and Vickers & Co. after a family dispute in 1829. Subsequently Sandersons became a partnership as Sanderson Bros. & Newbould Ltd. Naylor, Hutchinson and Vickers split into Naylor, Vickers & Co. and Naylor, Benzon & Co. in 1863.[288]

Brown, Bayley & Dixon. Set up by John Brown's nephew and other partners with the support of John Brown himself in 1870 to compete with his original company, from which he was separated by the other Brown's directors in the following year.[289]

Henry Bessemer & Co. Bessemer established his works in Sheffield with the active involvement of his partner Longsden and a number of sleeping partners to provide risk capital.[290]

Chas. Cammell & Co. This company was originally Johnson, Cammell and Co., a partnership between Charles Cammell and Thomas Johnson, an accountant.[291] Cammell took on further partners to assist in financing growth in 1855.

Osborn's. In 1875 Samuel Osborn strengthened his firm by taking George Wood, George Jackson Smith, Robert Woodward and Arnold Pye-Smith into partnership.[292]

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[286] Firth Brown, 1903, 1; Tweedale, 1986, 19; Walton, 1948, 191
[287] Marshall and Newbould, 1925, 1 & 4
[288] Marshall and Newbould, 1925, 1; Scott, 1962, 5
[289] Tweedale, 1986, 19
[290] Erickson, 1986, 142-3; Brandt, 1959, 99
[291] Erickson, 1986, 144-5
[292] Tweedale, 1986, 60

Other examples are to be found - see for instance the case study of J. Edgar Allen and Co. in Chapter 12.

The most significant organisational change in the Sheffield steel industry between 1864 and around 1890 was the move towards limited liability and public quotation. Incorporation had been pioneered by colliery companies from 1856, but (with the exception of the Sheffield Co-op Commercial & Manufacturing Co. in 1861) it was eight years before the trend spread to the metal trades.[293] Selected significant undertakings which became limited companies are included in Table 5.11.[294]

Newton identified some 90 firms of all types from the Sheffield and Rotherham area which adopted limited liability between 1856 and 1885, and this is probably a good indication of the scale of incorporations, even though one or two firms such as Firth's and Brown's do not appear in her list. In 1873, iron and steel firms were the largest single group of companies registered.[295] Even so, by 1891 only 29 steel converters and refiners out of a total of 242 (11.98% of the total) advertised themselves as limited companies in White's Directory. Though this included other big firms such as Sam'l Fox & Co., substantial companies like Spear & Jackson and Kayser, Ellison are not in the list. This suggests that although the shareholding in companies may have been widening, the control exercised by shareholders over operational matters would have been very restricted. This view is reinforced by evidence that groups and individuals such as the Firth family, Thomas Jessop, Robert Hadfield, Ellis of John Brown & Co. and the Vickers brothers maintained strong control over their firms after incorporation.[296] Newton found that limited companies rarely attracted investors from outside the local area,[297] that they were usually conversions of existing private companies,[298] and that management thereafter tended to continue on 'private' company lines - a letter from the Manchester capitalist David Chadwick about the establishment of Yorkshire Engine even provided documentary proof that this was a deliberate strategy.[299] Consequently, it seems safe to conclude that this major change in the ownership of key Sheffield companies would have had little effect on location decisions during the study period.

b. Consolidation After 1890

[293]Newton, 1993, 237
[294]For a more comprehensive list, see ibid.
[295]11 out of 17 companies - ibid., 147
[296]Tweedale, 1986, 38, 44, 70, 54; Firth Brown, 1903, 1
[297]Newton, 1993, 236
[298]Ibid., 151
[299]Ibid., 296

One of the marked trends amongst the largest steel companies after about 1860 was vertical integration to take control of raw material supplies and manufacturing companies using the refined steel product. By 1879, Brown's owned iron works at Swinton, two collieries near Rotherham and iron mines in Spain.[300] They added shipbuilding on the Clyde and in Belfast after 1900.[301] Vickers bought the Maxim-Nordenfeldt Gun and Ammunition Company in 1897 and also operated shipyards in Barrow, ordnance works at Erith, Kent, and electrical and ordnance accessories factories in Birmingham. Cammell's merged with shipbuilders Laird Brothers of Birkenhead and became Cammell, Laird & Co. in 1903. Cammell's also bought Davy Bros., the steelmaking plant manufacturers shortly after 1900.[302]

Another important trend, and one which touched firms other than the 'big four' (Cammell's, Firth's, Brown's and Vickers) was horizontal integration through merger and takeover, both within the Sheffield industry and beyond. Although it became more significant after 1890, this was not a new tendency. The takeover of companies' stock and premises on bankruptcy was a relatively common occurrence, as described elsewhere in this thesis. The creation of parallel companies or merger with business rivals was also practised throughout the study period. Sanderson's were involved with U.S. companies from 1840.[303] The Owen's Patent Wheel, Tyre and Axle Co. merged with Hampton and Radcliffe in the early 1870s.[304] In 1865 William Butcher, a Sheffield steel, cutlery and edge tool manufacturer, was engaged in setting up an American works in Philadelphia in partnership with local businessmen.[305]

The pressure of foreign competition, the need for capital investment in ever larger pieces of plant and equipment, and the advantages of scale accruing to heavy industry forced an increase in pace in amalgamations and takeovers in the last decade of the nineteenth century and the early nineteen hundreds. Again, the roots of this movement went deep into the past of the Sheffield steel industry. The decline in profitability of John Brown & Co. after heavy investment in steel forging plant following the falling away of naval orders for armour plate in the mid 1860s had forced the split between John Brown and his fellow directors leading to Brown's departure from the Board.[306] Hadfield's had come close to bankruptcy in 1878 because of the time taken to recoup the cost of new plant

[300]Pawson and Brailsford, 1879, 232
[301]Pollard, 1969, 226
[302]Barraclough, 1976, 72
[303]Tweedale, 1987, 14
[304]Erickson, 1986, 145-6
[305]Tweedale, 1986, 26
[306]Tweedale, 1986, 19

(see Chapter 6 below). The growing cost of investment and the success of foreign manufacturers led to a clustering of steelmaking firms. Jonas and Colver absorbed the 'Universal' and 'Pilot' works in Sheffield and a German company. Seebohm and Diekstahl took over the 'Globe' and 'Eagle' works. Osborn's bought up several smaller firms. Edgar Allen and Co. took over Askham Brothers and Wilson Ltd. in Sheffield and then went on to form the Edgar Allan Manganese Steel Co. by takeover of the Chicago Heights Branch of the American Brake Shoe and Foundry Co. and the Tropenas Steel Company's Delaware plant. Hadfield's also established ties with U.S. companies around 1900. Firth's and Brown's went for a partial merger in 1902/3 after Firth's began to experience problems in obtaining sufficient returns on capital, though this seems to have been perceived by Brown's as an acquisition of Firth's. Firth's also bought a substantial interest in Harland and Wolff in Belfast and in the Firth-Stirling Steel Company in America. Firth's established the Salamander Works in Riga, Russia.[307]

Vertical and horizontal integration may have diversified the overall range of products made by the companies which carried out mergers and takeovers. The trend for larger companies at plant level, however, was towards the increased specialisation exemplified by the concentration on specific product ranges which we have already noted at the East Hecla Works and Templeboro' Mills (armaments), Edgar Allen's (tramway equipment) and elsewhere. This was the next logical step in the progress of factory production, away from the concept of the steelworks as a grouping of sometimes large but often diverse workshops towards the single product-line bulk plant. The trend would have been less marked for small and medium sized companies but could certainly be said to apply to some of the specialist toolmakers. In Sheffield it would usually be denied its full expression by the concentration on special steels and the associated need to be able to handle relatively small customised orders, although the stainless steel plants of the 1970s came close to achieving the ultimate in specialisation.

c. Changes in Management Structures

Our model of steel company development assumes growth from small beginnings with capital accumulating under the guiding hand of an entrepreneur, a small group of partners or a family. As the need for capital injections and the desire to spread risk grew with scale, the circle of investors in the company would be widened by the addition of partners or the adoption of limited liability and the

[307]Pollard, 1969, 226; Walton, 1948, 236; Tweedale, 1986, 7; Tweedale, 1987, 119-20; Firth Brown, 1954

broadening of shareholding by public or private subscription. Even after flotation the dominant figures on company Boards usually remained the same as those who had controlled the company when it was private. We need not assume, therefore, that extension of ownership would have had a significant effect on decision making. Nevertheless, the latter years of the nineteenth century did see changes in the management of steel companies.

For the largest firms, management of the huge forces involved in bulk steel production and heavy engineering had to be done at first by sub-contract and team work.[308] As late as 1908 the rate of wages was:

> ... largely affected by the prevalence of subcontracting ... a foreman or overseer is paid for a job directly by the firm employing him and he is left free to make private arrangements with his 'team' or helpers as to the remuneration which each shall receive; ... he is often allowed to engage or dismiss his men as he pleases.[309]

Some idea of the scale of the problem can be gleaned from the growth in numbers employed by some of the larger companies shown in Table 5.12.

Between 1904 and 1914 at least 8 firms in the heavy industries employed 2,000 workers or more each and a further six between 1,000 and 2,000.[310] The problem of increased organisational scale led to the growth of a supervisory class and the introduction of direct labour control and departmental accounting to assist centralised management.[311] Even the Vickers brothers adopted a flexible cabinet style of management at Board level. Albert Vickers was able to assert with some justification that 'all members of the Vickers board are chosen for professional qualifications which suit them for special duties'.[312]

Erickson has shown that this was a general trend. Her review of the origins and early work of steel company owners and managers nationally is summarised in Tables 5.13, 5.14 and 5.15. Erickson's study had a national focus but included most of the main Sheffield manufacturers. It shows firstly the changing balance from entrepreneurial managers to management by people who inherited companies or were employed by the companies' owners. The largest proportion of those who controlled steel companies were experienced in relevant sectors and could thus be expected to make informed and technically rational judgements.

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[308]Pollard, 1969, 163
[309]Board of Trade, 1908, 409
[310]Pollard,1969, 162 & 226; Tweedale, 1993, 163
[311]Tweedale, 1993, 163
[312]Tweedale, 1986, 70

Origination from within the industry was not true of all. W.G. Armstrong, whose firm was to merge with Vickers later in the twentieth century, began his career as a solicitor. John Firth was an architect. Robert Hadfield Snr. had been a vestry clerk.[313] Nevertheless, most of the Sheffield manufacturers had backgrounds either selling or making steel. Charles Cammell started as an apprentice ironmonger in Hull. John Brown and Samuel Osborn began as factors and merchants of Sheffield files, though Osborn also worked as an apprentice toolmaker and commercial traveller before setting up his own business.[314] Thomas Firth Snr., Thomas Jnr. and Mark Firth all began as steel melters with Sanderson Bros.[315] Daniel Doncaster II, who founded a steelmaking company, was the son of a 'little mester' and began by building his own converting furnace before progressing to crucible and then Bessemer steelmaking.[316] Robert Hadfield Jnr. chose to work as an apprentice steelmaker.[317] Later generations such as Thomas Vickers and Harry Brearley (inventor of stainless steel and sometime works manager for Firth's and Brown, Bayley and Dixon) received formal technical educations.[318]

Although the practical business grounding of most steel manufacturers may have led to corporate cultures which were at times perceived to be parochial and conservative[319] one cannot doubt the technical expertise of these manufacturers, nor the capacity of some of them for innovation or the ready adoption of innovations made by others. Many went abroad to trade, study, set up factories or investigate new technologies.[320] As Erickson points out, and John Brown and J. Edgar Allen[321] exemplify, entrepreneurs may be creative at some stages in their careers and less so at others. The change from entrepreneurial to corporate control structures also makes it less easy to single out entrepreneurs as lone decision makers in many steel firms.[322] Nevertheless it can be argued with confidence that there was nothing inherent in the management or structure of Sheffield steel companies which would lead to illogical location decisions. The changes in the latter half of the century towards more integrated ownership and plant design would, of course, have influenced location decisions. Decision making itself was usually in the hands of people who knew the requirements of steel manufacturing in considerable depth.

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[313] Ibid., 63; Tweedale, 1986, 41; Marshall and Newbould, 1925, 4
[314] Erickson, 1986, 144-5
[315] Marshall and Newbould, 1925, 1
[316] Daniel Doncaster & Co., 1938
[317] Tweedale, 1986, 41
[318] Ibid., 6-9; 65
[319] Erickson, 1986, 143; Tweedale, 1986, 15
[320] Tweedale, 1986, 7, 15, 16, 25, 42, 65, 77
[321] See later case study
[322] Erickson, 1986, 140

Newton has shown that those investing in Sheffield companies (at least between 1851-81) were also likely to be knowledgeable about local industry. She found that industrialists preferred to use internal sources of finance such as recycling profits or (in incorporated firms) calls on shares.[323] She identified a 'capital network' of some 63 investors holding multiple shares in joint stock companies in the area. 87% were from Sheffield or Rotherham; 33% were manufacturers of iron, steel, boilers and wire; and 6% were mining or selling coal.[324] 46% of the directors of the Sheffield Union Banking Company (hereafter Union Bank),[325] which specialised in loans to industrial clients, were manufacturers.[326] In 1872, these directors appointed Dennis Davy, of the Sheffield machine tools company Davy Bros., as a special adviser to the bank's manager and Board on the 'conducting of the Sheffield Trades', to improve their knowledge of local industry still futher. While the Sheffield & Hallamshire Bank followed the national tendency of provincial banks in being relatively cautious about providing capital for industry,[327] it did have some major industrial customers. 58% of its directors were steel, iron, or other metal manufacturers, and 22% were in mining or other forms of manufacturing.[328] Both banks had directors whose own manufacturing companies, or firms in which they held shares, were customers of the banks.[329] Not only were manufacturers themselves likely to have the skills and knowledge necessary to understand the commercial needs of their companies (including location criteria), therefore; there is strong evidence that most of those supplying them with capital would be equally knowledgeable, and just as likely to make rational judgements about the wisdom of entrepreneurs' location decisions.

x. <u>Conclusions About Steelmaking</u>

A number of conclusions can be drawn from the history of Sheffield's steelmaking sector:

a. The technological developments which led to large scale steel production by the big name companies took place against a backdrop of continuity in the use of more traditional steelmaking methods. This would have created the

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[323]Newton, 1993, 300
[324]Ibid., 231
[325]One of four banks with head offices in Sheffield between 1850 and 1885: The Sheffield & Hallamshire, Sheffield Union Banking Company, Sheffield & Rotherham Bank and Sheffield Banking Company - ibid., 44
[326]Ibid., 57-8
[327]Ibid., 136
[328]Ibid., 60 & 80
[329]Ibid., 67 et seq.

potential for the existence of different locational criteria as between different types and sizes of firms. At the very least there would have been a strong incentive for firms contemplating large scale production to compete vigorously for the big, level sites needed to accommodate their plant.

b. The low level of uptake of machine based production methods and corporate organisation by the cutlery industry would have allowed cutlery factories to use sites intensively by building multi-storey premises with trades and crafts demanding lower floor loadings on the upper floors. A good example would be the Electro Works of Walker & Hall. In 1893 their factory, which made electro-plate and all types of cutlery, employed 1,000 people in four and five storey buildings. According to a contemporary these were the result of 'many and frequent enlargements' since the foundation of the firm in the 1840s.[330] This approach to expansion would have reduced land take and could also be expected to encourage locational inertia by permitting expansion upwards on existing sites. This would have reduced competition for land between the cutlery and steel sectors.

c. The organisation of much of Sheffield's metalworking on an outworking and sub-contracting system meant that the number of people employed by a firm was not necessarily reflected in the landtake required for that firm's premises. This was especially true of the light trades. Again this would have tended to reduce competition for land between the cutlery and steel sectors.

d. The fact that the golden age of the cutlery industry was ending, and its growth rate declining from the mid 1860s as the steel industry took off, would have been yet another factor giving the comparative advantage in seeking new sites to the steelmakers.

e. The roots of technological and organisational changes are detectable in most cases well before the widespread adoption of those changes. The emergence of new locational demands may occur at unexpected points in the business cycle from unexpected companies as someone tries to develop a product or method regarded by most other manufacturers as outlandish. Thus specific locational requirements of firms developing or adopting new techniques are likely to become apparent well before they develop into anything like a marked trend for whole sectors of the industry.

[330] Binfield et al, (eds.) 1993, Vol.III, 48

f. Although there was home grown innovation, much of the skill of the Sheffield steel industry was in exploiting the innovations of others (see Table 5.16) and capitalising on them by being able to call on the resources of a skilled workforce to produce very high quality products. The emphasis on quality means one would not necessarily expect manufacturers to seek the least cost solution to a problem. They would tend to seek the least cost consistent with their objective of producing a product of sufficient quality to satisfy their standards of production. That this was sometimes done even at the cost of being excluded from less discerning markets where cheaper competition prevailed is amply demonstrated by the complete collapse of Wostenholm's American business by the end of the nineteenth century, when the firm's directors discovered that '... the Americans make a knife which is apparently good enough for the average American'.[331]

The structure of the steel industry, the nature of its production processes, the rate of innovation and competitive pressure for growth all suggest a sector with high potential for mobility among at least a significant proportion of firms. The large proportion of small companies had little capital and limited expansion potential. Traditionally they would rent workspace rather than owning or leasing a property,[332] though investment in steel furnaces would render them less mobile than many cutlers and toolmakers. Medium sized and larger firms had the potential to own or lease their own factory.[333] The detailed locational effects of this industrial structure are plotted in Chapter 6.

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[331]Tweedale, 1986, 80
[332]Pollard, 1969, 55
[333]Ibid.

4. Sheffield's Urban Growth

This section begins with two cameos of Sheffield. The first, from a local history of 1750, sets the scene before the significant urban expansion in the last quarter of the eighteenth century. The historian described Sheffield as:

> ... a poor, little, dirty mean-built town; the streets were badly pitched, the channel ran down the centre of them, and but few of the causeways were flagged. The houses had gable ends and gutters with protruding spouts, which, during a shower of rain discharged what they received on the heads of the passers by; whilst the scavenger's cart was as yet an unknown luxury. At night the distant lamps dispensed but a feeble gleam ... the workshops had mud floors ... and the chamber above was attained by a ladder ... no glass was in the windows ... [334]

This picture can be contrasted with the description of the town given in a Board of Trade report on working class living conditions in 1908:

> The central district is occupied by the public buildings, the principal business houses and numerous factories engaged chiefly in the cutlery, electro-plate and other trades not requiring very heavy plant. On the eastern and north-eastern side of the city in the districts of Attercliffe and Brightside are the iron and steel works which, though of recent origin in Sheffield as compared with the cutlery trade, have risen to great importance. In this neighbourhood also are the collieries. Many large residences are found in the west and a few in the north, while the south-west is occupied largely by the middle class. Except in certain districts in the west, working-class houses are found in all parts of the city; while, though the factories and workshops are chiefly confined to the centre, the north-east and east, it is impossible to travel far in any district without hearing and seeing the signs of industry ... there is also a fringe of small red-brick houses marking the advance of working class and lower middle-class dwellings into the rural districts ... The recreation grounds are ... numerous and cover a very considerable area ... In recent years extensive street improvements have been undertaken by the Corporation, which is engaged at the present time in clearing a large insanitary area, and in erecting working-class dwellings. The electricity supply and the water supply are in the hands of the Corporation, and the important city markets have also been acquired ... The municipal tramway service is very extensive ... [335]

Sheffield underwent massive and deep seated change over the years between these two descriptions, much of it deriving from the processes described earlier in

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[334] History of Hallamshire, quoted in Pawson and Brailsford, 1879, 46
[335] Board of Trade, 1908, 407

this chapter. Appendix 10 is a chronology setting developments in transport and industrial technology alongside urban change to provide a simple summary of these relationships. We will now see how Sheffield's growing population was accommodated and how the city was shaped.

i. Population Growth

Physical changes in the town were accompanied by the growth in population which characterised most nineteenth century industrial centres. Appendix 7 shows that there were substantial rises in the number of inhabitants in Sheffield in every decade of the study period. The highest percentage growth was in the 1820s when the light trades were making steady secular progress. The 1850s and '60s also saw rapid increases as the heavy trades prospered and raised demand for less skilled labour. The leaner years of the '70s and '80s saw slower population change.

The Appendix also tells the story of suburbanisation. It breaks the population down into Townships, the local government sub-divisions used in Sheffield throughout the nineteenth century (see Figure 5.8). In the 1820s and '30s, numbers living in central Sheffield rose significantly in percentage and absolute terms. There were increases in the western and southern suburban Townships of Ecclesall and Nether Hallam as more people lived away from the centre, and suburbs such as St. George's/Portobello and Shales Moor (Nether Hallam) were being laid out.[336] In the 1850s, '60s and even the depressed years of the '70s this trend continued, but the eastern suburbs of Attercliffe and Brightside showed even more spectacular growth as they accommodated the workforce for the large steel and engineering plants. Towards the end of the century the dawning of the age of commuting by electric tram led to expansion in Nether Hallam and Heeley, accompanied by the increasing popularity of more distant Upper Hallam to the extreme west and the inclusion in the city of Norton to the extreme south.

The change in the distribution of population growth was reflected in patterns of physical development. Figure 5.9 shows a broad brush picture of these patterns, which are discussed in more detail below.

[336]J. Leather's Plan of Sheffield, 1823

ii. Urban Change 1770-1830

Prior to 1830 the population and much of its working environment had been concentrated in a dense area which became the urban core of the town. This lay to the south-west of the Don and Sheaf around the parish church, market place and the southern end of Lady's Bridge. The end of the eighteenth century and early years of the nineteenth saw the beginnings of what might be characterised as suburban growth. An attempt at a dignified Georgian square was made at Paradise Square west of the centre in 1771. A substantial mixed residential and industrial area was developed by the Dukes of Norfolk south of the town centre in Alsop Fields between 1776 and 1793. East of the Sheaf, streets began to be laid out in the Park in the 1790s. This latter development never really thrived and quite quickly developed a reputation for poor quality, short tenure housing. Even in 1888 it was reported to be too inaccessible to provide convenient housing for working class people.[337]

Parliamentary Enclosures began to remove commons and open fields. Ecclesall township was enclosed between 1779 and 1788; Brightside 1788-95; Upper Hallam, Nether Hallam and Heeley 1791-1805; Attercliffe 1810-19. The enclosure of Little Sheffield Moor south-west of the town in 1779 led very quickly to sub-division into allotments for building and the development of the areas to the west and east. In 1795, land north of the Don at the end of Lady's Bridge was enclosed and The Wicker laid out for building. This was the principal (and fortunately very broad) street by which access would be gained to the Lower Don Valley for many years to come. The area round the parish church was also redeveloped in the 1780s.[338]

The town markets and the streets approaching them became severely congested due to the pressure of a growing population. The Howard family obtained an Act in 1784 to purchase property and improve the markets, slaughterhouse and approach streets. These works were finished in 1786.[339] In 1793 the new Infirmary was begun. In 1808 the Town Trustees provided a new Town Hall.[340] Other developments in the town centre were, however, sporadic, speculative and unco-ordinated.[341]

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[337]SCTH, M of E, PP1888 XXII, Q.3525
[338]Walton, 1948, 142-3
[339]Baines, 1822, 293-4
[340]Ibid.
[341]Walton, 1948, 142-3

iii. Urban Change 1830-50

The developments at the end of the eighteenth century and during the early years of the nineteenth tended to create rational geometric grid street patterns in the new suburbs. The next significant building boom in the 1830s and early 1840s produced suburbs of a more Arcadian character and less rigid, more informal structure. The shape of this boom can be deduced from figures published by Holland in 1843 for development of new roads in the various townships from 1831-36 and 1836-41. 156 new roads were projected in the first period, of which 76 were in Sheffield Township, 52 in Ecclesall (Broomhall and Broomhill) to the south-west and 12 in Nether Hallam (Walkley and Crookes) to the west and north-west. Of these 156 projected roads, all but 49 were started by 1843. In the later period, fewer roads - 93 - were proposed and 27 were not yet begun in 1843. 45 of the proposed roads were in Sheffield Township, 32 in Ecclesall and 10 in Brightside. The first half of the decade was the more optimistic, but given that only six streets from both periods were actually finished by 1843 it is clear that these proposed streets liberated a more than adequate supply of building land for the decade and subsequent years.[342]

The suburbs to the south and south-west of the town had a middle class feel, with broad tree lined avenues and large villas. Estates began to be broken up for suburban development at Broom Hill in 1827 and Broom Hall in 1829 with Endcliffe Crescent between them laid out in 1830.[343] In 1840 the cutler and Americanophile George Wostenholm purchased 150 acres south of Broomhall partly for a mansion for himself. He laid out the remaining land on principles based on Kenwood Village near Oneida Lake, New York. This area (Sharrow) was perhaps the only, and certainly the most conscious, attempt to apply town planning (as opposed to estate management) principles to suburban development in nineteenth century Sheffield.[344] Park Hill and East Bank south of the Park also saw the development of middle class housing at this time.[345]

On Crookesmoor and in Upperthorpe west of the central area, more prosaic dwellings appeared for better off artisans and clerks.[346] In general the trend was for these new developments to move west and south away from the cluster of manufactories in and around the town centre where the steam engine was

[342]Holland, 1843, 52-3
[343]Ibid., 168
[344]Tweedale, 1986, 80; Caulton, 1980, 526
[345]Walton, 1948, 168
[346]Ibid.

beginning to be a significant factor adding to the smoke nuisance created by furnaces.

Sheffield did not have the solid feel of a fully developed city as the mid-century approached. It often took several years to fill up building plots in new streets, which would have created a 'gappy' effect in many new suburbs.[347] Until the 1850s and '60s 'there were many small farms within the town and smallholdings right in the heart of the industrial areas'.[348] By 1850, though, virtually all open space had been squeezed out of the area within a mile of the parish church.[349] Better quality working class housing was to be found west of the town centre between West Street and Division Street. The Ponds, the Park, the Crofts and the Wicker provided plentiful supplies of cheap, low quality tenements and houses in poorly drained, unhealthy and densely peopled courts. The population of Sheffield Township lived at an average density of 24 to the acre, but the tightly packed population of these areas exceeded this by a considerable amount.[350]

Some attempt had been made to improve municipal facilities. The Duke of Norfolk had opened a new corn exchange in 1830 and relocated the Shrewsbury Hospital almshouses in 1827 to enable further extension of the markets.[351] However, sanitary conditions remained poor. The only civic building of any dignity was the Cutlers' Hall.[352] By the mid-century two freehold land societies (out of several begun about 1830) had developed estates in Crookes and Upperthorpe successfully. New societies were established in 1849 to develop land in Crookes, Heeley and Walkley[353] all west or south of the town centre. These had a lasting effect on the town's suburban layout.[354]

iv. Urban Change 1850-90

As the heavy industries began to prosper in the mid-century, a new trend emerged in suburban development. Residential areas to the south and west of the town centre such as Hillsborough, Walkley and Heeley did continue to extend. In general they were occupied by skilled artisans and those employed in the light trades which, by and large, expanded in areas immediately around the town centre and districts such as Lowfield and Highfield. In the Lower Don

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[347]See Chapter 11 below on the development of the Norfolk Estate
[348]Blackman, 1963, 93
[349]Pollard, 1969, 4
[350]Ibid., 4 & 15
[351]Walton, 1948, 169
[352]Ibid.
[353]Pollard, 1969, 22
[354]Bacon's Large Scale Plan of Sheffield, 1910

Valley, however, the suburbs of Pitsmoor, Brightside and Attercliffe began to grow to provide cheap, low quality mass housing for employees in the heavy trades.[355] From 1850-71, Pitsmoor, Brightside, Upperthorpe and Walkley experienced greatest growth. From 1871-91 Attercliffe and Heeley took much of the expanding population. The middle and wealthy classes were still moving west.[356] It was in 1860, for example, that Mark Firth pioneered Ranmoor as a residential area and John Brown moved to Endcliffe Hall. They were quickly followed by several other manufacturers and Endcliffe, Ranmoor and Tapton became Sheffield's most exclusive suburbs.[357] In the Park, the Crofts, Pitsmoor and Brightside by contrast, the proportion of industrial workers in the population grew significantly between 1841 and 1871.[358]

So far, suburban development had not really taken Sheffield beyond the size consistent with a 'walking city'. The impact of journeys to work on industrial location will be examined in Chapter 8 below. For the moment we should record that the first horse bus service began in 1852 and the first horse tram route opened in 1873. Both services were run on a private profit making basis and would have been of most benefit to the middle and upper classes.[359] Of 14 bus routes operating in 1862, half served mainly middle class suburbs.[360] The early horse tramways did venture into the working class areas of Attercliffe, Brightside and Carbrook, and Workmen's Cars were running by 1877.[361] Of twelve bus routes then extant, half were still serving wealthier suburbs, and three were serving the artisans' suburbs of Heeley, Walkley, Upperthorpe and Hillsborough.

v. Urban Change 1890-1914

Following the recession of the 1870s and moderate recovery thereafter, the next significant burst of suburban development came at the end of the nineteenth century and into the early twentieth. This expansion certainly took the residential population well beyond the bounds of the 'walking city'. It has been associated by a number of writers with the municipalisation of the tramways in 1896, with the establishment of a standardised policy of low fares (see Chapter 8

[355]Pollard, 1969, 89-90
[356]Caulton, 1980, 517
[357]Tweedale, 1986, 37; Walton, 1948, 225
[358]Passmore, 1975, 116
[359]Pollard, 1969, 90
[360]Passmore, 1975, 121
[361]Sheffield Red Book, 1877, 47

below), and electrification from 1898;[362] though the rate of house building began to rise significantly as early as 1893.[363]

During the last 25 years of the nineteenth century and into the early twentieth the Fitzwilliams developed their Ecclesall estate on the Midland Railway two and a half miles south of the city centre.[364] In the 1890s Meersbrook, Millhouses, Sharrow, Fulwood, Ecclesall, Walkley, Crookes and Firvale all saw vigorous suburban development. In the East End, Brightside and Attercliffe continued to grow, and the eastward march of the larger industrial plants was matched by the development of the remoter eastern fastnesses of Tinsley, Catcliffe, Darnall and Intake. The absorption of Hillsborough and Norton into the city in 1901 demonstrated that their rapid growth had made them integral to Sheffield's suburban ring. New estates at Middlewood and Crookes grew up around tram termini. As well as redeveloping the Crofts, a slum area near the centre of the city, the Council also began to plan housing development in the suburbs. In 1900 it purchased land at High Wincobank for a 'working men's garden suburb', with the first homes occupied in 1906.[365] Following the Housing and Town Planning Act 1909, comprehensive development plans were published in 1911 for similar ventures at Bannerdale, Ecclesall/Abbey Lane and Hillsborough/Wadsley.[366]

vi. Industrial and Commercial Development and Urban Change

There was, of course, a parallel tendency for industrial premises to decentralise and this will be examined in much greater detail in later chapters as the main focus of this thesis. The Board of Trade report quoted above provides a good summary of the result of this process. Many smaller cutlery and other craft based firms remained close to the city centre, although there was a gradual shift away from the urban core into the ring of newer streets in Alsop Fields, Rockingham Street, Portobello, St. George's and Netherthorpe and east of the Sheaf on the edges of the Park. Medium sized firms graduated either northwards to the southern banks of the Don in Millsands, Shalesmoor and (after 1850) Philadelphia or across the river to the Wicker and the northern banks of the Don in Bridgehouses and Neepsend. After the mid-century this size of firm could also be found on land leased from the Duke of Norfolk south of the town centre in

[362]Caulton, 1980, 170; Olsen, 1973, 338
[363]Aspinall, 1977, Fig. 3
[364]Rowley, 1974-7, 202; Cannadine, 1980, 422
[365]Pollard, 1969, 185-6; Hughes, 1959, 3
[366]Ibid., 187; Ibid.

Highfield and Lowfield. For the largest firms the tendency after 1835, but especially after 1845, was to develop works in the Lower Don Valley.

Throughout the second half of the nineteenth century there was a movement eastwards along the railway and canal from Brightside through Carbrook, Grimesthorpe and Attercliffe to Tinsley and ultimately Templeboro' on the Sheffield/Rotherham boundary. Medium sized firms also moved to this area, especially around the canal, Long Island, the Royds area and west Attercliffe. Although industrial premises did not confine themselves to the valley bottoms, there was a perceptible tendency at the most generalised level of analysis for at least the medium sized and larger firms to go for lower lying and more level land. Residential development was far less sensitive to levels and gradually colonised all but the steepest of Sheffield's hillsides.

There is no precise match between residential development and the trade cycle in Sheffield but there are broad linkages.[367] The prosperity of the mid-1830s saw the beginnings of the expansive suburbs which dominated much of the south-west of the city in later years. Again in the mainly buoyant 1850s there was suburban growth. Aspinall's detailed study of housebuilding[368] shows a strong peak in the four years of good trade which preceded the slump of 1874-9, but decline began ahead of the fall in trade.[369]

Although the mid-'70s produced a house building industry more optimistic than its metal industries counterpart in that recovery began before the industrial upturn,[370] there was a more parallel relationship thereafter. There was a marked growth in housing development throughout the later 1890s leading to a rate of housebuilding almost double that of any other year of the century in each of 1898, 1899 and 1900 when the armaments industry was also booming. In Chapter 4 we discussed the extent to which there might be competition between industrial and residential land uses, and the degree to which their building cycles might alternate. If there was competition between industrial and residential land uses in Sheffield the evidence suggests it was closer to being coincident than completely contracyclical.

While new areas of land were being brought into use, there were also changes taking place in the uses of some of the existing building stock and redevelopments taking place in the town centre. We have already noted the

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[367]Aspinall, 1977, 5
[368]Ibid., Fig.3
[369]Ibid., 7
[370]Ibid.

construction of the Corn Exchange in 1830. More will be said of other street improvements later in this section. From 1850 the rate of growth in the resident population of the central area began to decline (see Appendix 7) as it took on more of the characteristics of a central business district. Residences gave way to shops and offices, while in the area on the periphery of the town centre, some houses were converted or absorbed into manufacturing premises.[371] In 1882 and 1887 the Duke of Norfolk bought land from the gas company to extend the markets.[372] One interesting feature which did not seem to change much in spite of consistently high rates of suburbanisation was the link between ownership of manufacturing premises and 'living over the shop'. Passmore found that in both 1852 and 1872, 41% of his samples of employers lived at their place of work.[373] Timothy Caulton found a corollary to this in the proportion of residential premises with workplaces attached in samples of 2,500 homes taken from the rate books for 1871 and 1901 - 10.72% in 1871 and 9.84% in 1901.[374]

vii. Local Government in Sheffield

In Sheffield, municipal authority was fragmented for much of the study period and, as Briggs points out, it never really had the committed social and political leadership during the Victorian period to give it the kind of civic vision found in cities like Birmingham.[375] The result was usually a piecemeal approach to improvement promoted by a small but enthusiastic group of reformers, against strong countervailing forces favouring no intervention by the public authorities if it were at a cost to the ratepayers.[376]

All activity by public bodies would have effects on local taxation. Because of the continued role of the Highways Boards and vestries these effects would be difficult to quantify before 1864, and evenly distributed thereafter. Given the lower standards of road construction reported by Holland in Brightside and Attercliffe, one might expect that highway rates would have been lower for industrialists in that area, but we will see below that the Brightside surveyor was particularly stringent about new construction standards, so this assumption is difficult to verify. The other significant areas of intervention for industrial location decision makers in Sheffield would have been the building and

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[371] Pollard, 1969, 89; personal observation of cutlery factories in the Division Street area and Alsop Fields in the late 1970s
[372] SCTH, M of E, PP1888, QQ.7703-4
[373] Passmore, 1975, 126-7
[374] Caulton, T.J.,Unpublished research progress note, Sheffield, 8th November 1976, copy in author's possession
[375] Briggs, 1971, 36
[376] Barber, 1993, passim

improvement of highways and the control of their use, controls over environmental pollution and the regulation of building. Pollution and traffic management are dealt with in Chapters 6 and 7. Here we will concentrate on highways and building control.

To understand the evolution of Sheffield's local roads it is important to know how responsibility for them changed over time. At the turn of the eighteenth century the parish was still the principal body responsible for local highways and streets.[377] From the toll bars in the suburbs at the end of the turnpikes into the centre of town, the upkeep of the streets fell to the local population. In Sheffield, however, the picture was complicated by the existence of two chartered trusts stemming from a grant by Thomas, Lord Furnival in 1297, subsequently divided in two in the sixteenth century. The Town Trustees administered funds[378] for widening streets, building public recreation grounds, erecting baths and improving sanitary conditions.[379] The Church Burgesses were mainly responsible for the upkeep of Sheffield's parish churches and payment of their clergy, but were also required to spend up to £20 per annum on the upkeep of highways and bridges.[380]

In 1818, a Police (or Improvement) Act was promoted as a local initiative and represents the first real stirring of civic responsibility in the nineteenth century. It created Commissioners to provide a police force, and organise cleansing and lighting the highways in Sheffield Township. Ninety-eight Commissioners, augmented by the Town Trustees and the officers of the Cutlers Company constituted the Commission.[381] Following the General Highway Act, 1835,[382] this Commission was joined by Highway Boards for each of the townships of Sheffield, Brightside, Attercliffe, Ecclesall, Nether Hallam and Upper Hallam. Thus there were several bodies in each Township with responsibility for either making and/or repairing highways, and by and large each left its responsibilities to the others.[383] Nor was there any hurry towards centralised municipal control. The town did not seek a charter under the Municipal Corporations Act, 1835 until 1843, under threat of incorporation in a wider Yorkshire police authority. The Borough came into existence in November of that year.[384] So it was just as

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[377]Dyos and Aldcroft, 1974, 66
[378]Around £1,870 in 1865 and £4,560 in 1873 - Pawson and Brailsford, 1879, 51
[379]Ibid., 51-2
[380]Ibid., 54
[381]Walton, 1948, 168
[382]Dyos and Aldcroft, 1974, 240
[383]Pollard, 1969, 15; Walton, 1948, 174
[384]Walton, 1948, 174

the first signs of large scale heavy industrial enterprise were emerging that the seeds of co-ordinated local government were sown.

The seeds were slow to germinate. At first the Borough Council took on only limited powers to control the police force.[385] Other authorities such as the Town Trustees continued to improve streets.[386] So did the Dukes of Norfolk, using labour supplied by the Board of Guardians to repair roads and form a new street to link the old and new turnpikes in Pitsmoor in 1843.[387] In 1846 the Council resolved not to take responsibility for highways[388] and refused to become involved in improvements to sewers and insanitary housing in spite of a report to the Health Committee recommending action to improve public health.[389] The Sheffield Highways Board did lay new sewers in 1848 in response to the new Public Health Act.[390] As late as 1860 the Council resolved that it was 'not expedient at the present time to consider the most efficient means of improving the sanitary condition of the Borough',[391] following a heavy electoral defeat when it had attempted to introduce a Bill to take over the Highways Boards. Opposition was led by the Chairman of the Sheffield Highways Board supported by the Vestry. It was rooted in attempts by local ratepayers to minimise expense and retain power in the Board and Vestry. The Bill also failed because of bad timing - it was introduced in a period of local recession.[392]

In 1864, a significant change occurred in Sheffield's local government. Because of growing prosperity;[393] the demands which large scale manufacturing and rapid jerry building of houses were beginning to make on the capacity of the urban infrastructure; the influence of two vigorous steel manufacturers as Mayors;[394] and a revival of involvement by professional men (especially solicitors) on the Council[395] following years of domination by parsimonious small freeholders[396] the Council began to take a more central role in the life of the town. When the Dale Dyke Dam collapsed in 1864, Jessop took the lead in the relief efforts and co-ordinating communications with central government.[397] In

[385]Ibid., 183
[386]Ibid.
[387]ACM/LB/A/78 & 128
[388]Walton, 1948, 184
[389]Ibid., 185-6
[390]Roberts, 1979, 17
[391]Briggs, 1971, 237
[392]Barber, 1993, 34-6
[393]This was the year in which John Brown & Co. and Cammell's became public companies
[394]John Brown, 1861 and Thomas Jessop 1862 and 1864
[395]Walton, 1948, 241; Barber, 1993, 37
[396]Pollard, 1969, 15
[397]Amey, 1974, 67 et seq.

that year the Local Government Act of 1858 was adopted. The Improvement (by then known as Lighting and Cleansing) Commissioners and Highways Boards were abolished and a Borough Surveyor appointed.[398]

Building bye-laws were introduced, with the New Works and Plans Sub-Committee of the Highways Committee taking responsibility for approving all significant building projects from January 1865.[399] The Council had no legal authority to control land use, except where it used land itself. The building bye-laws were used simply to enforce basic standards of construction and prohibit back-to-back housing.[400] They would have had no effect on industrial location decisions within Sheffield since they were in force equally across the whole town.

The impact of more ordered municipal authority at this point in the nineteenth century should not be exaggerated. The Corporation faced an enormous task to deal with basic problems such as narrow, incommodious streets and insanitary drainage.[401] The provision of less fundamental municipal facilities such as parks began to feature in the Corporation's work[402] but philanthropic effort remained important. Mark Firth established Firth Park in 1875.[403] For most of the period the Dukes of Norfolk retained ownership of Norfolk Park, opened to the public in 1841.[404] Duke Henry Fitzalan donated over 160 acres of land for public recreation between 1860 and 1917 as well as leasing land at Bramall Lane and Owlerton for cricket and football grounds.[405] Steel manufacturers such as Firth and Jessop, and later Edgar Allen, remained active in promoting charitable undertakings to improve education, health care and accommodation for the elderly.[406]

There was, however, a trend towards greater municipalisation deriving from the effects of legislation and the continuing need for a more sophisticated mechanism to co-ordinate the building and management of infrastructure and other civic necessities for what had become a major urban-industrial complex. After the turn of the twentieth century, radical Liberals and socialists began to exert stronger political influence, with seats on the Council after 1905. This also injected a stimulus for greater intervention and reform.

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[398] Walton, 1948, 207
[399] Aspinall, 1977, Appendix
[400] Walton, 1948, 214
[401] Ibid., 210 & 238
[402] E.g.Weston Park was opened in 1875
[403] Sheffield Red Book, 1877, 81
[404] Walton, 1948, 169
[405] Dictionary of National Biography, Vol.23; Pawson and Brailsford, 1879, 134-5 & 136-7
[406] Tweedale, 1986, 37 & 53

The main fruits of this trend were:[407]

1869 Fire Insurance Companies turn over their equipment to the Police via the Town Trustees.

1872 Medical Officer of Health appointed to comply with provisions of Public Health Act 1848 (following replacement of Privy Council by Local Government Board as enforcing authority in 1871).

1875-84 Council procures disturnpiking of Sheffield turnpike roads.

1884 Combined sewerage system commenced.

1886 First sewage treatment works opened.

1887 Council buys Water Company and commences programme of reservoir construction.

1896 Council takes over tramways.

1897 New Town Hall opened; refuse incinerator constructed.

1898 Council takes over Electric Light and Power Company (founded 1892); first municipal housing clearance and redevelopment begins in the Crofts under Housing of the Working Classes Act 1890.

1899 Council takes over market rights from Duke of Norfolk; Council joins Derwent Valley Water Board.

1900 Council takes responsibility for cemeteries; City boundaries extended; land purchased for High Wincobank garden suburb.

1902 Functions of School Board transferred to Council by Government; Council and local entrepreneurs promote University Charter; Council's Neepsend electricity generating station begun (opened 1904).

1906 First homes occupied at High Wincobank.

1894-1913 Abbeyfield, Millhouses, Whiteley Woods, Bingham, Loxley Chase, Bole Hills and High Hazels Parks purchased by the Council.

In 1893, Victorian Sheffield's municipal organisation reached its zenith when the Crown granted a petition declaring the Borough a City. Although the administrative effect was largely symbolic, this gesture confirmed the importance of Sheffield as a settlement and of its local government as a shaper of the way the city was run and developed physically.

[407] Walton, 1948, 202-39; Briggs, 1971, 237

viii. Gas and Electricity

Neither gas nor electricity were major suppliers of power to the steel industry before the very last years of the study period. Electricity supply is discussed elsewhere in this chapter. The gas industry, however, had an effect on industrial location as a competitor for large industrial sites for gas generation and storage. Apart from the transport undertakings and the collieries (which latter confined their activities above ground to established sites on the edge of the Park and the coal depots already described) the gas companies were probably the largest land users not involved in some form of metal production. Their location strategy is thus of interest in understanding overall industrial land use patterns. Except where stated, information about the gas supply is taken from Roberts' pamphlet.[408]

Sheffield was among the early adopters of town gas, having its first gas supply before 1820.[409] The first gas works was set up by the Sheffield Gas-Light Company on a site in Shude Hill near the Sheaf Bridge. It was selected to provide a reasonable balance between offending the noses of the citizens of Sheffield and providing economical pipe runs to supply them with gas. Proximity to the canal for coal and equipment supplies was also an advantage. Gasholders were brought to the town by boat. Canal water was used to wash gas. The land had already been put to a noxious use before the gas company bought it. The new Police Commissioners were using it as a dung heap.

From initial supplies to 20 street lamps between the Cathedral and Waingate and a few domestic customers and warehouses, demand grew rapidly. New gasholders were added in 1821, 1829 and 1834. In 1835 a number of manufacturers including Rawson, Baker & Co. and Turton's promoted a rival company, the Sheffield New Gas Company. The two companies competed for only three years before agreeing to co-operate in 1838 and merge in 1844 as the Sheffield United Gas-Light Company. The new gas company's works were in Effingham Road between the canal and the Don, convenient for the Duke of Norfolk's coal depots.

There was dissatisfaction with this monopoly and with the quality and regularity of the gas supply in the mid-late 1840s.[410] As a result the Town Council and disgruntled consumers formed the Gas Consumers' Company and began to build a new gas works at Neepsend on the MSLR in 1852. This undertaking lasted

[408]Roberts, 1979
[409]Robson, 1973, 179-81
[410]Walton, 1948, 184

only three years before a dispute about the right to lay pipes led a Parliamentary Committee to press amalgamation under the United Company's control. Thereafter the amalgamated company resisted attempts at municipalisation until well into the twentieth century. Demand grew apace. In 1835, 10-15 million cu.ft. per annum were being consumed. This rose to 150 million in 1854 and 402 million in 1864.

The company needed new premises and purchased a site in Grimesthorpe on the Midland Railway in the Lower Don Valley in 1862 for a new consolidated gas works. Meanwhile, the Neepsend works was extended in 1864, though powers were taken under an Act of 1866 to erect a new works at Grimesthorpe. Work on this had to be suspended in 1868 when it was discovered that mine workings under the site made it unsafe for gas works development. Consumption continued to rise, however, reaching 769 million cu. ft. per annum in 1874. In the early 1890s the technical problems at Grimesthorpe were overcome and two new gas holders erected. A full production plant was completed there in 1898. Although consumption fell by 1.4m cu.ft. per annum by 1903 because of competition from electric lighting, a new gas holder was built at Neepsend in 1903. The fall in demand was soon more than compensated for by growing requirements from domestic cookers and industrial processes. In 1918 some 4,600 million cu. ft. of gas was being produced.

Gas production thus took three large level sites (Effingham Road, Neepsend and Grimesthorpe) with good canal or railway access during the mid-nineteenth century at just the time when the steel industry was growing, and was clearly a competitor for land with the new steel giants.

ix. Highways Improvements

Description of highway improvements has been separated, somewhat artificially, from the broader consideration of urban growth and municipal authority because of its particular significance for industrial location decision makers. Even after the advent of railways, good local road access remained important for even the largest manufacturer. For smaller firms not located by the railway it was vital.

a. Street Improvements Before 1850

As the observer of the town in 1750 (quoted above) noted, the streets of Sheffield in the mid-eighteenth century were narrow, poorly drained and unsuited in any volume to traffic more mechanically sophisticated than the packhorse. During the building boom at the end of the century the streets on the outskirts planned by the Duke of Norfolk's agent Vincent Eyre and local surveyors the Fairbanks family were generally wide and straight for their time. In the central area, efforts to widen the streets by the Town Trustees and the Duke of Norfolk were more than offset by speculative redevelopment by others who clung to existing ownership patterns at the expense of producing a more efficient road network, in spite of local feeling that this did not assist business.[411]

By the 1820s and '30s, when the Improvement Commissioners had been set up, there seems to have been little improvement in the town centre apart from the introduction of gas street lighting in 1819,[412] though the building of the new Corn Exchange and relocation of the Shrewsbury Hospital in 1830 led to some localised rationalisation.[413] Steps had also been taken (mainly by the Town Trustees) to increase and improve the crossing points over the Don and Sheaf. The first crossing (Lady's Bridge) was first built in 1154[414] and widened to 38' in 1768[415]. A second bridge (Washford Bridge) dating from at least 1535 was rebuilt in stone in 1789.[416] This carried the turnpike to Rotherham north eastwards on a line south of the Don. Continuing north eastwards, a new bridge was built across the Don in 1780 to carry New Hall Road.[417] A bridge point at Brightside dated from at least 1328[418] just at the point where Jessop's eventually built their Brightside Works. In 1829 the Town Trust built Blonk Bridge just down river from Lady's Bridge.[419] This gave more direct access from the Canal Basin to the Wicker and the Lower Don Valley.

Up river from Lady's Bridge there were no road crossings of the Don until Wadsley Bridge before 1850. The Iron Bridge, a footbridge, was erected in 1726[420] to link the Nursery with the main town.

In the town centre a bridge also crossed the Sheaf by 1736.[421] It was rebuilt by the Dukes of Norfolk (whose markets were close by) in 1769 and 1801.[422] By 1820 it was dilapidated again[423] and rebuilding began in 1821 under the

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[411]Ibid., 143
[412]Ibid., 168; Roberts, 1979, 8
[413]Tayler's Map of Sheffield, 1832
[414]Roy Davey, 1984, 32
[415]Baines, 1822, 285
[416]Roy Davey, 1984, 41; Sheffield Red Book, 1877, 9
[417]Roy Davey, 1984, 45
[418]Ibid., 41
[419]Ibid., 38
[420]Ibid., 32
[421]Gosling's Plan of Sheffield, 1736
[422]Roy Davey, 1984, 78
[423]Baines, 1822, 285

auspices of the Town Trustees.[424] A parallel bridge was erected to connect the Canal Basin to the town centre in 1819.[425]

Although there seems to have been a good deal of criticism about the state of Sheffield's roads before 1850, the one more objective observer whose record has survived considered that the public roads were in good order in 1840. The indefatigable collector of Sheffield statistics G.C. Holland found that of the town's 262 surfaced public roads (approximately 29 miles) and 117 surfaced private roads (approximately 16 miles) 296 were in good condition and 96 were bad. 78% of the bad roads were private. There was a predominance of square stone and boulder surfacing in Sheffield Township. The parishes of Brightside and Ecclesall preferred macadamised roads, according to the figures in Table 5.17.

The choice of surface presumably reflected the steeper gradients and heavier usage of roads in the central area. About 4/5 of Sheffield roads were surfaced, compared with 1/8 in Ecclesall and only 1/150 in Brightside. Much of the problem of inadequate thoroughfares in Sheffield Township, then, lay with private owners, perhaps because their roads were not finished. Holland records 107 new streets being developed in all townships between 1831-36 of which only 5 were finished, 55 were partly built and 47 were set out only. The main roads were given the lion's share of public resources and the bad roads were relatively unimportant.[426]

Holland also mentions the work of the Town Trust in widening Snig Hill, Campo Lane and Trippet Lane in about 1840-3 - all were roads leading into the town centre from the west and north-west - and constructing New Queen Street to connect Queen Street to West Bar Green in the same locality.[427] Property was bought by the Town Trust in 1848 for further widening of Snig Hill.[428]

b. <u>Street Improvements After 1850</u>

By the 1850s the situation had deteriorated badly.[429] The streets in the town centre were congested, inconvenient, poorly drained and inadequately scavenged.[430] Some ten years after incorporation as a Borough, on 9th March 1853, Alderman Carr laid the first stone of the new Borough Bridge (completed

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[424]Roy Davey, 1984, 78
[425]Ibid.
[426]Childs, 1993, 21
[427]Holland, 1843, 52, 78-9, 84 & 97
[428]<u>Sheffield Red Book</u>, 1870
[429]Barber, 1993, 35
[430]Pollard, 1969, 8-15

1860) which crossed the Don north of the Iron Bridge at the northern end of the new Corporation Street.[431] This was the fruit of the Sheffield Bridges and Streets Act, 1852, the first significant indication of Council involvement in highway improvements, which cut through an old and complex maze of streets in Soho to connect the main north western approach to the town centre along West Bar with Bridgehouses Station on the MSLR north of the Don.[432]

Neepsend Bridge was built by public subscription in 1854[433] to connect Neepsend and Philadelphia. By 1863 it had been joined by Ball Street Bridge down river just north-west of Kelham Island, connecting the industrial areas of Neepsend and Shalesmoor[434] and there was a crossing further up at Hillfoot. Down river from Blonk Street Bridge, the new Norfolk Bridge was built by the Duke of Norfolk to join Long Island with Attercliffe Road in 1856,[435] providing an alternative, though more tortuous, route to Victoria Station and the canal basin from the industrial areas to the east.

Although it is difficult to find evidence of a conscious strategy, the thrust of the improvements in the fifteen years after 1850 was to open up better access from the transport termini to the rest of the town and to allow traffic from the termini to by-pass the town centre. White's Plan of 1863 shows another projected bridge from Attercliffe Road to Victoria Station along Victoria Road, but this was never built. Apart from the major approaches to Victoria Station itself, further significant remodelling of the road network resulting from the development of the railway system took place after 1870, when the Pond Street (later Midland) Station on the Sheffield-Chesterfield Extension Railway was opened. The unsavoury Ponds area was largely swept away. Sheaf Street to the north and Howard Street to the west provided broad new approaches to the station.[436]

A Borough Surveyor was appointed on adoption of the Local Government Act in 1864. Sheffield still did not have a street and drainage system adequate to cope with the demands of an expanding industrial town.[437] Planning got under way for radical improvements to the central streets. These began with the driving of Leopold Street, the Surrey Street extension and Pinstone Street.[438] Pinstone Street provided an essential broad link between the Moor (the principal south-

[431] Sheffield Red Book, 1877, 9-20
[432] Barber, 1993, 34
[433] Roy Davey, 1984, 26
[434] Ibid., 25
[435] Ibid., 40
[436] O.S. 6":1 mile, 1850;, Sheet 294 White's New Plan of Sheffield, 1873
[437] Walton, 1948, 207
[438] Ibid., 238

west route to the town centre) and Fargate. Surrey Street and Leopold Street crossed this axis, linked to the roads serving the Midland Station. By 1897 many tall buildings (including the new Town Hall) had been built to line these new streets.[439] In 1888, Fargate was widened. The widening of the High Street followed in 1892. In 1888 the Council also rebuilt Newhall Road Bridge.[440] This policy of improvement continued into the early twentieth century.[441] By 1910, the development of Brightside and Attercliffe had led to further bridging of the Don downstream of Attercliffe Bridge in the locations described below.[442] Lady's Bridge was widened in 1861.

Much of the town's road system was still being built by private builders and estate developers. The Highway Boards and then the Borough Surveyor imposed strict standards before they would permit private roads to be adopted.[443] This was another way in which public authorities brought about the upgrading of urban capital, albeit indirectly. In some cases it was left to private individuals or companies to effect essential improvements, as when Cammell's bridged the Midland Railway on Sutherland Street and Brown's widened the Carrwood Road Bridge over the railway.[444] From 1900-4 the Sheffield District Railway had to rebuild Brightside Bridge and also constructed at least one of the two bridges (Stevenson and East Coast Roads) connecting its Attercliffe Goods Depot to Brightside.[445] In Grimesthorpe Vickers had to reconstruct the Abyssinia foot bridge to Carbrook to take road traffic in 1907 as a condition of consent from the Council to close local footpaths to allow extension of the River Don Works.[446]

This brief excursion into the role of the public authorities and the development and improvement of the road system leads to a straightforward conclusion. Because of the intermittent and tardy nature of street improvements in the town centre, and the emphasis placed on by-passing the centre when new roads and bridges were built before 1875, there would have been every incentive for manufacturers to move to or locate initially in suburban locations where new, broader streets gave ready access for carts and waggons.

x. Communication of Information

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[439] Ibid.; Bacon's Large Scale Plan of Sheffield, 1910
[440] Roy Davey, 1984, 45
[441] Board of Trade, 1908, 407
[442] Bacon's Large Scale Plan of Sheffield, 1910
[443] ACM/LB/F/958; SCTH, M of E, PP1888 XXII, QQ.8120 & 22
[444] Barraclough, 1976, 60-1
[445] Roy Davey, 1984, 47; SCSDR, M of E, 1896, Q.499
[446] Roy Davey, 1984, 47

In Chapter 3 it was remarked that the communication of information can be an important factor in location decisions. This falls into two main categories: the ability to get information about potential locations and especially the availability of property; and the ability to communicate between headquarters and remote plants.

a. Local Newspapers

The most important means of communication about the local property market were newspapers and bills of sale, and oral communication with local property agents and solicitors. Evidence of oral transmission of information will be found in subsequent chapters.

Local newspapers began to be published in 1754 and were more significant for the advertising they carried than for news.[447] In 1787 the Liberal Sheffield Register (later the Iris) was started, to be followed by the Tory Mercury in 1807. A news reading room opened in 1810.[448] In 1819 the radical Sheffield and Rotherham Independent began to appear. In 1846 the Conservative Sheffield Times emerged. All these were weekly papers but with abolition of the Stamp Tax in 1855 the Sheffield Daily Telegraph went on sale. The Times eventually absorbed the Iris and Mercury in 1873, and bought the Telegraph (which continued to be published) in 1864. The Independent became a daily with the abolition of all paper duties in 1861. The final evolution came in 1885 with the publication of two evening papers - the Conservative Star owned by the Times/Telegraph proprietors and Liberal Sheffield Mail.[449] All these newspapers carried property advertisements so there was no shortage of publications for prospective sellers to find purchasers.

b. Telegraph, Telephones and Post

The postal and telegraph systems developed in Sheffield in parallel with those of the rest of the country. The telegraph arrived with the railway. By 1849 most other major towns in England and several in Scotland could be contacted.[450] The first six pillar boxes to provide more convenient access to the postal system than the central post office in the High Street (moved to the Old Haymarket in 1872) were erected in February 1859.[451] Local post was an important means of

[447] Walton, 1948, 133-4
[448] Ibid., 148
[449] Ibid., 228-9
[450] Head, 1849, 132-3
[451] Sheffield Red Book, 1877, 10; Pawson and Brailsford, 1862, 67; Pawson and Brailsford, 1879, 111

business communication. There were frequent same day deliveries and the Norfolk Estate Agents' letter books show that many business transactions were conducted using this service.[452]

Sheffield was an early pioneer of the telephone, with an exchange before 1882.[453] Employment in the telegraph and telephone services grew from 16 in 1861 to 156 in 1891 (see Appendix 3). It is difficult to trace the adoption of the telephone by individual companies but ephemeral letterheads in the Sheffield archives suggest the larger steel companies were early users. Sheffield's local telephone exchanges were connected into a trunk network serving most of the major British cities by 1892.[454] The consequences for industrial location were that branch plants could be developed more remotely from head office, and the ability to extend the scope of management geographically was increased - no doubt easing the processes of integration described earlier.

5. Conclusion

In spite of difficult topography, which limited choices for communications routes and large scale building, Sheffield's development in the nineteenth century followed a fairly conventional course for an industrial town. Its 'industrial revolution' came later than some of its counterparts which had industries which mechanised sooner. Until the 1890s it did not have a civic leadership which sought to invest public money in symbols of public wealth, or indeed in public necessities more often than not. On the other hand it avoided the fate of some cities which built up a huge public debt.[455] Investment in public infrastructure and urban capital in the town centre may sometimes have lagged behind the needs of industry. However, the rate of suburbanisation allowed for the development of new areas which could accommodate the changing requirements of industrialists for factory locations and provide a wide range of housing for them and their workers. The railway system also failed to invest adequately for much of the century but the locational advantages provided by existing fixed capital and a skilled workforce seem more often than not to have persuaded firms to stay and fill the available land around Sheffield with factories rather than move elsewhere. The rest of this thesis will concentrate on how and why that industrial development came about in the form it did.

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[452] ACM/LB passim
[453] Robson, 1973, 174
[454] Ibid., 177
[455] Briggs, 1968, 237

Table 5.1

Rank Order of Midland Railway Goods Stations With More Than 100 Staff in 1912[456]

Town or City	Number of Staff
London	2,778
Birmingham	1,589
Leicester	870
Manchester	742
Sheffield	686
Bristol	474
Liverpool	438
Leeds	431
Nottingham	417
Bradford	389
Derby	387
Heysham Harbour	187
Rotherham	108

[456] Stations employing more than 100 staff on goods duties, taken from Midland Railway - Classification of Goods Stations, Cost of Living, Etc., signed by J.G.Hodgkinson, Chief Goods Managers Office, Derby, April 1912 - PRO/RAIL 491/1066

Table 5.2

Steel Production Statistics From Available Data Sources, 1835-1905[457]

	Bessemer Steel (Tons)		**Open Hearth (Tons)**		**Crucible (Tons)**	**Puddled (*) & Blister Steel (Tons)**
Year	**National**	**Sheffield**	**National**	**Sheffield**	**Sheffield**	**Sheffield**
1835						12000
1837						18000
1842						16250
1843						21400
1846						26250
1851						35000
1853						40000
1856						51500
1859 &1860					25-30000	25-30000*
1863						78270
1868	110000					
1869	160000					
1870	215000		25000			
1871	329000		28000			
1872	410000		40000		5900	
1873	469000		77500		3300	
1876	700000		128000		3900	
1877	750000		137000			
1878	807527	293000	174000			
1879	834222	210000	174939	21000		
1880	1044020	273000	250913	24000		
1881	1441719	392812	338000	34000		
1882	1673649	420000	436000	42000		
1883	1553380	285763	455500	40000		
1884	1299676	205983	461965	43440		
1885	1304127	233940	583918	47799		
1886	1570520	238950	694150	39500		
1887	2064403	305815	981104	59292	}	

[457]BITA, Burn, Barraclough, Birch & Carr & Taplin

1888	2012794	196406	1292742	81692	} Open Hearth Figures
1889	2140791	255092	1429169	121747	} Include Leeds

Year	Besseme r Steel (Tons) National	Sheffield	Open Hearth (Tons) National	Sheffield	
1890	2014843	293531	1564200	134864	} Open Hearth Figures
1899	1825074	329886	3030251	230115	} Include Leeds
1900	1745004	328934	3156050	257234	} Open Hearth &
1901	1606253	278272	3290791	302999	} Bessemer Figures
1902	1825779	323459	3083288	160086	} Include Leeds

Table 5.2 contd.

Average Steel Output 1881-1905 (Thousands of Tons) (Burn)

	Besseme r 1881-5	Open Hearth 1881-5	Besseme r 1891-5	Open Hearth 1891-5	Besseme r 1901-5	Open Hearth 1901-5
Scotland	0	212	0	472	0	1045
S.Wales	433	138	386	233	396	713
Sheffield & Leeds.	308	41	257	135	318	237
NE Coast	293	23	353	520	350	928
NW Coast	421	21	453	106	581	164
Rest	0	23	98	78	220	229
Total UK	1455	458	1547	1544	1865	3316

Table 5.3

Proportion of Finished Steel Types Produced in Sheffield, 1859-60[458]

Total production 50-60,000 tons p.a., of which:

Puddled and common spring steel	50%
Common cast steel	15%
Cast steel for mill spindles,spades, shovels etc.	10%
Better quality cast steel	10%
Good quality cast steel	10%
First quality cast steel	4%
Extra quality cast steel	1%

458Barraclough, 1984, Vol.2

Production capacity of 6 main works - 5,000 tons p.a. each.

Table 5.4

Sheffield Works Adopting the Siemens-Martin Process - Number of Open Hearth Furnaces[459]

	1882	1886	1890
Vickers	10	10	10
Cammell's	6	9	5
Brown's	4	2	2
Albion Steel & Wire Works	2	2	2
Firth's	-	3	3
Osborn's	-	2	2
Brown, Bayley & Dixon	-	1	1
Bessemer's	-	-	1

Table 5.5

Converting and Refining Capacity of Six of Sheffield's Largest Steel Producers, 1852[460]

	Converting Furnaces	Melting Furnaces (No. of Holes)
Wm. Jessop & Son	10	120
Naylor, Vickers & Sons	8	90
Sanderson Bros. & Co.	10	110
Thos. Firth & Sons	?	80
Thos. Turton & Sons	11	48
Johnson, Cammell & Co.	6	40

[459] BITA, 1883, 155; 1887, 46; 1891, 33
[460] Pollard, 1969, 80

Table 5.6

Bessemer Converters in Use and Idle in Sheffield and District 1882-90[461]

Company	1882 In Use	Idle	1883 In Use	Idle	1886 In Use	Idle	1890 In Use	Idle
John Brown & Co.	2	2	2	2	2	2	2	-
Sam'l Fox & Co. (Stocksbridge)	4	-	2	2	2	2	2	2
Steel, Tozer & Hampton (Rotherham)	4	-	2	2	2	2	2	2
Chas. Cammell & Co.	8	-	8	-	6	2	4	4
Wilson Cammell (Dronfield)	4	-	-	-	-	-	-	-
Brown, Bayley & Dixon	2	2	2	2	2	2	2	2
Hy. Bessemer & Co.	2	2	2	2	2	2	2	2
Total	26	6	18	10	16	12	14	12

Table 5.7

Numbers of Steel Converters and Refiners in Sheffield, 1797-1901

Year	Number of Firms
1797	16
1814-5	29
1822	55
1828	54
1837	79
1841	84
1852	112
1861	139
1871	168
1879	246
1891	242
1901	212

[461]BITA, 1883, 36; 1884, 36; 1887, 133; 1891, 106

Table 5.8

Survival of Steel Converters and Refiners

Years From	To	Total Number of Survivors	Percentage of Firms Surviving
1797	to 1814-5	7	46.67
1814-5	to 1822	20	68.97
1822	to 1828	23	41.82
1828	to 1837	25	46.29
1837	to 1841	44	55.70
1841	to 1852	43	51.19
1852	to 1861	66	58.93
1861	to 1871	78	56.11
1871	to 1879	105	62.50
1879	to 1891	151	61.38
1891	to 1901	164	67.76

Table 5.9

Sizes of Sheffield Metal Companies 1880-1914[462]

	1880	1901	1911
Small (RV £1-150)	182 (57.1%)	193 (53.2%)	234 (64.6%)
Medium (RV £151-500)	92 (28.8%)	113 (31.1%)	74 (20.5%)
Large (RV £501-1,500)	29 (9.1%)	38 (10.5%)	32 (8.8%)
Giant (RV 1,501+)	16 (5.0%)	19 (5.2%)	22 (6.1%)
Total	319 (100%)	363 (100%)	362 (100%)

Table 5.10

Sizes of Sheffield Steel and Tool/Engineering Companies, 1880-1901[463]

	Basic Steel Producers		Tool/Engineering Firms	
	1880	1901	1880	1901
Small	28 (46.7%)	31 (48.4%)	77 (52.0%)	80 (47.3%)
Medium	21 (35.0%)	21 (32.8%)	43 (29.1%)	56 (33.1%)
Large	8 (13.3%)	9 (14.1%)	16 (10.8%)	17 (10.1%)
Giant	3 (5.0%)	3 (4.7%)	12 (8.1%)	16 (9.5%)
Total	60 (100%)	64 (100%)	148 (100%)	169 (100%)

462 Lloyd Jones and Lewis, 1993, 223
463 Ibid., 214

Table 5.11

Main Flotations of Sheffield Steel and Other Metal Companies

Company	Year Incorporated	Paid Up Capital
John Brown & Co.	1864	£1 million
Chas. Cammell & Co.	1864	£1 million
Yorkshire Engine Co.	1865	£200,000
Vickers	1867	£155,000
Joseph Peace & Co.	1868	£50,000
Brown, Bayley & Dixon	1873	£500,000
Hallamshire Steel & File Co.	1873	£60,000
Kelham Rolling Mills	1873	£100,000
Cardigan Iron & Steel Wire Co.	1873	£60,000
William Cooke & Co.	1873	£16,000
Davy Bros.	1874	£100,000
Cocker Bros.	1875	£60,000
Wostenholm's (cutlers)	1875	£100,000
Henry Bessemer & Co.	1877	£120,000
Thomas Firth & Sons	1881	?
William Jessop & Sons	1885	£400,000
Hadfield's Steel Foundry	1888	£110,000

Table 5.12

Employment Growth in Sheffield Steel Companies[464]

Company	**Year**	**Numbers Employed (approx)**
Brown, Bayley & Dixon	1871	1,000
	1872	1,500
	1914	800+
John Brown & Co.	1856	200
	1863	2,500
	1872	5,000
	1914	5-6,000
Thos. Firth & Sons	1842	20-30
	1857	500
	1890	2,000
	1914	3,100

[464] Various sources

Company	Year	Numbers Employed (approx)
Chas. Cammell & Co.	1844	20-30
	1865	3,000
	1872	4,000
	1914	5-6,000+
Vickers	1865	800
	1890	2,000
	1914	5-6,000+
Hadfield's	1890	4,000
	1914	5,690
Steel, Peach & Tozer	1883	450
	1914	1,800
Jessop's	1890	1,200
	1914	2,000
Thomas Turton	1865	1,000
Sam'l Fox (Stocksbridge)	1914	2,000
Jonas & Colver	1914	1,500
Samuel Osborn	1914	1,000
J. Edgar Allen	1914	400+

Table 5.13

Review of Origins and Career Progression of Steel Company Managers and Owners[465]

Type of Career	Percentage Distribution		
	1865	1875-95	1905-25
Independent (i.e. founded own works)	56	35	15
Family, or invested in going concern (i.e. those who inherited their position or whose careers arose from their financial investment. Excludes sleeping partners and others not engaged in active management)	30	37	51
Salaried administrator (primarily employees)	11	24	30
Professional (independent professionals)	3	4	4
Total	100	100	100

[465]Erickson, 1986, App. C

Table 5.14

Early Work of Steel Manufacturers[466]

Type of Work	Percentage Distribution		
	1865	1875-95	1900-25
Partner or Owner	26	21	19
Director	0	2	6
Clerical	15	15	13
Sales	7	11	5
Managerial	4	10	12
Manual Work or Apprentice	13	4	2
Metallurgist/Laboratory Assistant	0	3	5
Engineer/Apprentice Engineer	24	21	20
Law	4	5	7
Accountancy	0	1	3
Other Professional	3	6	7
Other	3	1	1
Total	99	100	100

Table 5.15

Type of Work Done by Steel Manufacturers During the First Part of Their Careers;[467]

Type of Industry	Percentage Distribution		
	1865	1875-95	1905-25
Iron or Steel	40	53	46
Engineering and Finished Metal Trades	21	12	12
Mining	11	9	11
Railroads or Shipping	11	6	6
Unrelated Industry or Commerce	7	8	4
Banking and Insurance	0	2	3
Professions	9	10	18
Total	99	100	100

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[466]Ibid., 56
[467]Ibid., 63
[468]Ibid., 63

Table 5.16

Sources of Major Innovations in Sheffield Steelmaking Technology up to 1914

Within Sheffield and District	Outside Sheffield and District
- Crucible Steel[469]	- Cementation Steel
- Armour Plate Rolling	- Shear Steel
- Manganese Steel	- Steel Casting (though note Hadfield's development of the technology)
- Stainless Steel	- File Making Machinery
- Air Hardened Tungsten Steel	- Tungsten Steel
- Bright drawn bar steel	- Puddled Steel and Iron
- Vanadium high-speed steel	- Bessemer Steel
- Silicon Steel	- Open Hearth Steel
	- Basic Steelmaking
	- Nasmyth Steam Hammer
	- Electric Furnaces
	- Side Blown Converters (Tropenas process)
	- Tungsten-Chromium Steel (Taylor-White heat treatment process)
	- Hydraulic Press

Table 5.17

Types of Road Surface in Sheffield (Miles/Furlongs/Poles)

	Brightside Township			Ecclesall Township		
	M	F	P	M	F	P
Square Stones	0	0	17	0	3	24
Boulders	0	0	32	3	3	18
Macadamised	19	1	26	28	0	38
Total	19	2	35	32	0	0

[469]Stretching a point to count Doncaster as part of the Sheffield district

Figure 5.1 (following page)

Topography of Sheffield and District

Contours at 100 ft. (30.5 m) intervals

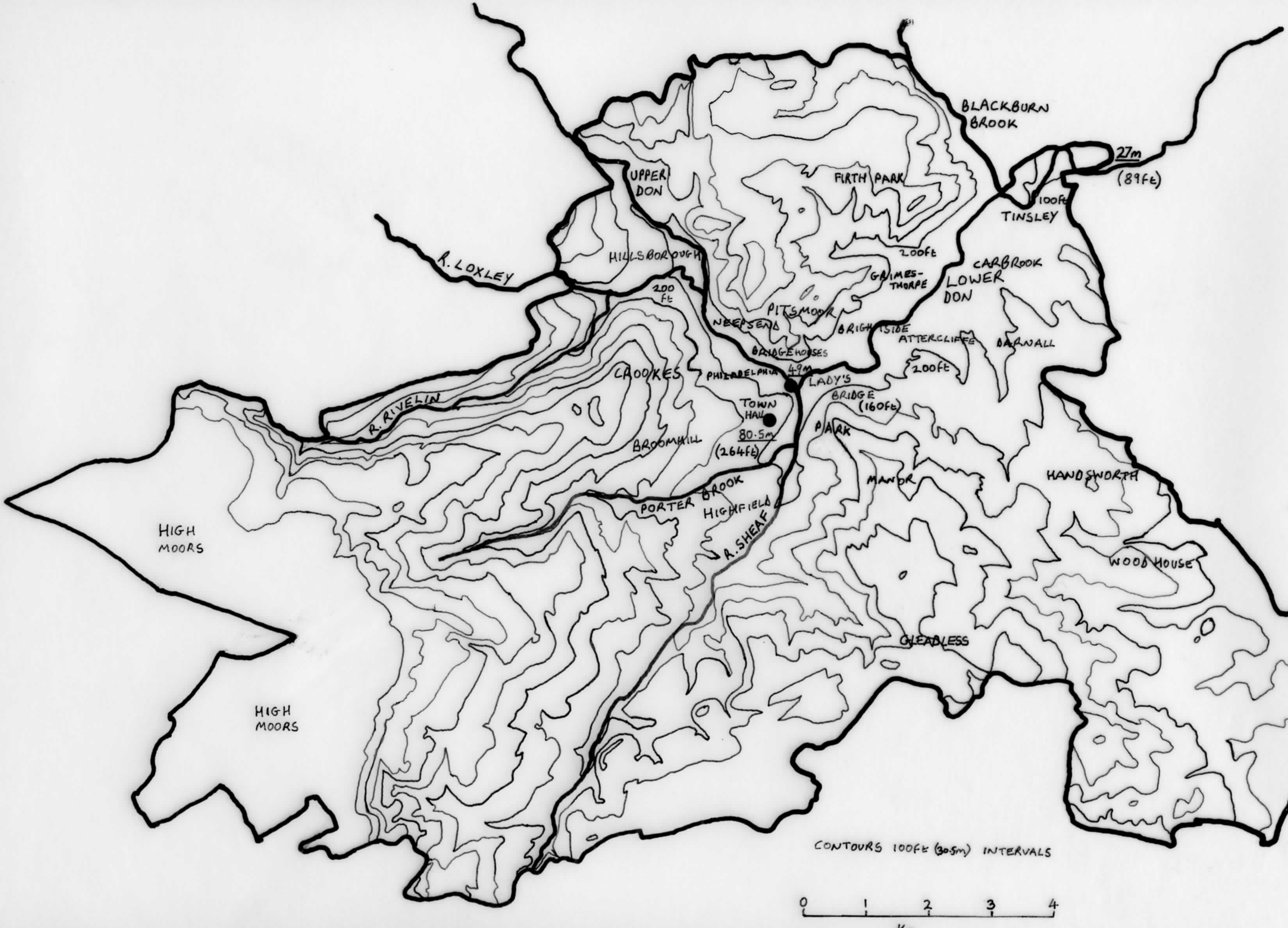

BLACKBURN BROOK
27m
(89ft)
100ft
TINSLEY
UPPER DON
FIRTH PARK
200ft
R. LOXLEY
HILLSBOROUGH
CARBROOK
GRIMES-THORPE
LOWER DON
200 ft
PITSMOOR
NEEPSEND
BRIGHTSIDE
ATTERCLIFFE
DARNALL
BRIDGEHOUSES
200ft
49m
CROOKES
PHILADELPHIA
LADY'S BRIDGE
(160ft)
R. RIVELIN
TOWN HALL
80.5m
(264ft)
PARK
BROOMHILL
MANOR
HANDSWORTH
PORTER BROOK
HIGHFIELD
R. SHEAF
HIGH MOORS
WOODHOUSE
GLEADLESS
HIGH MOORS
CONTOURS 100ft (30.5m) INTERVALS
0
1
2
3
4
Km

Figure 5.2 (following page)

Turnpike Roads - Routes through Sheffield

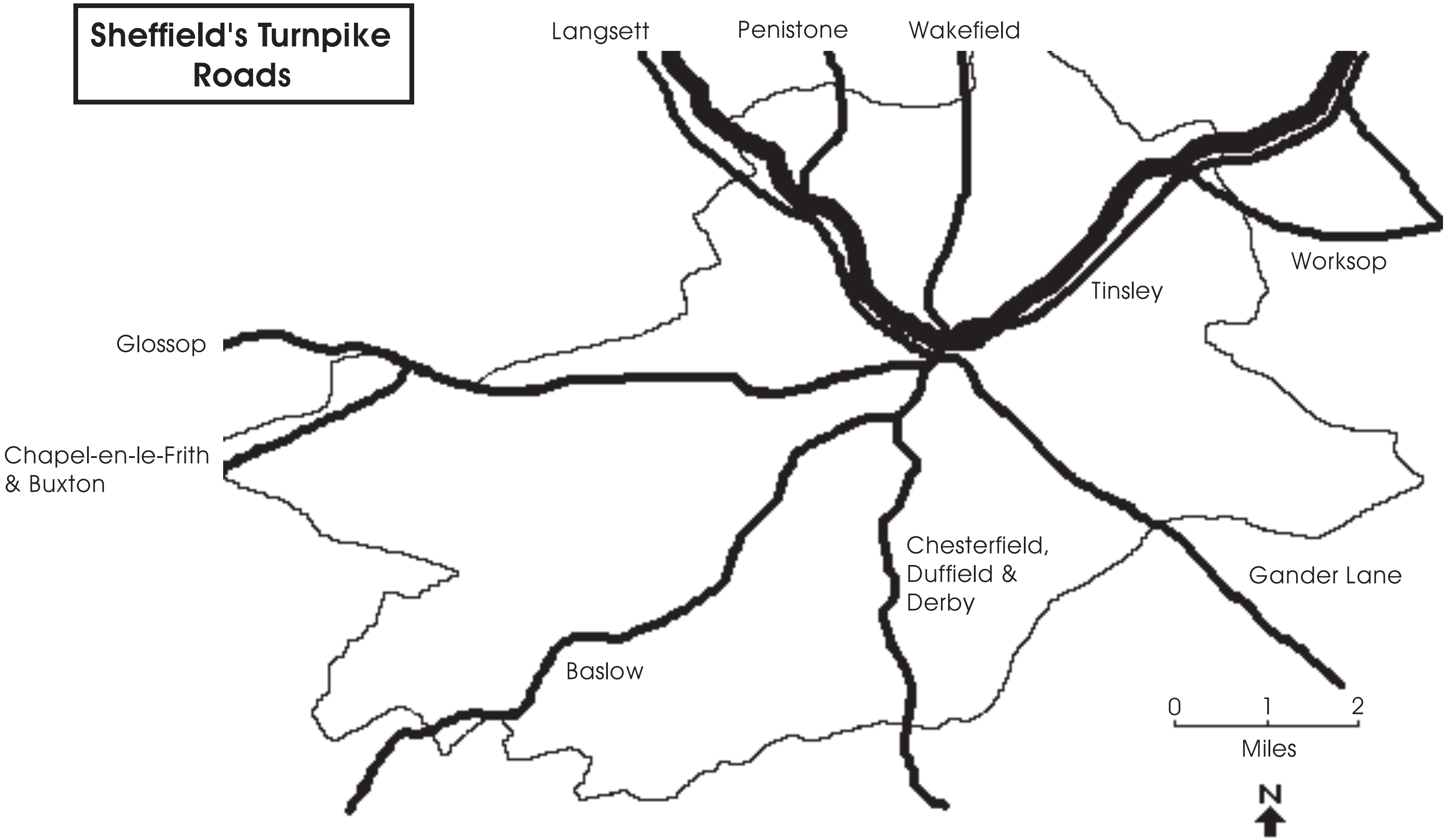
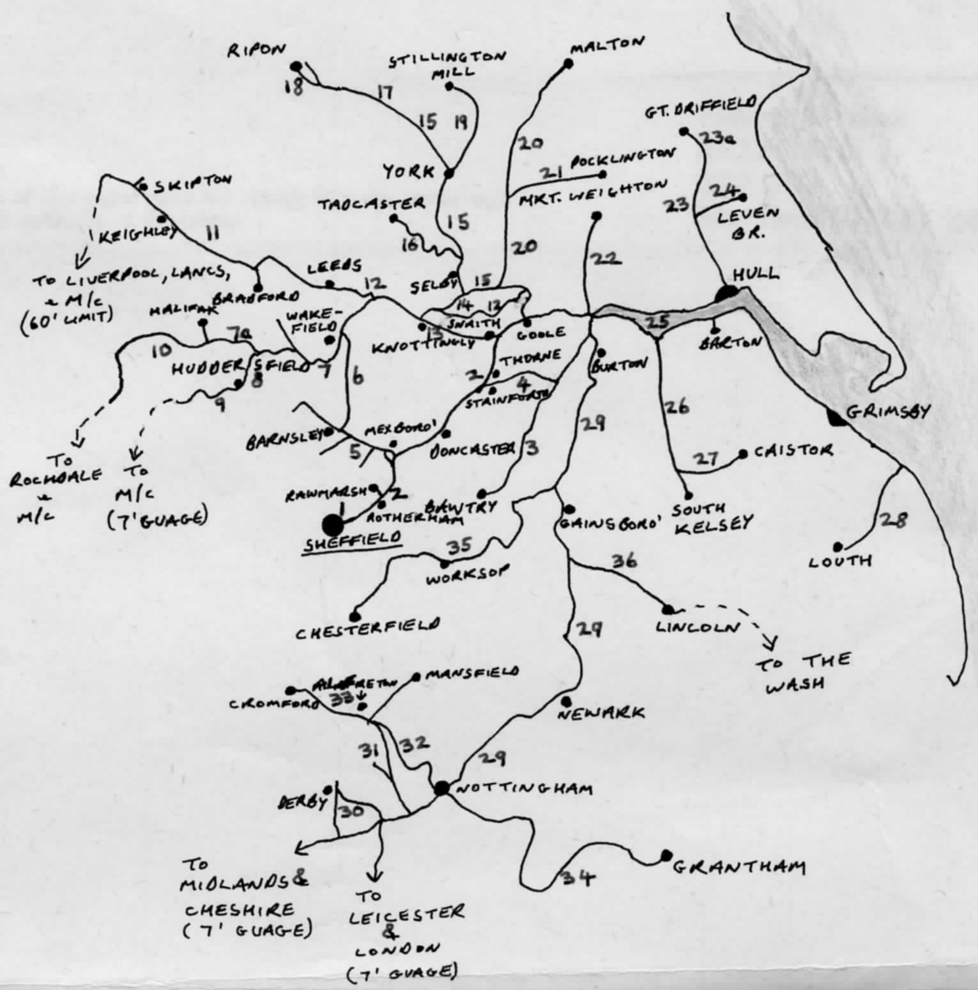

Sheffield's Turnpike Roads
Langsett
Penistone
Wakefield
Worksop
Tinsley
Glossop
Chapel-en-le-Frith
& Buxton
Chesterfield,
Duffield &
Derby
Gander Lane
Baslow
0
1
2
Miles
N

Figure 5.3 (following page)

Waterway Connections to Sheffield in 1822



<u>Figure 5.3</u>

<u>Waterway Connections to Sheffield in 1822</u>

1	Sheffield Canal	13	Knottingley & Goole Canal	25	River Humber
2	River Don Navigation	14	Selby Canal	26	Ancholme Drain & Navigation
3	Old River Don	15	River Ouse	27	Caistor Canal
4	Stainforth & Keadby Canal	16	River Wharfe	28	Louth Canal
5	Dearne & Dove Canal	17	River Ure	29	River Trent
6	Barnsley Canal	18	Ripon Canal	30	Derby Canal
7	Calder Navigation	19	River Foss	31	Erewash Canal
8	Huddersfield Broad Canal	20	River Derwent	32	Nottingham Canal
9	Huddersfield Narrow Canal	21	Pocklington Canal	33	Cromford Canal
10	Rochdale Canal	22	Market Weighton Canal	34	Grantham Canal
11	Leeds & Liverpool Canal	23	River Hull	35	Chesterfield Canal
		23a	Driffield Canal	36	Fossdyke Canal leading to Witham Navigation
12	River Aire	24	Hull & Leven Canal		

Figure 5.4 (following page)

Destinations of Coal from R.C. Clarke's Silkstone Collieries by Canal from Randomly Surviving Bills of Lading and Boatmens' Orders

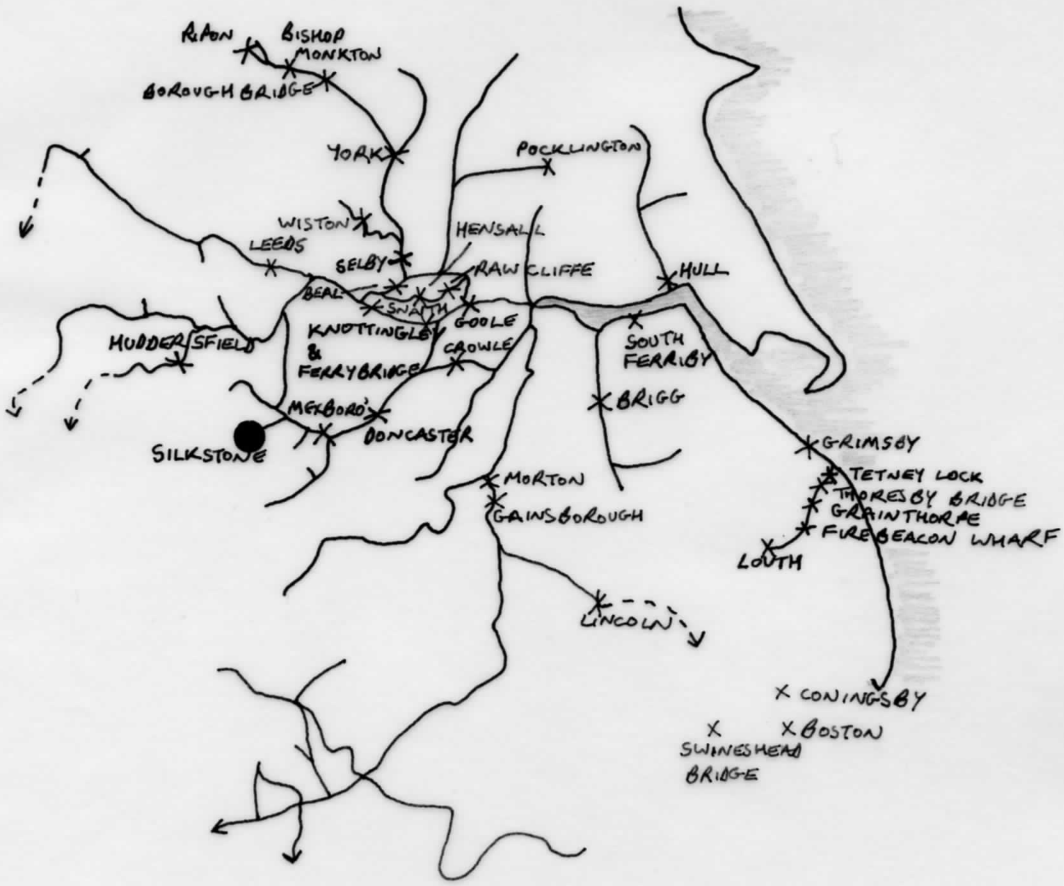


Figure 5.4

Destinations of Coal from R.C. Clarke's Silkstone Collieries by Canal, from Randomly Surviving Bills of Lading and Boatmens' Orders 1833-46 (SC/CR 135-40, 142-4, 149-51)

Figure 5.5 (following page)

Chronology and Geography of Public Railway Development in Sheffield, 1838-1900

Figure 5.5

Railways Serving Sheffield's Industrial Districts - Key to Ownership and Dates

Railway	**Ultimate Owner**	**Enacted**	**Work Begun**	**Opened in Sheffield**
Sheffield & Rotherham (S&R)	MR	Jul 1836	Jan 1837	Oct 1838
Sheffield, Ashton-under-Lyne and Manchester (SAMR)	MSLR/GCR	May 1837	Oct 1838	Jul/Dec 1845
Sheffield and Lincolnshire Junction (SLJR)	MSLR/GCR	Aug 1846	Oct 1846	Feb 1849
South Yorkshire Railway (SYR) to S&R at Tinsley	MSLR/GCR			Sep 1854
SYR Tinsley to Darnall	MSLR/GCR		1861	Aug 1864
MSLR Tinsley to Rotherham	GCR			1868
MR Brightside to Chesterfield	MR	Jul 1864	Jul 1865	Feb 1870
MR Dore to Manchester	MR			1893
MR Blackburn Valley Line	MR			1893
London and North Western (LNWR) Nunnery Goods Branch	LNWR			May 1895
Sheffield District Railway (SDR)	MSLR/GCR	Aug 1896	Nov 1896	May 1900
LNWR City Goods Branch				Feb 1903


BARNSLEY
SYR
1854
MR 1897
ROTHERHAM
1838
SYR
1864
MSLR
ROTHERHAM
1868
MANCHESTER
SDR
1900
TREETON
S&R (MR)
1838
SDR
1900
SYR 1864
S&R (MR)
1838
MR
1870
MSLR
1845
1849
CANAL
1819
1849
MSLR 1849
MSLR
1849
1870
LNWR 1895
1903
NOTTINGHAM
MR
1870
CHESTERFIELD

Figure 5.6 (following page)

Locations of Railway Goods Stations in Sheffield

Figure 5.6

Sheffield Goods Stations, Yards and Depots - Key to Station Names, Dates and Ownership

No.	**Station**	**Date Opened**	**Original Company**	**Notes**
1.	Wicker	1838	S&R (MR)	Spital Hill Tunnel connection to Bridgehouses begun 1846; Became goods only 1870; Improved 1875 & 1892 (new depot for timber, stone, coal in Upwell St.)
2.	Bridgehouses	1845	SAMR (MSLR)	Became goods only 1851
3.	Park	1855	MSLR	Initially goods branch only; Depot built 1865
4.	Pond Street	1870	MR	
5.	Queens Road	1892	MR	
6.	Broughton Lane	1864	SYR	
7.	Nunnery	1895	LNWR	Originally named City; 40 ton truck capacity; Siding & engine shed
8.	City	1903	LNWR	10 ton wagon capacity
9.	Blast Lane (originally Nunnery Coal Depot)	18th Century	Sheffield Colliery	Initially a yard for the Duke of Norfolk's Sheffield collieries, became a goods station in early 20th century
10.	Attercliffe Goods Station	1900	SDR	40 acres; 400 wagon yard; 35 ton crane capacity
11.	Salmon Pastures Coal Yard	Between 1863-73	Sheffield Colliery	
12.	Nunnery Colliery Yard (Soap House Depot)	Before 1832	Nunnery Colliery	Grew considerably through 19th century; named after Palissy Oil Grease and Soap Works which sttod adjacent
13.	Bernard Road Sidings	c.1865	MSLR	
14.	Attercliffe Sidings	1860 (date of land purchase)	MR	
15.	Brightside Sidings	1870 (date of land purchase)	MR	
16.	West Tinsley Goods Station	1900	SDR	

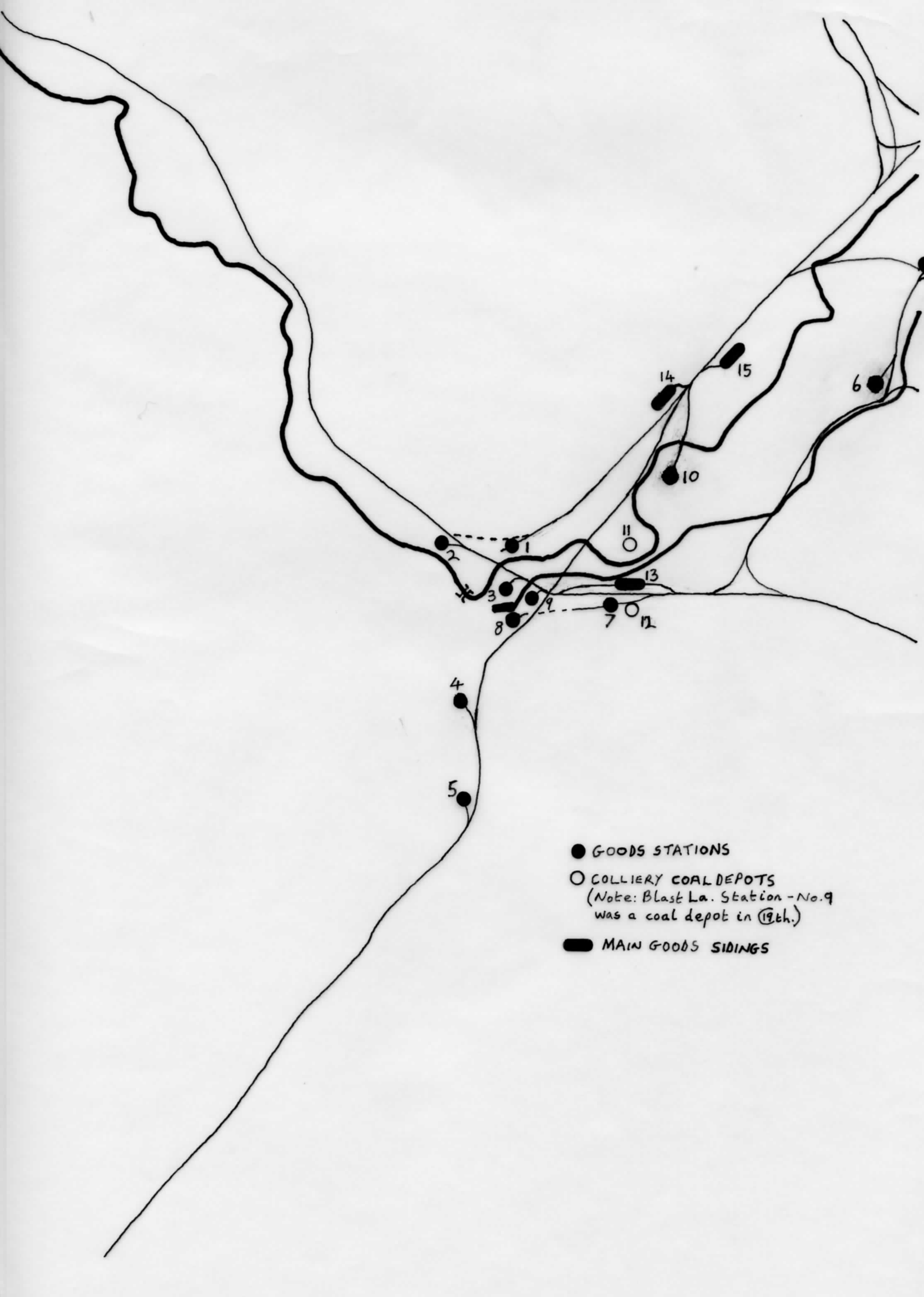
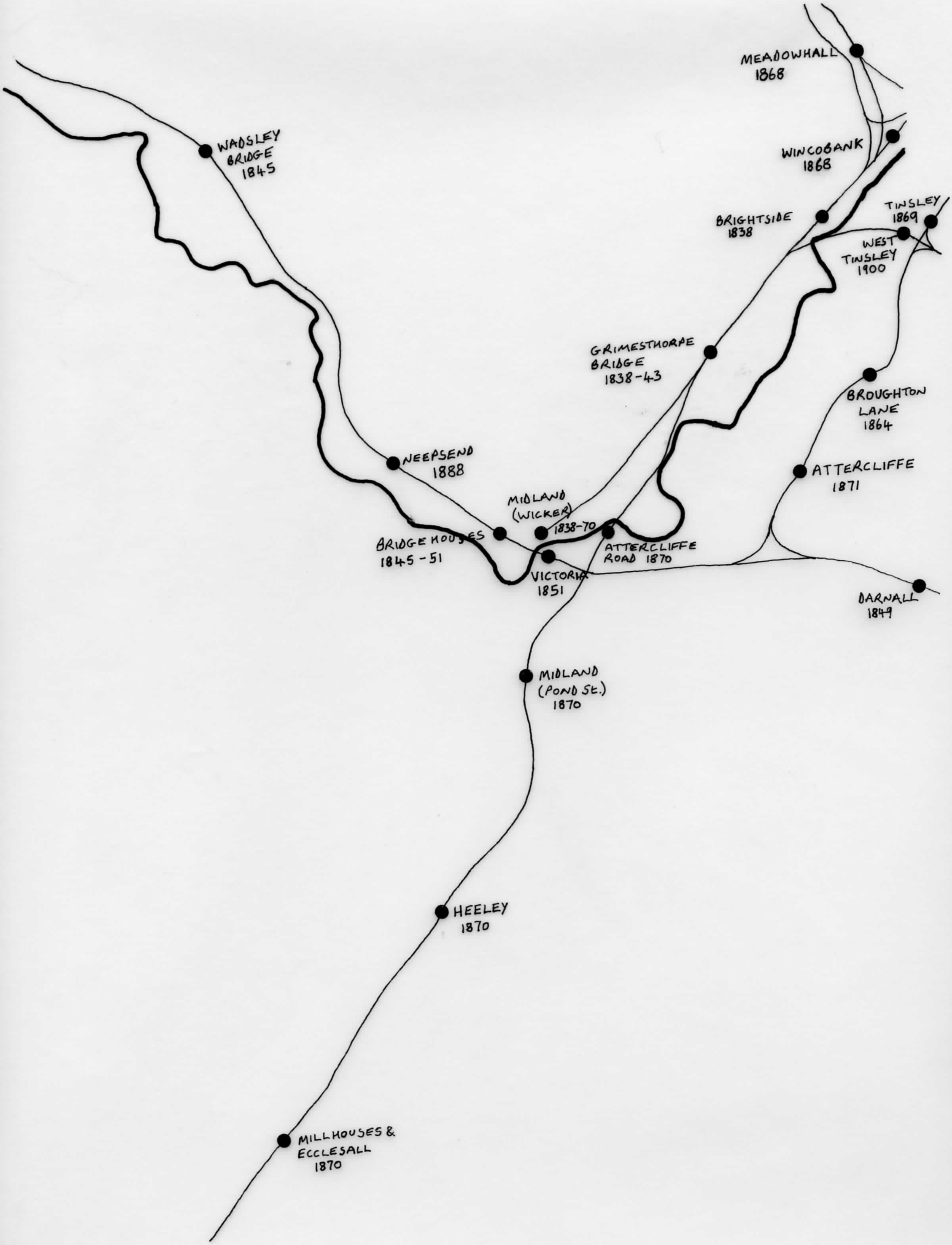

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
GOODS STATIONS
COLLIERY COAL DEPOTS
(Note: Blast La. Station - No. 9
was a coal depot in 19th.)
MAIN GOODS SIDINGS

Figure 5.7 (following page)

Locations of Railway Passenger Stations in Sheffield



WADSLEY BRIDGE 1845
MEADOWHALL 1868
WINCOBANK 1868
BRIGHTSIDE 1838
TINSLEY 1869
WEST TINSLEY 1900
GRIMESTHORPE BRIDGE 1838-43
BROUGHTON LANE 1864
NEEPSEND 1888
ATTERCLIFFE 1871
MIDLAND (WICKER) 1838-70
BRIDGEHOUSES 1845-51
ATTERCLIFFE ROAD 1870
VICTORIA 1851
DARNALL 1849
MIDLAND (POND St.) 1870
HEELEY 1870
MILLHOUSES & ECCLESALL 1870

Figure 5.8 (following page)

Sheffield's Nineteenth Century Local Government Divisions (diagramatic)

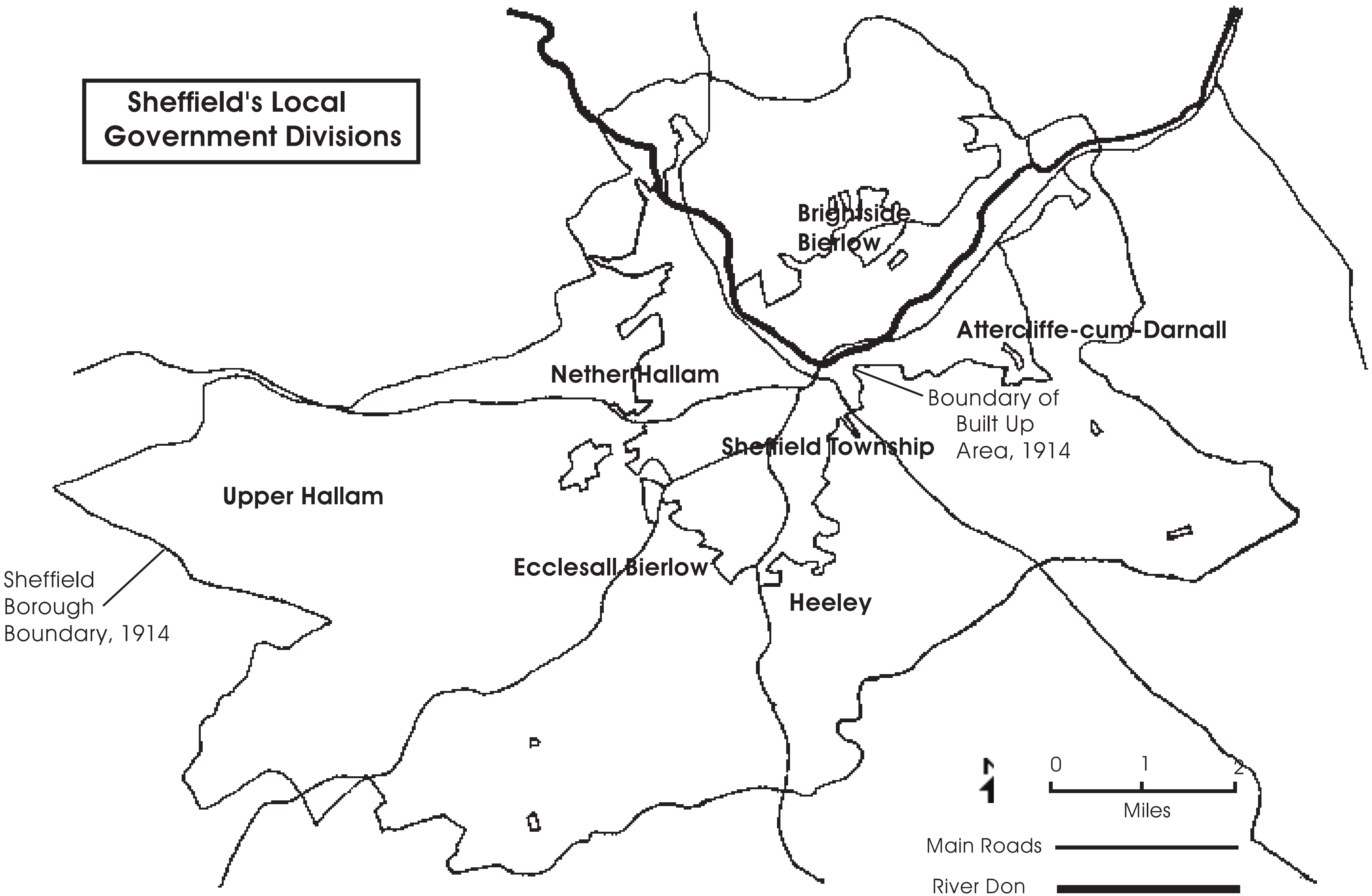

Sheffield's Local
Government Divisions
Brightside
Bierlow
Attercliffe-cum-Darnall
Nether Hallam
Boundary of
Built Up
Area, 1914
Sheffield Township
Upper Hallam
Sheffield
Borough
Boundary, 1914
Ecclesall Bierlow
Heeley
0
1
2
Miles
Main Roads
River Don

Figure 5.9 (following page)

Sheffield's Urban Growth to 1914

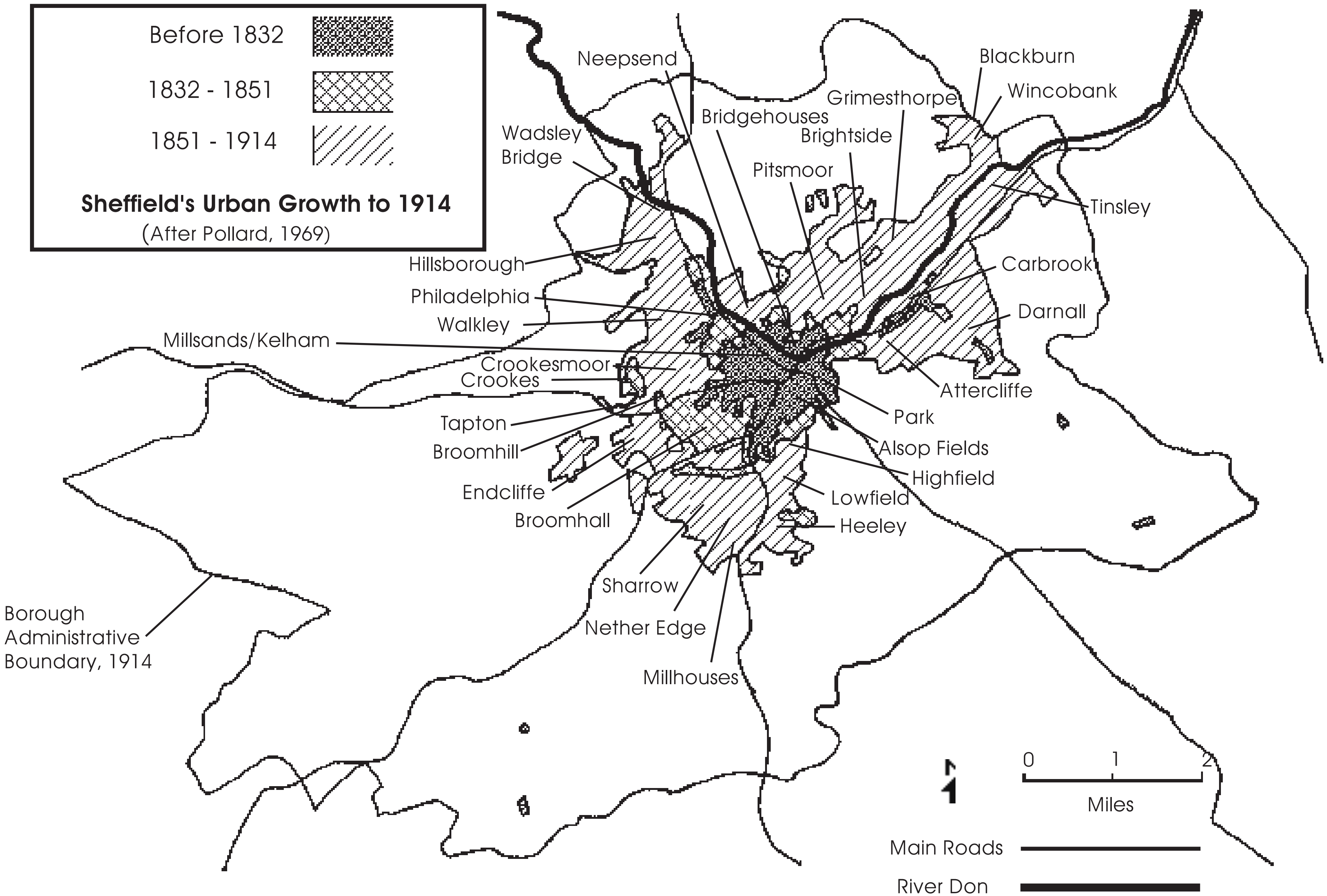

Before 1832
1832 - 1851
1851 - 1914
Sheffield's Urban Growth to 1914
(After Pollard, 1969)
Neepsend
Blackburn
Wincobank
Grimesthorpe
Bridgehouses
Brightside
Wadsley
Bridge
Pitsmoor
Tinsley
Hillsborough
Carbrook
Philadelphia
Darnall
Walkley
Millsands/Kelham
Crookesmoor
Crookes
Attercliffe
Park
Tapton
Alsop Fields
Broomhill
Highfield
Endcliffe
Lowfield
Broomhall
Heeley
Sharrow
Nether Edge
Millhouses
Borough
Administrative
Boundary, 1914
0
1
2
Miles
Main Roads
River Don

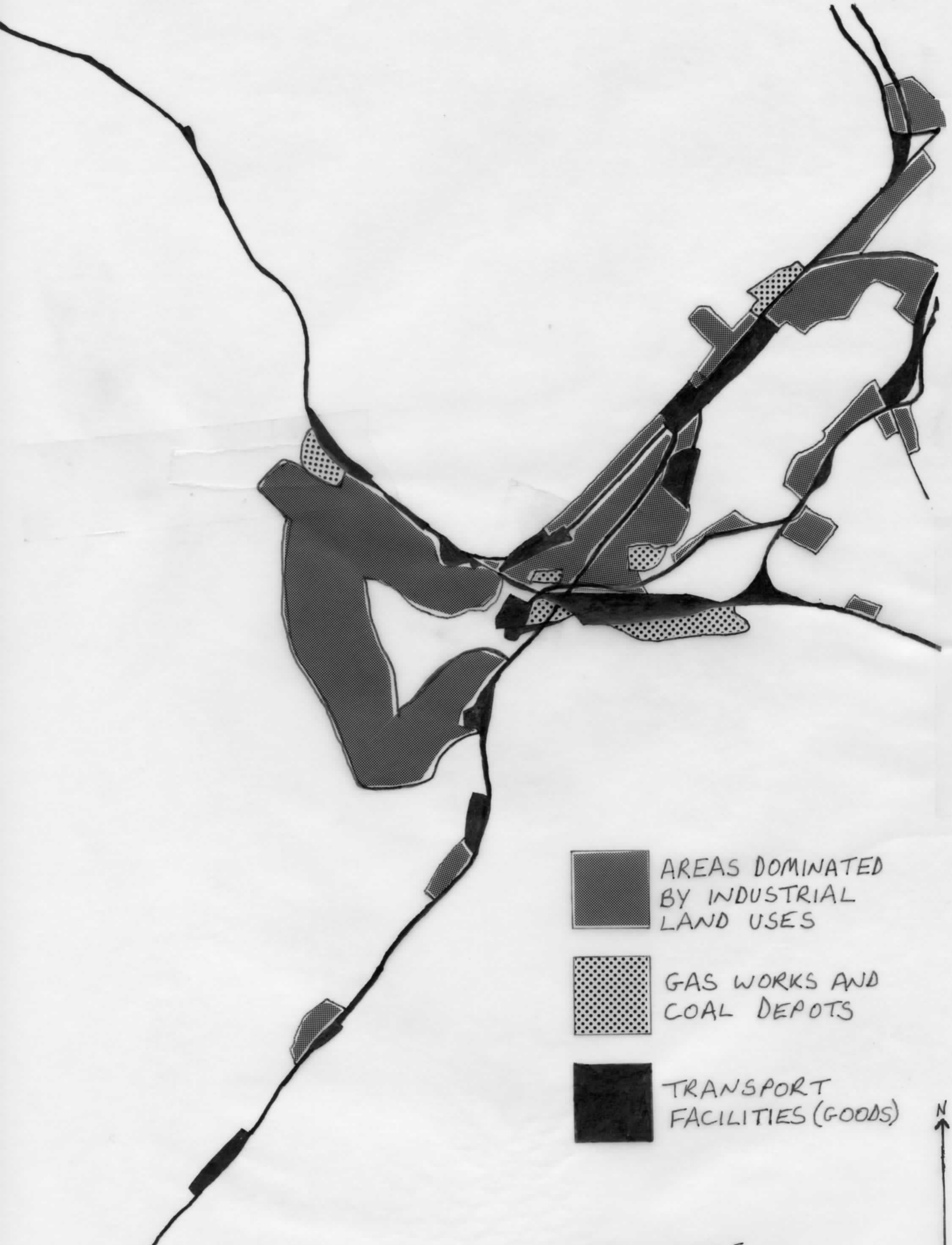
Figure 5.10 (following page)

Distribution of Transport and Industrial Land Uses in Sheffield, 1850


AREAS DOMINATED BY INDUSTRIAL LAND USES
GAS WORKS AND COAL DEPOTS
TRANSPORT FACILITIES (GOODS)
N
1 MILE

Figure 5.11 (following page)

Distribution of Transport and Industrial Land Uses in Sheffield, 1903


AREAS DOMINATED BY INDUSTRIAL LAND USES
GAS WORKS AND COAL DEPOTS
TRANSPORT FACILITIES (GOODS)
N
1 MILE

CHAPTER 6

THE LOCATION OF THE STEEL INDUSTRY IN SHEFFIELD

Much significance is attached in contemporary accounts (from the 1850s) and modern writings to the establishment of the large new manufactories in Brightside and Attercliffe adjacent to the railway. To relate this to the development of the town we need to understand:

i. The chronology of the location process;
ii. Location by new firms and relocations;
iii. The influence of the railways;
iv. Environmental factors affecting location;
v. Topography and location.

1. Chronological Mapping of Steel Factory Locations

To provide a development chronology the locations of steel companies had to be plotted to produce a time series of maps showing their distribution. An appropriate data source had to be identified which would contain ideally the name of the firm, its type of business, its location and the size of operation or at least the site area occupied. It would be preferable for the data source to be consistent throughout the century in defining the type of firm and to be available for the whole of the study period. No data source could be found which met all these criteria.

The potential of the Building Register produced by the New Works and Plans Sub-Committee of the Highways Committee of the Sheffield Borough Council under the 1848 Health of Towns Act was assessed. This Register was used by Aspinall for his analysis of the building industry in the latter half of the nineteenth century.[1] Unfortunately the information it contained on the building of new factories was inconsistent and fragmentary. It was not possible to identify whether development was on a new site or an addition to existing premises. Nor was it clear which facilities were for the steel industry. Furthermore the Register was not kept before 1864.

Rate books were another potential source. Lloyd-Jones and Lewis based their analysis of the industrial structure of the town on rate books[2] as did Timmins

[1]Aspinall, 1977
[2]Ibid.

(1989) when studying crucible steel making. Unfortunately the books were less informative for the earlier part of the century and it is not always easy to distinguish type of firm.

The only other source was the trade directories produced by various publishers throughout the century, which contained entries for most of the businesses carried on in the town. The directories met most of the criteria referred to above, except that they did not allow evaluation of the size of firm, but other work has filled this gap (see Chapter 5). The method adopted was similar to that used in the author's study of Manchester. The technique of tracking the location of firms by comparisons between trade directories was also used by Moses and Williamson to study changes in the location patterns of companies in four industries in Chicago between 1908 and 1920.[3] Directories were used by Shaw and Wild to measure shop densities and track retail decentralization in six towns in the north of England between the 1820s and 1880s.[4] In the present study, the location of steelworks was plotted on a map from the address given in the directory. As explained in Chapter 5, decennial plots (or the nearest approximation) of the location of 'Steel Converters and Refiners' were made.

- <u>The Pattern of Location</u>

The time series of maps which follows indicates the general distribution of firms. Because addresses in directories are not always precise and street numbering changes over time, it is difficult to plot some locations exactly. Firms were plotted as close as possible to the most probable location of their address. In the case of factories big enough to feature on contemporary maps the plots are accurate. This applies particularly to companies located beside the railways and to larger firms in the Millsands and Penistone Road areas. The locations were plotted onto a 4" = 1 mile modern street map of Sheffield, referring to older maps for the positions of streets which no longer exist. The maps were then reduced by photocopying. Where firms had more than one plant, this is recorded as a separate dot only if more than one address was shown in the directory.

Throughout the maps the following abbreviations are used to identify districts of Sheffield:

A = Attercliffe
AF = Alsop Fields
B = Brightside

[3]Moses and Williamson, 1967, 127
[4]Shaw and Wild, 1979, 289

Bh = Broomhall
Br = Broomhill
C = Crofts
Cm = Crookesmoor
D = Darnall
G = Grimesthorpe
H = Highfield
He = Heeley
M = Millsands
O = Owlerton
P = Park
Pi = Pitsmoor
Ph = Philadelphia
Pn = Ponds
R = Rockingham St. area
SG = St. George's
SP = St. Paul's
T = Tinsley
Wa = Walkley
WB = Wadsley Bridge

Goods stations are identified by a triangle. The development of the canal and the railway system is also plotted chronologically.

Figure 6.1[5]

Locations of Steel Converters and Refiners, 1797

Robinson's Directory lists only sixteen Steel Converters and Refiners. Apart from three outliers in Attercliffe (then a village) most of them are found to be evenly distributed close to the western periphery of the then developed area. Most were well within half a mile of Lady's Bridge which led from the main settlement to the Wicker. The bridge and the River Don are used as locational reference points throughout this series of maps. The location of the steel converters and refiners premises seems to follow the same pattern as 'the majority of the cutlery and tool-makers ... widely dispersed round the western margins of the old town and in all areas recently built'.[6] All were in easy reach of the main radial road routes leading into the centre of the town.

[5]To assist the continuity of the argument, Figures 6.1-6.12 have been placed in the main body of the text rather than at the end of the chapter

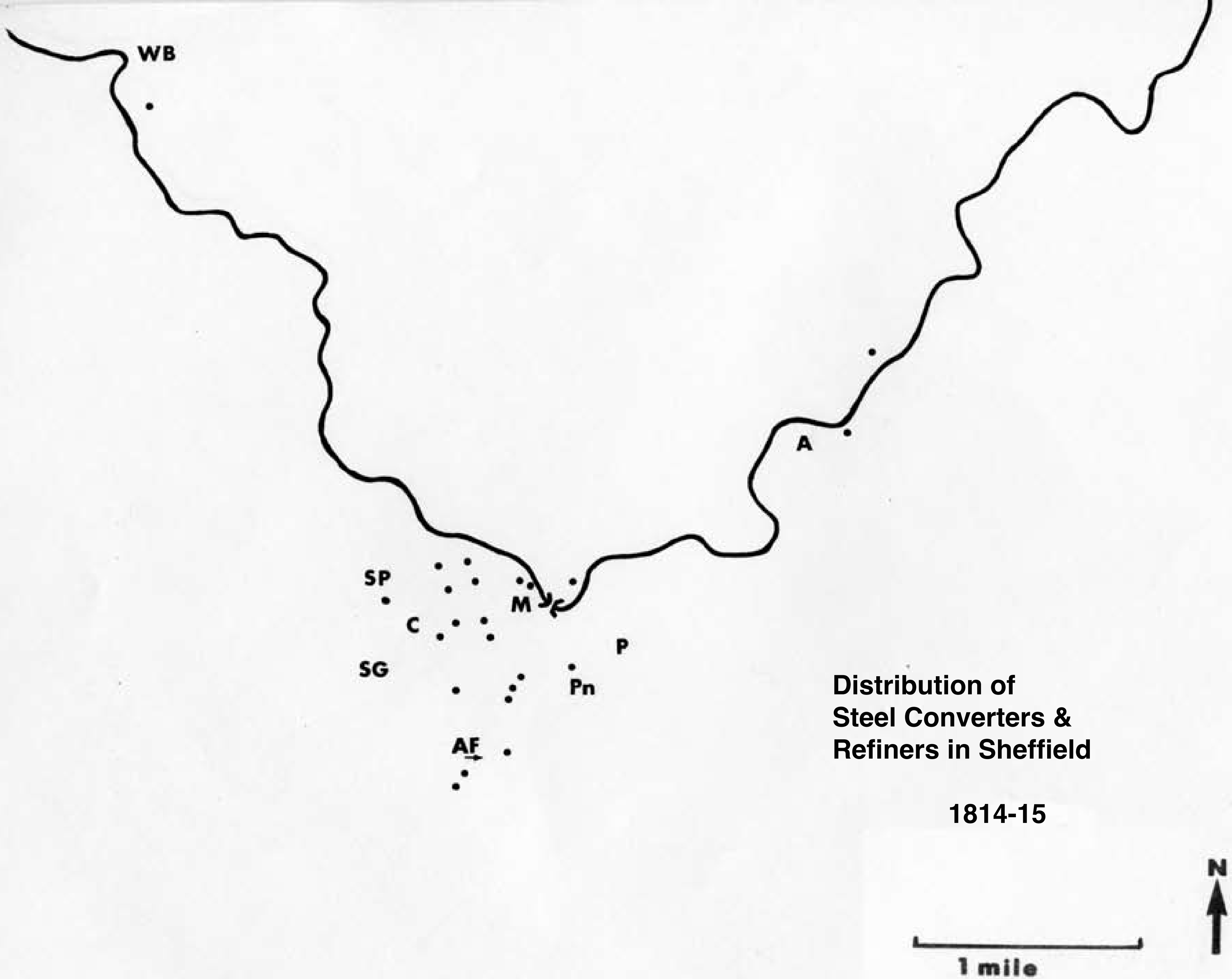
[6]Hunt, 1956, 232


A
M
C
P
Pn
Distribution of
Steel Converters &
Refiners in Sheffield
1797
N
1 mile

Figure 6.2

Locations of Steel Converters and Refiners, 1814-15

Seventeen years later there were only another 13 companies. Once again most were positioned around the western edge of the town, with the Alsop Fields area, developed fifteen years earlier, accounting for some firms and some encroachment on the Ponds. Distances of almost one mile from Lady's Bridge are found, although this does not necessarily represent the distance from the town's main centres of activity around the market area and the High Street, which would have been slightly less.



Distribution of
Steel Converters &
Refiners in Sheffield

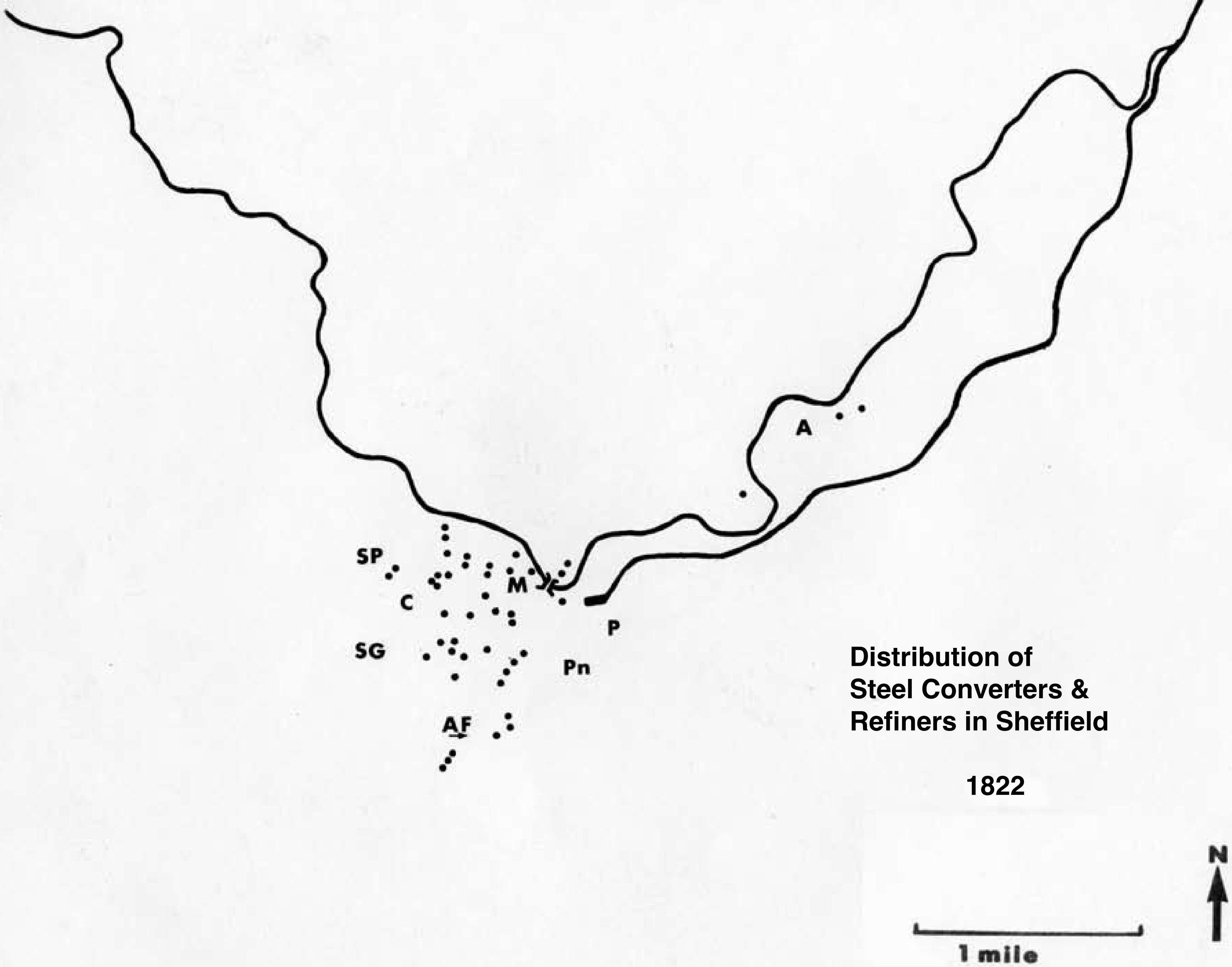
1814-15

14-15

Figure 6.3

Locations of Steel Converters and Refiners, 1822

By this time the canal had arrived but had not had time to have any noticeable influence on the location of Steel Converters and Refiners. The number of firms had almost doubled from 1814-15, to 55. This is reflected by a higher density of firms, particularly in the Alsop Fields/Rockingham Street areas and between Millsands and the Crofts. On the whole, the tendency is to reinforce the locational pattern of previous years.



Distribution of
Steel Converters &
Refiners in Sheffield

1822

Figure 6.4

Locations of Steel Converters and Refiners, 1828

Six years later the number of firms had not changed significantly and the location pattern was similar. If anything, there had been some centrifugal movement but only two firms appear to have had canal side locations. One of these was the Sheaf Cutlery Works of Messrs. W.M. Greaves & Son, the first large factory to locate on the canal, four years after it opened;[7] later occupied by Turton's Cutlery Works. Between 1820 and about 1840, several other companies took advantage of a move to locate on the canal or near the canal basin. These included Jessop's Park Works, Huntsman's, and the Metham, Canal and Fitzalan Works. By the 1860s the Baltic Works had joined them.[8]

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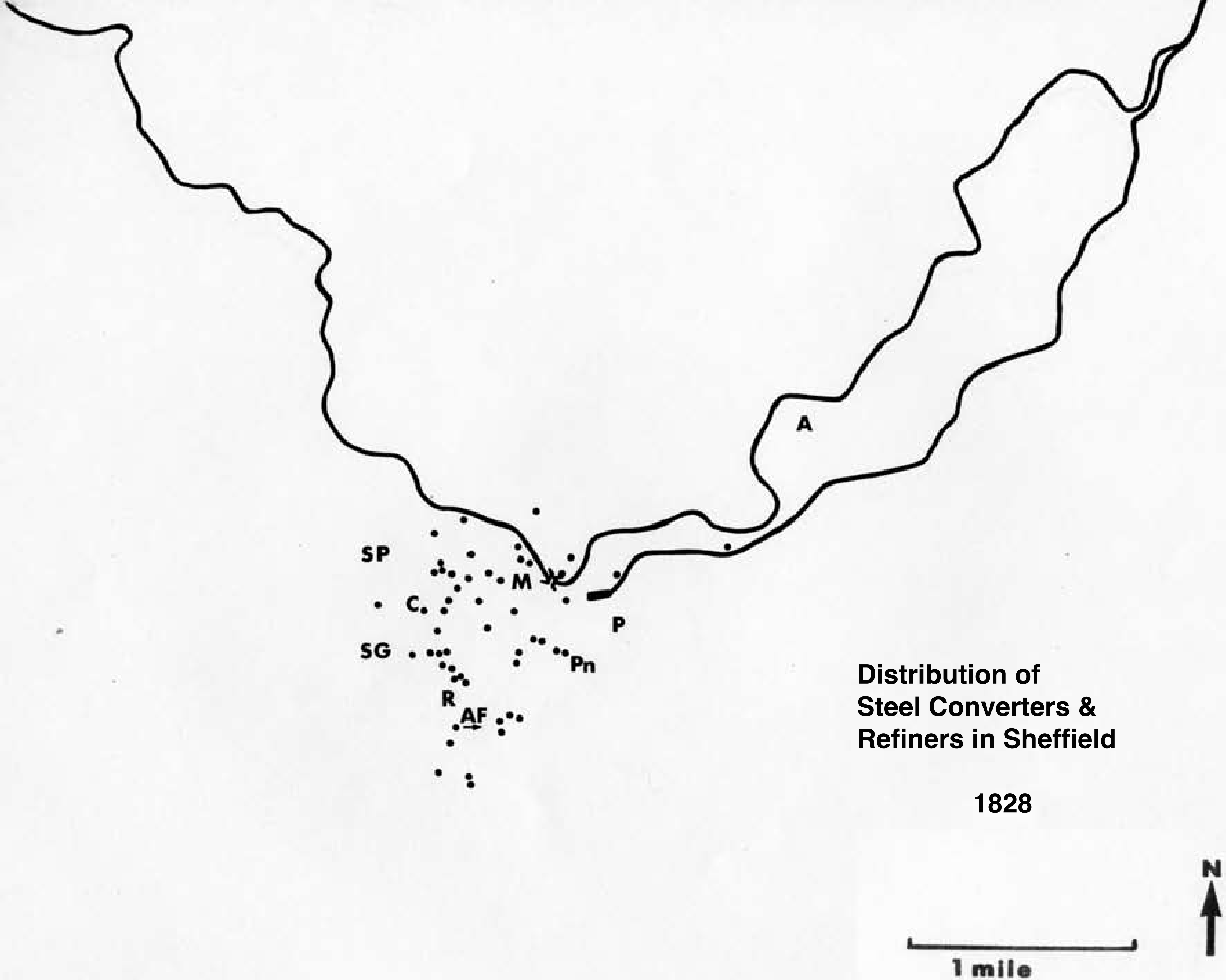
[7]Ibid., 234

[8]OS 6":1 mile Map of Sheffield, 1850; Sheet 294 ; White's Plan of Sheffield, 1863



Distribution of
Steel Converters &
Refiners in Sheffield

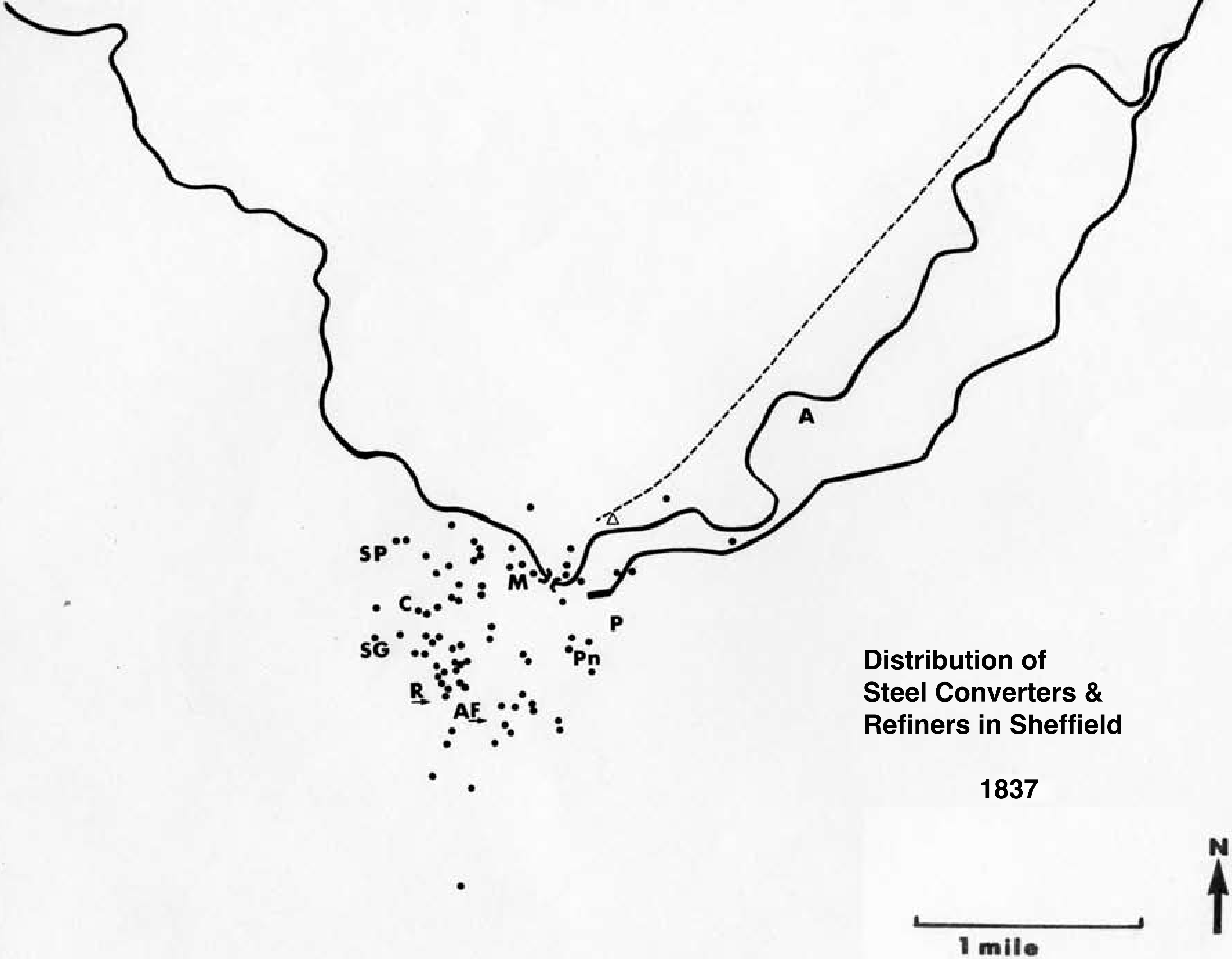
1828

Figure 6.5

Locations of Steel Converters and Refiners, 1837

By 1837 the Sheffield and Rotherham Railway (shown by a broken line on the map) was under construction and a goods station was to be situated in the Wicker in November of the following year. One firm (Spear and Jackson) had already established a site at 2 Savile Street and three are sited in the Wicker. Three companies were located by the canal. The majority of firms were, however, still to be found around the same western belt which characterised earlier years. The tendency for this belt to have moved away from central sites is clearer but the distribution of firms remained relatively even. At this time most of the manufacturers who were to found the giant steel companies of later years had yet to set up their own businesses and when they did so they were to choose initial locations close to the town centre - for example John Brown in Orchard Street from 1844 and then Furnival Street.[9]

[9]Walton, 1948, 190



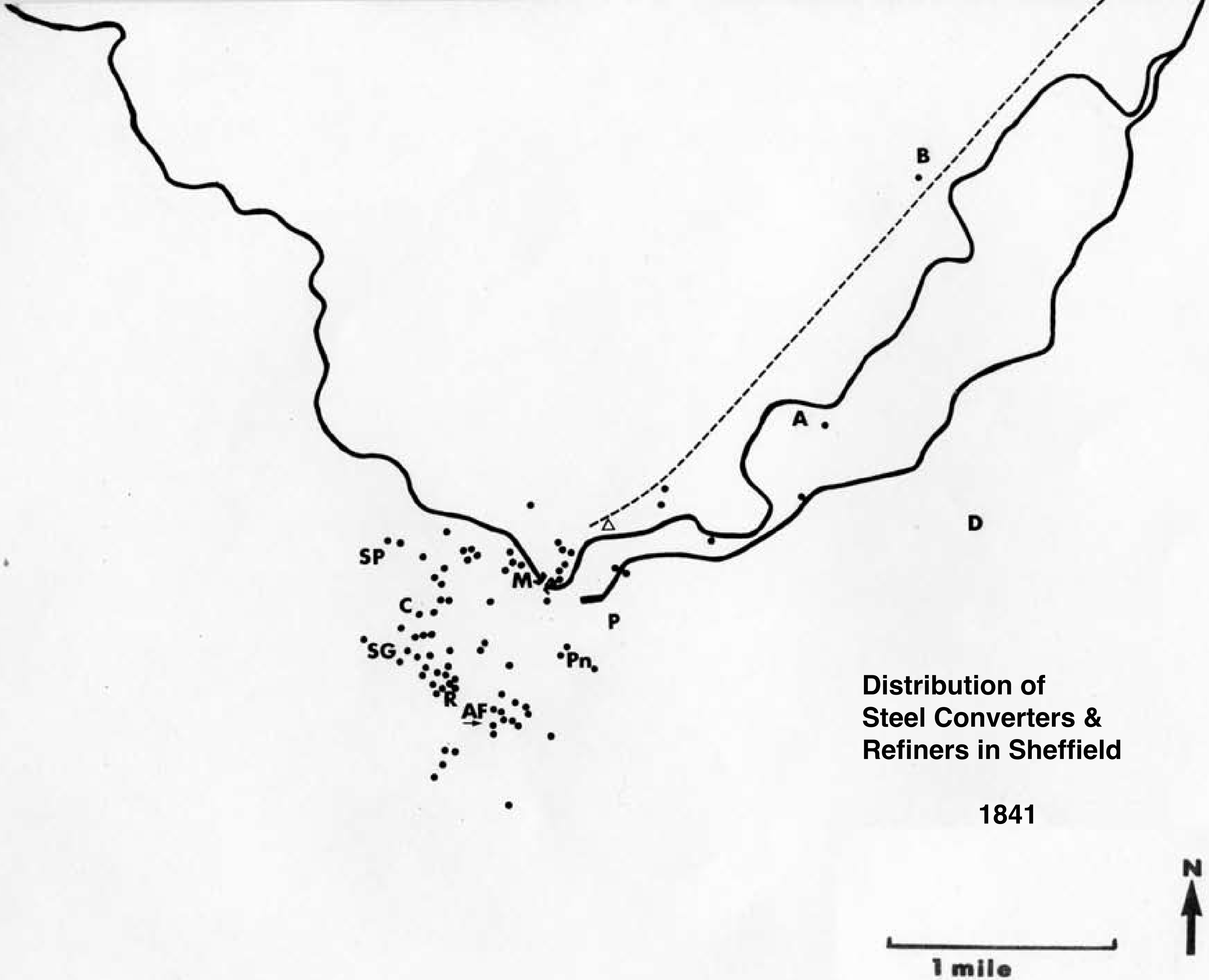
Distribution of
Steel Converters &
Refiners in Sheffield

1837

Figure 6.6

Locations of Steel Converters and Refiners, 1841

By 1841 the ring of firms to the west and south of the city centre had become more pronounced, largely due to an increased concentration of firms. On the whole the distribution was relatively even. Significantly, however, there had also been a minor shift eastwards into the Wicker and surrounding streets.



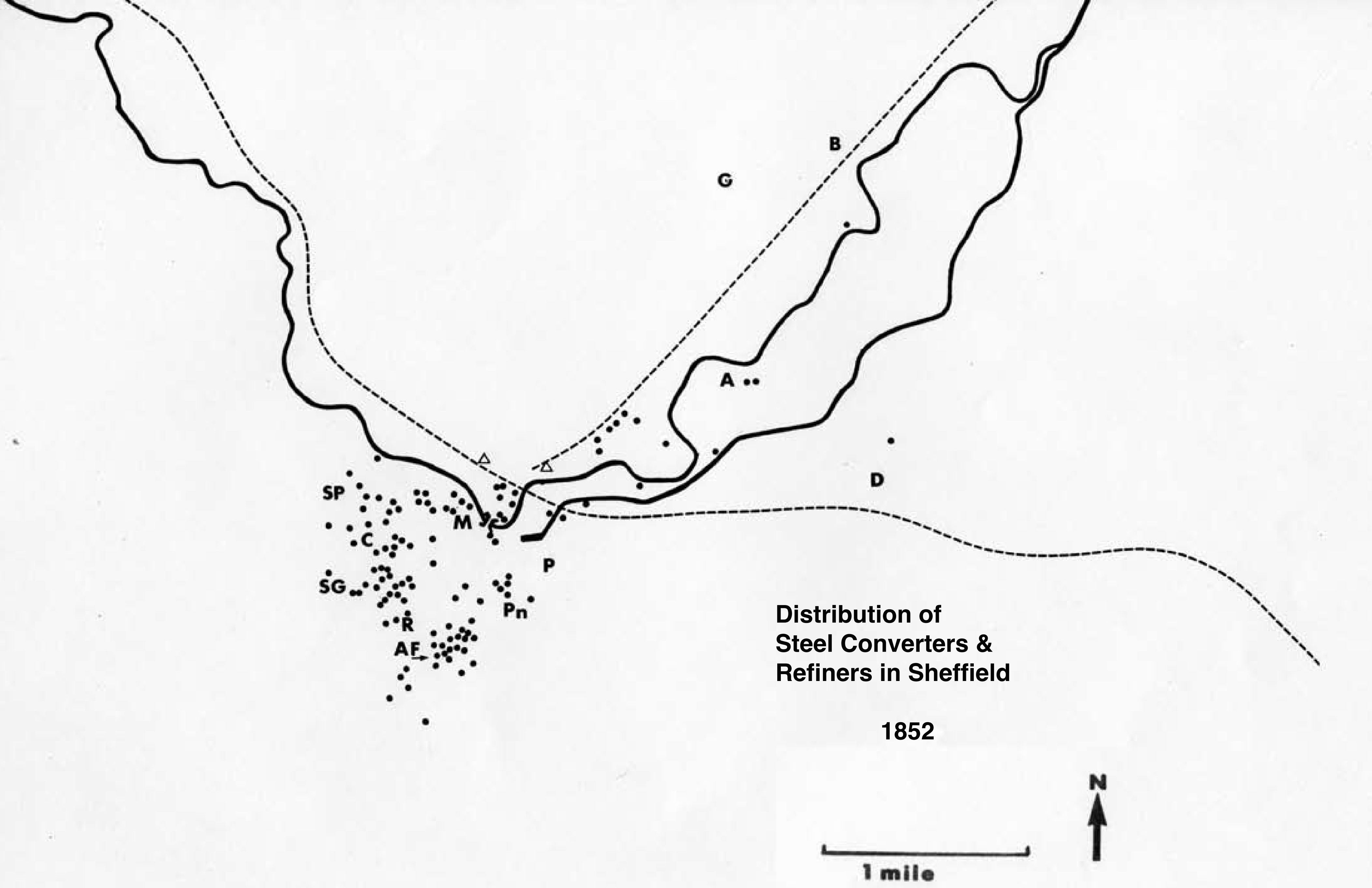
Distribution of
Steel Converters &
Refiners in Sheffield

1841

Figure 6.7

Locations of Steel Converters and Refiners, 1852

Perhaps the most notable change by 1852 was the arrival of the Manchester, Sheffield and Lincolnshire Railway (connected to the Sheffield and Rotherham line by a tunnel not shown on these maps) and the establishment of the Bridgehouses freight depot. There had been a noticeable growth of factories beside the Sheffield and Rotherham Railway, including Firth's Norfolk Works in Savile Street and Johnson, Cammell and Co.'s Cyclops Works. Nevertheless, the most significant trend was the continued growth in numbers of firms in the western and southern area peripheral to the town centre, with some concentration in Alsop Fields but a relatively even distribution nonetheless.



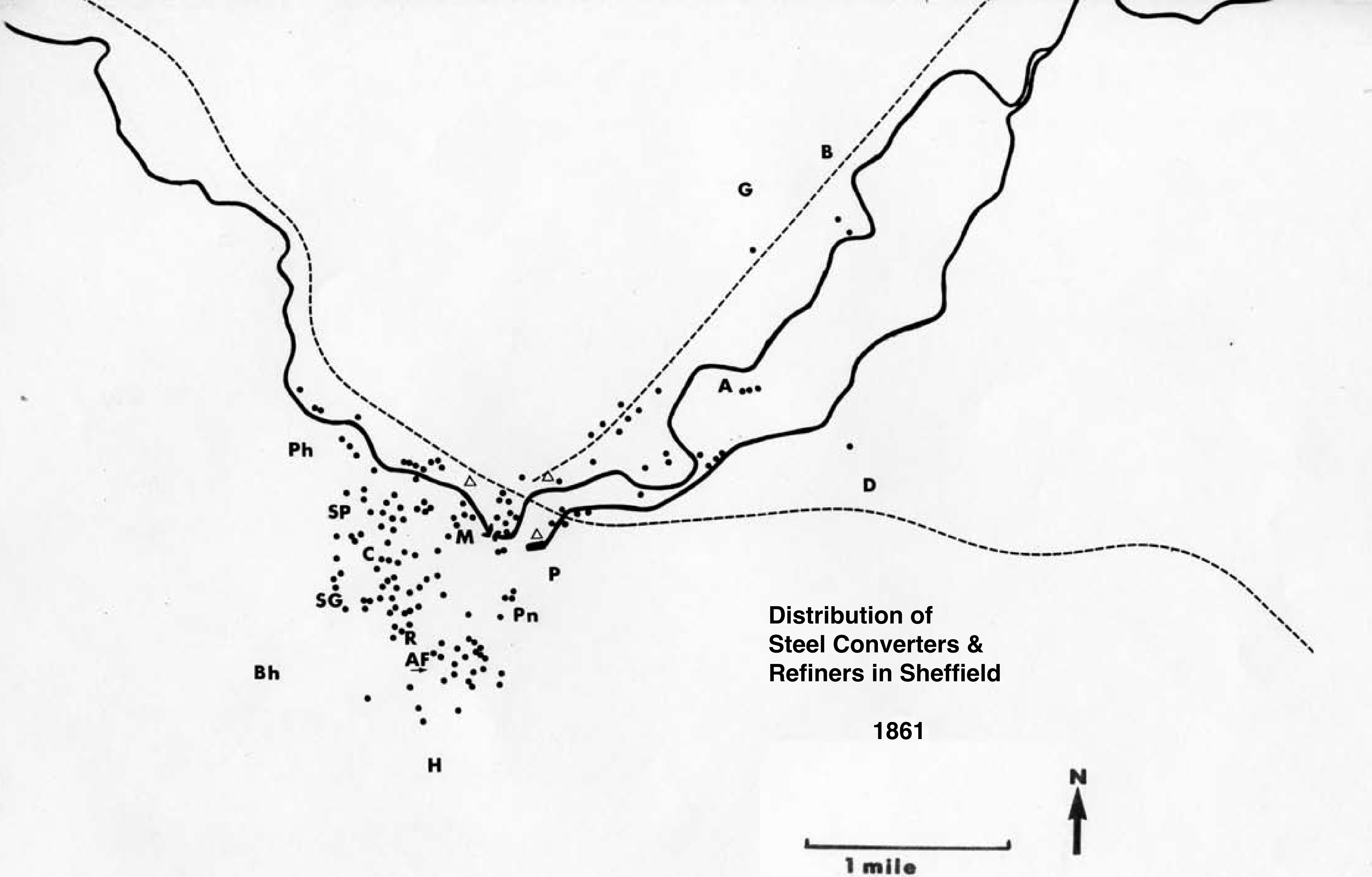
Distribution of
Steel Converters &
Refiners in Sheffield

1852

Figure 6.8

Locations of Steel Converters and Refiners, 1861

By 1861 a new goods line had opened to Sheffield Park (beside the canal basin) although the freight depot on the site was not completed until 1865. The railway and canal sides in the Lower Don Valley were becoming more densely populated with firms and there were a number lying between the MSLR line and the Don north west of Bridgehouses goods depot. On the whole the main concentration of firms was still in a belt west and south of the town centre, although an increased number were to be found in Attercliffe and the Philadelphia district.



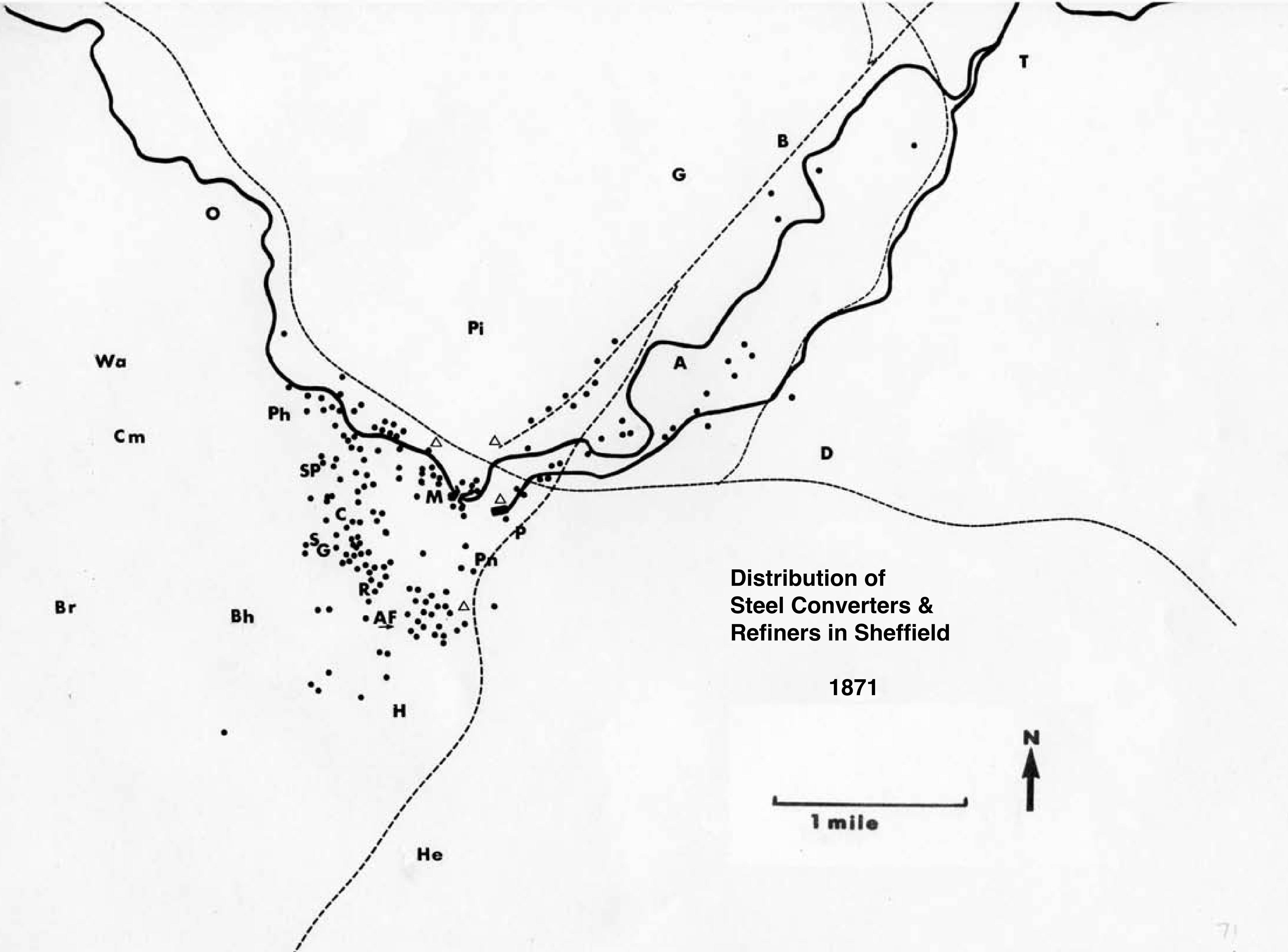
Distribution of
Steel Converters &
Refiners in Sheffield

1861

Figure 6.9

Locations of Steel Converters and Refiners, 1871

The pattern of railways was now more complex. The Sheffield - Chesterfield extension of the Midland railway had penetrated the Ponds and Heeley providing a new goods depot at Pond Street. The South Yorkshire Railway connected with the MSLR and provided an alternative line through the Lower Don Valley. The pattern of industrial location remained similar to that of previous years but there were more firms in suburban locations such as Attercliffe, Brightside, Philadelphia and St. Mary's/Heeley. The band of firms to the west and south of the town centre remained pronounced.



Distribution of
Steel Converters &
Refiners in Sheffield

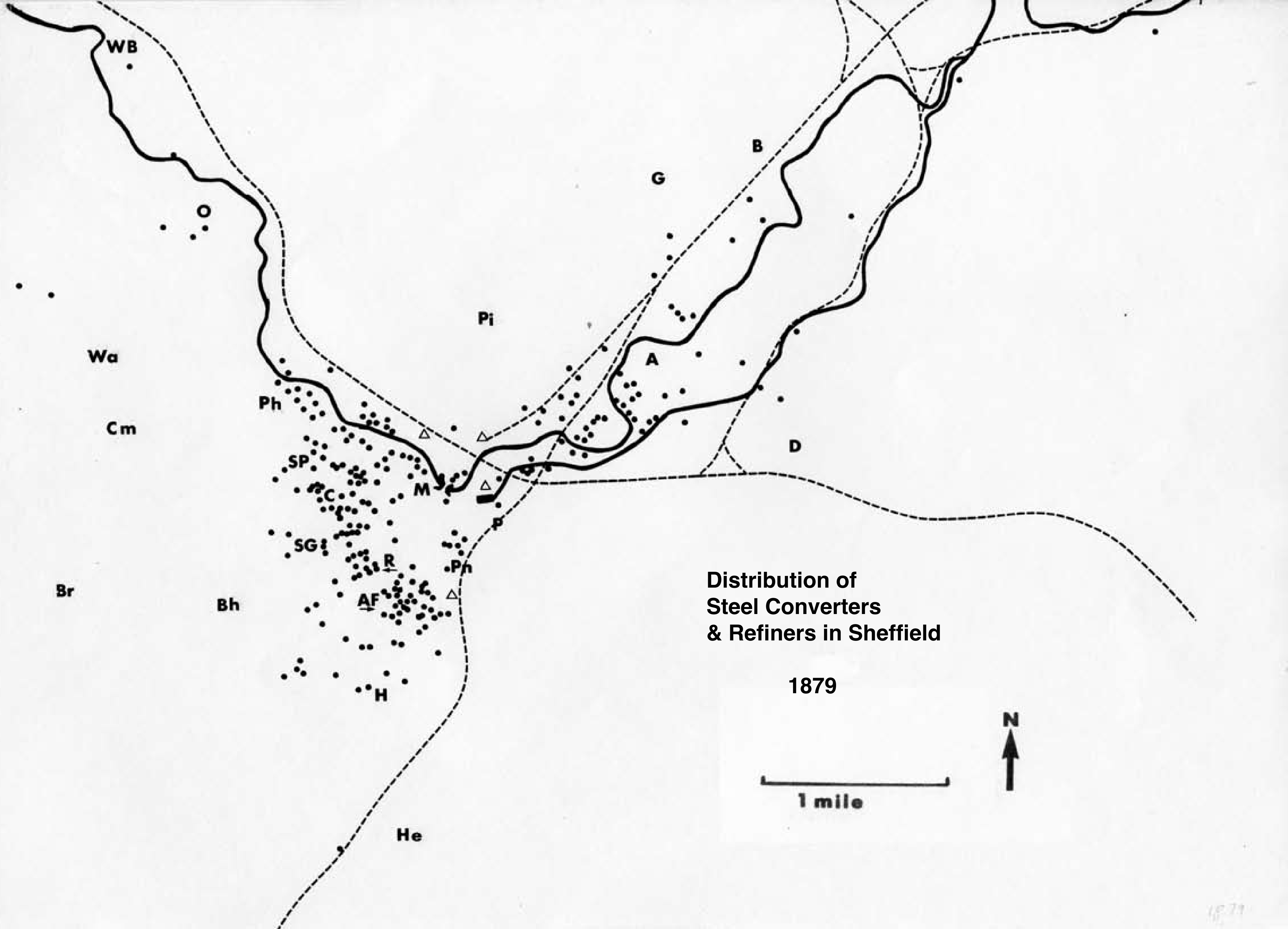
1871

Figure 6.10

Locations of Steel Converters and Refiners, 1879

Eights years later the suburbanisation of the steel industry had become more pronounced with over 45 firms in the Don Valley including some outliers at Tinsley and in Owlerton. Nevertheless the overriding pattern of companies clustered around the outskirts of the town centre remained significant. The expansion of large steel companies in the early 1870s had clearly had an impact in the East End but the medium sized and small firms had retained their traditional locational base, perhaps in part because of their role as suppliers to the cutlers who remained in these areas.[10]

[10]An example of such linkages is provided by the early history of Frth's in the 1840s, when they were noted as producers of high grade cutlery steel, exclusively for home consumption - Marshall & Newbould, 1925, 3



Distribution of
Steel Converters
& Refiners in Sheffield

1879

Figure 6.11

Locations of Steel Converters and Refiners, 1891

By 1891 the locational patterns developed earlier had become stable. Canal and railway side sites were densely occupied in terms of site area per firm but not in terms of number of firms.[11] A cluster of firms in the Ponds area which was noticeable in 1879 had grown more dense but on the whole there were no significant changes. Heeley goods depot was open and Queens Road depot is shown, although it actually opened the following year.

[11]Goodfellow, for example, suggests that the situation of works and warehouses between Sheffield and Tinsley made it impossible further to develop the canal - Goodfellow, 1956, 165

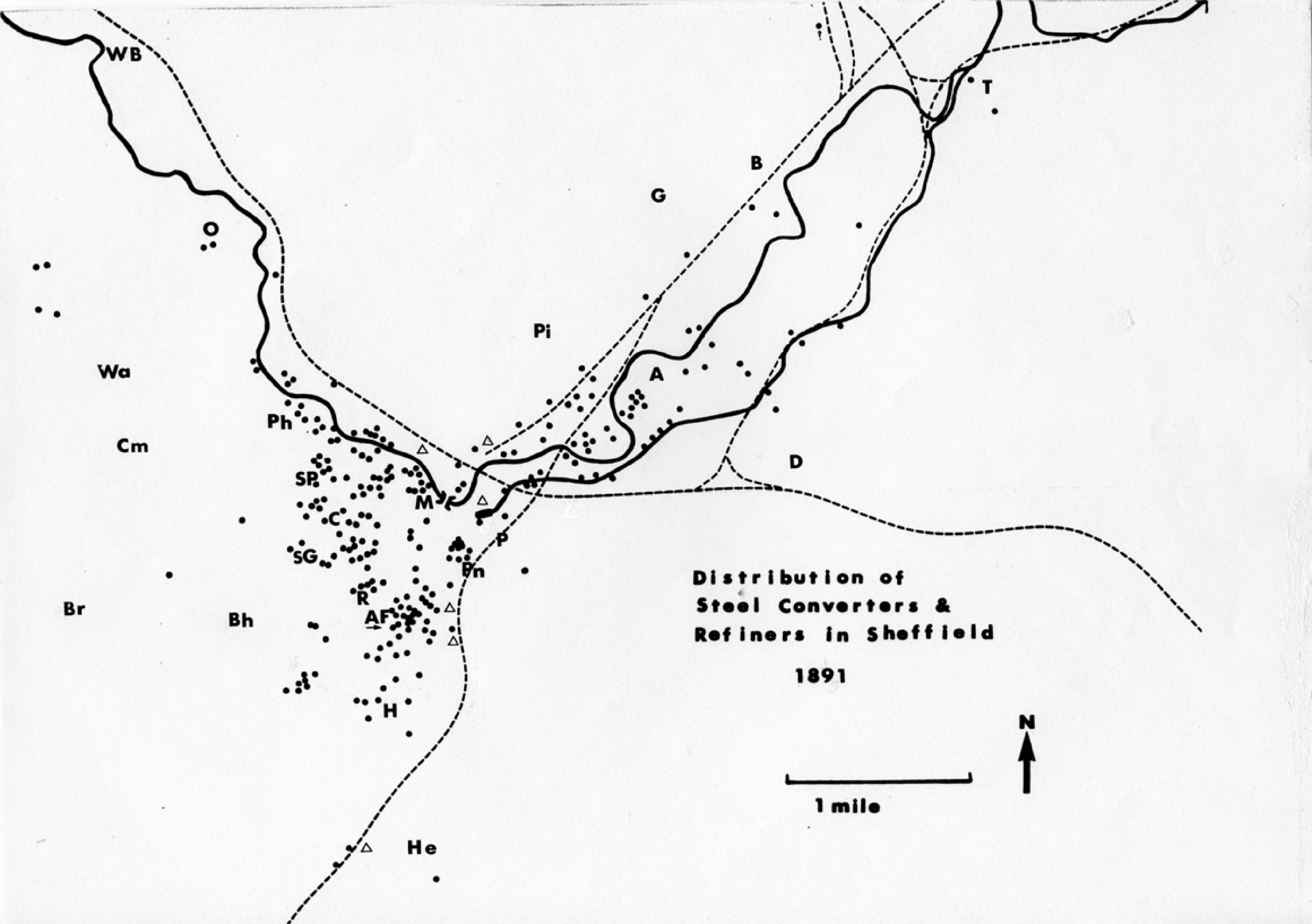
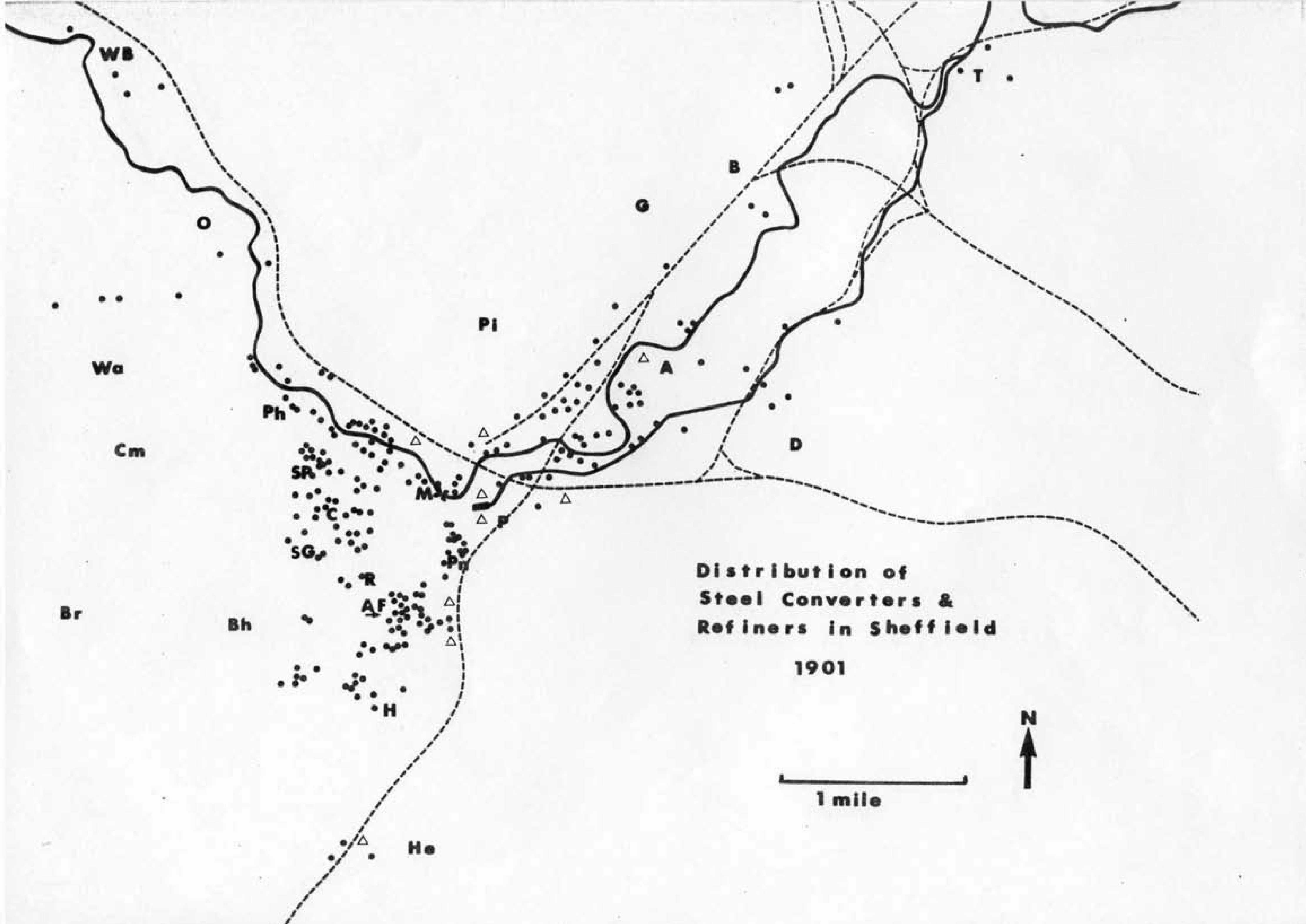

WB
O
Wa
Cm
Ph
SP
C
SG
Br
Bh
R
AF
H
He
M
P
Pn
Pi
G
B
A
D
T
Distribution of
Steel Converters &
Refiners in Sheffield
1891
N
1 mile

Figure 6.12

Locations of Steel Converters and Refiners, 1901

The final plot in this series shows the most developed railway system including the Sheffield District Railway with its Attercliffe and West Tinsley Goods Stations, opened in 1900. Also new was the LNWR's City Goods Depot in Bernard Road. For the sake of completeness the LNWR's later Broad Street depot of 1904 is also shown to the south of the canal basin. Yet again the overall pattern of location remained the same.


WB
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Wa
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He
M
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Pn
Pi
G
B
A
D
T
Distribution of
Steel Converters &
Refiners in Sheffield
1901
N
1 mile

2. Other Land Uses

Steel converters and refiners were only one sector among the Sheffield trades. Contemporary maps, directories and guides show that although the large steel works were relatively dominant as a class of land use in the Lower Don Valley by the late nineteenth century, a good deal of land was devoted to other uses such as steel stockholders, boiler makers, silver refiners (Royd's Mill), gas works, locomotive and carriage works, collieries and colliery railways and housing for the workforce of the area. In other parts of the town the cutlery and silver plating and Britannia Metal industries were substantial entities. Next to the canal and railways, much land was devoted to terminal facilities and ancillary uses serving the main lines. Apart from the public wharves at the canal basin, some companies had private wharves divorced from their works. Firth's and John Brown & Co. had wharves and warehouses for the importation of Swedish iron. John Read's Sheffield Silver Refinery Co., Benjamin Huntsman & Co., Davy Bros. and Charles Derwent also had private wharves.[12] The land required for railway company sidings, mineral and goods depots and engine sheds was also of considerable extent. The location pattern for a particular industrial sector (in this case steel) is therefore a reflection not only of the factors internal to that industry but also external pressures caused by the relative ability of other sections of the property market to bid for sites.

A fairly clear distribution emerges for the location of the steel sector, suggesting that there were either quite well defined industrial zones in the city; that the steel industry was a strong enough competitor for land to enable it to follow a coherent pattern within given districts where comparatively proximate location between works was an advantage (or both); or that the industry could use land not desirable to other users for one reason or another - this seems less likely given the intermingling of steel works with other businesses.

[12] ACM/S384, 1842; SC Attercliffe-cum-Darnall Poor Rate Book No.1, 1875, 131, 132 and 171; Firth Brown, 1954; ACM/B/486

3. How Mobile Were Steel Companies?

Little consistent information survives about companies' changes of address. To gain a general idea of the mobility of established firms, the addresses of companies surviving between the directories in the sample analysed earlier were compared. Companies which had definitely survived and had changed address or added a new plant to their entry were recorded. Care is needed in using this approach. Companies with more than one plant may have chosen to record the address of only one of them in any given directory, and changed to the address of a different plant in the next, perhaps because of a move of office premises. As will be seen in the case study of Edgar Allen and Co. in Chapter 12, a company might run more than one office establishment if it had several plants.

In the case of firms appearing to move to different addresses in the same street, it is possible that some streets may have been renumbered between directories (addresses immediately adjacent to each other have been excluded). Having noted these caveats, we can record that 103 firms surviving between directories seem to have either moved altogether or added one or more addresses to their entry. 69 of these companies (66.99%) show one such change; 25 (24.27%) two changes; 8 (7.77%) three changes and 2 (1.94%) four changes. Viewed as a proportion of all firms recorded as surviving in Table 5.8, the figures are as shown in Table 6.1.

It is dangerous to draw too many conclusions from such a small base. However, there is sufficient consistency in the data to suggest that a significant proportion of the industry was mobile. This proportion takes no account of new firms coming into the business which would require plants (bearing in mind, of course, that some firms from other sectors must have started up in steel without the need to move from existing premises). Taken together, the new and the mobile older firms were a significant part of the steel industry in terms of number of companies, though we cannot tell what proportion of production capacity or turnover they represented.

Towards the end of the nineteenth century greater locational stability seems to have become apparent, as it does on the mapping of the directory information. Although output and employment continued to expand after 1893 as a general trend, deep depression in steel in 1894 would have reduced the demand for new sites and the profitability of redeveloping or extending older ones. The slow down in mobility may also represent a 'filling up' of available land for significant new works in the most suitable parts of the town, and the maturity of the industry.

Certainly there is less vacant land of appropriate size for large scale operations apparent on maps of the area from the early part of the twentieth century.

4. Why Did Firms Choose Particular Locations?

The reason why new firms took over existing premises or developed new works is self-explanatory. The motivations for their choice of location are, conversely, more or less impenetrable at this distance in time. Little contemporary evidence survives on the subject.

The case of the renewal of the lease of the Park Iron Works presents an example of the setting up of what amounts to a new company, where the accessibility of the site was among a number of important factors addressed in the particulars of sale and company prospectus published in the Sheffield Independent in October, 1845. The Duke of Norfolk's land agent advertised to either dispose of the premises by private contract or for parties to subscribe capital to set up a company to take over the works as a going concern. Among the reasons why the promoters believed the business could be 'done to considerable profit and advantage' was the fact that 'water conveyance comes into the premises, and a railway communication is within about 200 yards, giving cheap access to all parts of the world'. Also important, however, were the high reputation of the Sheffield engineering trades, the successful business carried on by the previous tenants, the good condition of the works, ready availability of 'coals, coke, limestone, sand, and all necessaries for carrying on a good and respectable Trade ... at fair prices' and the extensive size and completeness of the foundry.

The establishment of the Yorkshire Engine Co. Ltd. in 1865 provides a straightforward example of a new works with very clear locational imperatives. Promoted by the Manchester capitalist David Chadwick, the company was intended to build 3-400 railway locomotives per annum.[13] The site chosen was on relatively level land in the mouth of the Blackburn Valley at Meadow Hall, on the MR's Barnsley-Sheffield route. This was some distance from the town centre and the main concentration of Sheffield steelworks, but the company needed good railway access and probably had more reason to be close to Rotherham's ironworks, given the importance of that material in locomotive construction at the time.

In 1870, Edwin Fox, a partner in George Gray & Co., described in general terms the selection of a site for new rolling mills at an arbitration hearing. The partners

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[13]Newton, 1993, 296

together looked for 'as eligible a spot' as they could find 'at a moderate rent'. The site selected was near the Wicker Goods Station and ease of access to the railway was considered to be a most important locational criterion. Access to the town centre seems to have been a consideration as well, though less important than the nearness of the railway station. This seems to be a good example of the process of striking a balance between the price of land and its accessibility - the firm could not find a site '... more moderate or suitable' than the one selected.[14]

Rather more can be deduced about relocation, which the evidence indicates to have been a relatively important element in the dynamics of steel industry location. Certainly, most of the large steel companies of the Don Valley were relocations of existing businesses.

i. Contemporary Opinions on the Importance of Railways

There is little doubt that contemporaries felt that the railways were going to be an important factor in industrial location decisions even before they opened. At the House of Lords Committee hearing into the proposed Sheffield and Rotherham Railway in July 1835, William Vickers of Naylor Vickers was asked to confirm that in a recent advertisement for the sale of the Corn Mills between Sheffield and Tinsley, the 'Approximation of the Railway ... was mentioned as an inducement to the purchaser'. Vickers agreed that he believed the advertisement was a 'true statement of the advantages which the railway would afford to the Corn Mill'.[15]

On 28 January, 1837, the Sheffield Independent carried the following advertisement:

> To steam engine makers, Millwrights, Iron Founders and Other Manufacturers. To be let, with immediate possession, the commodious WORKSHOPS, and large Yard, situated in Sheldon Row, in the Wicker employed for several years by Mr Smith for fitting up Steam Engines, and now in operation, with an excellent Engine, Dwelling House and Cottage ... This presents a highly advantageous opportunity for carrying on a well established Business, especially as the Works are situated close to the Termini of the projected Railways to Rotherham and Manchester. The premises are also well adapted to any branch of the Sheffield Manufacture requiring Steam Power and extensive Accommodation ...

[14]Transcript of Arbitration Proceedings, June 1870, Marsh and Others v The Midland Railway Co., SC Marsh 64
[15]PRO/RAIL/1067/10, 48

On the opening of the railway on 3 November, 1838 the Independent forecast that it would '... infallibly lead to most stupendous results ...'.

Contemporary commentators from the mid century onwards seem to place great emphasis on the importance of the railway as a motivating factor in the attraction of steel firms to new sites. Pawson and Brailsford's Guide enthuses:

> The largest development of manufacturing industry in the steel trade is on the line of the Midland Railway, from outside the Wicker Station towards Brightside. The first of the large manufactories erected in this neighbourhood was by Mr Charles Cammell ... and the building being once opened, the advantages of the contiguity of the railway became so obvious that many other large business premises were shortly afterwards erected there.[16]

The Sheffield Telegraph ran a series of articles on 'Local Workshops' in 1875. The ninth article, on the Yorkshire Engine Works,[17] declared that:

> The Midland Railway runs on this side; the Manchester, Sheffield and Lincolnshire on that. A better site could not have been chosen even had the Directors had the entire district at their disposal.

Thomas Horsey, an Auctioneer and Valuer from London, called on by the Midland Railway in an arbitration with Marsh Brothers in 1870 about the value of the land and water rights taken from their Ponds Works for the Chesterfield Extension of the railway (and therefore perhaps with an interest in diminishing the value of the works), considered that connection to the railway had superseded access to water power as the primary motivator in location decisions:

> ... Water Mills are becoming less and less valuable. No greater instance than that can be shewn in Sheffield itself because the large Steel Works in Sheffield instead of being on the Water are now on the Railway. Heaton and Son, Firths, Cammels, Sir John Brown, Nailor and Vickers are all on the Railway where they can get a site - Water power is very uncertain ... [18]

This is not to say that water power was wholly eschewed by major manufacturers. Jessop's were still using water wheels in 1913 because they provided a cheap source of power.[19] Burys' Regent Works in Penistone Road

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[16]Pawson and Brailsford, 1862, 124
[17]28th October, 1875
[18]Transcript of Arbitration Proceedings, June 1870, Marsh and Others v The Midland Railway Co., SC Marsh 64
[19]Thomas, 1913, 21

operated 'interesting specimens of the old forges and tilts by water power on a site of six acres' in 1879.[20]

By 1864 the capacity of a new railway to attract industry was established wisdom. The cutler John Hobson and an estate agent, Henry Horner, both told the House of Lords Committee on the MR's Chesterfield Extension that the new line would attract works to the Sheaf Valley.[21] As late as 1896, Robert Hadfield told the Committee on the SDR that he believed the railway would allow a very considerable amount of vacant land to be opened up. A block of land near New Hall Works would be developed by manufacturers '... if there were railway facilities given'.[22]

ii. Growth Without Rail Connections

a. Sam'l Fox & Co.

It would be wrong to assume that proximity to the canal or railways was always a prime motivating factor. Sam'l Fox & Co. (later a branch of the United Steel Companies Ltd.) located at Stocksbridge in 1841-2 to produce wires for the textile industry.[23] Samuel Fox took the lease of a mill for wire drawing and purchased the property outright in 1851, after achieving success with a wire umbrella frame patented in 1847. Steel making began using crucibles in 1860 with a Bessemer converter licensed at the factory in 1862.[24] By 1870 two 3 ton converters were working.[25] Fox placed his works outside Sheffield, some distance from the line of the railway to Manchester whose construction began three years before Fox took his lease. An unpublished history summarises the problem this gave the company as it expanded, and the way it had to be resolved:

> The nearest railway ... was at Deepcar on the MSLR (opened in 1845). ... Deepcar ... being some one and a quarter miles from the Stocksbridge Works, a gap was left in the transporting of raw materials for steel making and ... in transporting finished products to the Railway ... for distribution. This must have been a colossal problem ... as records show that in those days orders were placed with ... Fox's ... for main line rails which had to be taken first over ... one and a quarter miles of rough road, railed to a port and shipped to San Francisco ... To alleviate this

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[20]Pawson and Brailsford, 1879, 220
[21]HLRO, Evidence, MR (Chesterfield to Sheffield) Bill, HL1864, Vol.19, 53 & 89
[22]SCSDR, MofE, HL1896, QQ.806-9
[23]Newton, 1993, 298
[24]Stansfield, H., Samuel Fox and Company Limited 1842-1967, Sheffield 1967, quoted in Ed. Riley, 1988, 107
[25]Erickson, 1986, 145-6

> difficulty of transport between the works and the main line Railway, Samuel Fox and Co. laid down a Railway Line and obtained ... an Act of Parliament instituting the Stocksbridge Railway Company in June, 1874.[26]

b. Jessop's

Another company which grew to giant status without an initial railway connection was Jessop's. Founded in 1774 in Jessop Street on the edge of Alsop Fields, the company moved to the Park Works in Blast Lane in the early nineteenth century[27] a lease being granted to Henry Cadman, William Jessop and Samuel Fox near the canal for 'Manufactory Furnaces' in 1825 at a rent of 2.5d per sq. yd.,[28] with neighbouring premises being described in 1826 as 'adjoining Messrs. Eadon Jessop' in the 'street being the continuation of the canal wharf'.[29] The works was just across the road from the canal basin, though there was no direct connection to the waterway.[30] In around 1835 the firm took over the Brightside Works to cope with expansion of trade.[31] The Park Works was retained until 1898 when it was demolished to make way for extension of a railway goods depot, and the firm also ran the Soho Rolling Mills in Sheffield.[32]

By 1862, the Brightside Works had been extended so that it stood on either side of the River Don. The two halves were linked by a bridge big enough to carry a roadway for wagons and carts. In spite of the size of the works it had no direct railway connection.[33] By 1879, the local guidebook illustrated a branch railway coming into the site from the Midland main line, running on a viaduct and bridge. The cart bridge across the river had been replaced by a rail bridge serving the tracks within the works.[34] Jessop's became a limited company with a share capital of £400,000 in 1875.[35] By 1913 their site covered 60 acres and 4,000 workers were employed.[36] Having moved to Brightside to accommodate expansion before the railways served Sheffield, Jessop's were initially able to prosper and grow to a substantial scale relying on the carting system from canal and railway termini.

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[26] Brief History of Samuel Fox and Co. Ltd.,Typescript, 12 July, 1950, BSC Archive, Irthlingborough, BSC 042127
[27] Thomas, 1913, 3
[28] ACM/S384
[29] Ibid.
[30] Ordnance Survey 6":1 mile Map of Sheffield, 1855
[31] Thomas, 1913, 3; Pawson and Brailsford, 1862, 124
[32] Barraclough, 1976, 67
[33] Pawson and Brailsford, 1862, 120
[34] Pawson and Brailsford, 1879, 216
[35] Sheffield Red Book, 1877, 20
[36] Thomas, 1913, 4

c. Hadfield's (1)

This seems to have been sufficient also for Hadfield's in their early years. Robert Hadfield Senior went into partnership to produce wire at the Burton Wire Works in 1865. The partnership broke up, but two years later Hadfield began the development of casting in steel which was to be the foundation of his company's success until his son developed Manganese and Silicon Steels in the 1880s. Initially Hadfield Senior took over the Continental Works in Bessemer Road, Attercliffe to conduct his casting experiments.[37] This venture illustrates the close association between technical innovation and location decisions. The early history of the company also shows how near to the margin relocating firms sometimes operated - 'the enterprise was ... destined to tax to the full Hadfield (Snr)'s resources in money and physical endurance'.[38] Nevertheless:

> In 1872 he felt he could launch out still further. In place of the adaptation of old premises he decided to build for himself and install equipment more suited to his novel requirements. The site chosen was in Newhall Road Attercliffe.[39]

This was a site of about four acres to start with. 60-70 people were employed.[40] Once again the undertaking was daunting:

> The financial responsibility involved in this further venture was a heavy one which caused some misgivings among his friends ... for a few years the state of the order book caused some anxiety but at the end of the year 1876 the son was able to record that 'we only owe the Bank £33'.[41]

The works were added to considerably by the 1890s.[42] A Bessemer converter was installed in 1878 amid further financial trepidation, especially as this was the height of a slump in the steel industry. According to Main:

> The boldness of this decision to incur capital expenditure on a Bessemer plant is reflected in the son's remark 'May God be with us in this affair'.[43]

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[37]Main, c.1949, 2-2 and 2-3
[38]Ibid., Introduction and 2-3d
[39]Ibid., 2-6
[40]Ibid.
[41]Ibid., 2-66
[42]Ibid., 2-6
[43]Ibid.

The Hecla Works did not enjoy railway connections, being one third of a mile (536 metres) away from the Midland line. It was not until the 1890s that further expansion led the firm to connect to the railway system, in spite of producing substantial steel castings (see below).

Main, with his personal knowledge of Robert Hadfield Junior seems to feel that it was the topography of the area which made it attractive to larger enterprises:

> Attercliffe with its neighbouring Brightside was more and more ... recognised as the natural location rather than Sheffield for the heavier steel industries because of its more level and open terrain while still on the riverside;[44]

although he also acknowledges the importance of the coming of the railways to the area.[45]

iii. Proximity To, or Possession Of, Other Facilities

There were other important factors which were believed to recommend particular locations and which emerge in a few advertisements for premises, such as those wanted '... suitable for a small manufactury. Any where the Edge Tool or File Trade has been carried on, having a Melting Furnace, would be preferred'.[46] This advertisement indicates the importance for small traders of proximity to similar enterprises, and the desirability of finding an established workshop ready equipped for the trade. Agglomeration was not exclusively the province of small firms. Crowley's iron foundry in the Blackburn Valley supplied much of its output to the neighbouring Yorkshire Engine Works.[47] Both were large factories which benefited from co-location.

Also important was a good water supply and a steam engine, as emphasised by advertisements in the Independent on 18 March, 1837 and 11 August, 1838 respectively for the sale of workshops in Hollis Croft and Garden Street, and land at Kelham Wheel.

The Need to Grow

A common theme running through company histories which touch on the subject of relocation is pressure on space within the works, often coupled with changes

[44]Ibid., 2-9
[45]Ibid., 2-96
[46]Sheffield Independent, 18 February 1837
[47]Lodge, 1986

in technology, expansion in production or the inconvenience of operating a business from several sites. We have already seen indications of this in the case of Hadfield's early moves, and of Jessop's.

a. John Brown & Co.

John Brown was operating from four plants in 1853 'having expanded whenever and wherever he could'. In 1856 his company concentrated at the Atlas Works by the railway in Savile Street. This 3 acre site had been in use already as the Queens Works by Messrs. Armitage, Frankish and Barker, and Brown purchased it for little more than half its original cost of £23,000 and reorganised it.[48] Further expansion took place on nearby sites across the railway and to the east over the next 20 years.

b. Firth's

Firth's followed a similar course. Based at a site of 1,597 sq.yds. in Charlotte Street on its foundation in 1842, trade in high grade cutlery, shear and tool steels grew rapidly from about 1845. Loxley Tilt was rent in 1847 and Clay Wheel in 1849. There was no room for further expansion in Charlotte Street, so new ground was purchased. Work on the Norfolk Works in Savile Street began in the same year and the firm occupied its new buildings in 1851.[49]

Thereafter, both companies expanded by extension onto land adjoining the railway or in other nearby streets, as will be seen in the chapter below dealing with the Norfolk Estate. However, it is also important to note that further expansions took place away from the Norfolk Works. Firth's built an export warehouse and carthorse stable in Greystock Street opposite the Norfolk Works in around 1870, but at the same time the company took over a wharf in Effingham Road from Messrs. Cooper and Son and erected new buildings.[50] In 1856, a whole new works was established at Whittington near Chesterfield, on a site bought by the company. Whittington produced not only steel but puddled iron - an early example of vertical integration.[51] Two interesting examples of production and technological issues affecting the organisation and location of the works are given by the forging and foundry operations. As we have seen, the company initially used a forge at Clay Wheel. When use of this forge ceased in 1858, forging was put out to Nasmyth, Wilson and Co. in Manchester. This was

[48]John Brown & Co., 1903; Firth Brown, 1954
[49]Ibid.; Marshall and Newbould, 1924
[50]Marshall and Newbould, 1924, 39
[51]Ibid., 21; Barraclough, 1976, 59

found to be unprofitable, so forging was moved to Whittington where the puddling hammers were used. Eventually two Nasmyth steam hammers were installed at the Norfolk Works to do the job.[52] The establishment of a steel foundry in 1888 was associated with the takeover of the Savile Street Foundry Co.'s works; henceforth this became the East Gun Works.[53] By the 1890s the Norfolk Works was complemented by Shot Forge, Clay Wheel Forge, the West and East Gun Works, the Foundry, File Saw and Edge Tool Works. Rolling mills had been installed at the Norfolk Works and Firth's had 2,000 employees.[54] This was not the final configuration of the company's Sheffield establishment, however, for in 1907-8 new works were built in Weedon Street, Tinsley on the SDR to house the crucible steel shop and new rolling mills.[55] During World War I, Firth's also operated for the Government the Templeboro' National Projectile factory on the GCR's Rotherham and Mexborough Branch. Sold after the war by Firth's, this was another out of town plant reliant on direct rail connections and a tramway system which could deliver the workforce from Sheffield and Rotherham.[56]

c. Vickers

As recorded in the last chapter, Naylor Sanderson split in 1829 into Sandersons and Naylor, Hutchinson, Vickers & Co. The latter bought a business from Jonathan Marshall, from whom they rented premises at Millsands and Wadsley Bridge.[57]

By 1863 Millsands had become 'overcrowded and out of date'. Crucibles of molten steel had to be wheeled though public streets from one part of the works to another. Land was acquired from Earl Fitzwilliam. The River Don Works was established in Brightside Lane, initially making crucible steel.[58] According to a feature in Engineering in 1893 '... the firm found in the early sixties that their old works at Millsands were too small and they moved to Brightside where there was more room for expansion. About twenty acres were at first built upon; now there are forty five acres'.[59] The new works were built to allow the company to produce steel in large masses, while the Millsands works were retained to continue the traditional business of the firm.[60] The company underwent organisational

[52]Marshall and Newbould, 1924, 26
[53]Ibid., 58
[54]Ibid., 63
[55]Ibid., 81
[56]Lodge 289.14, 1985
[57]Scott, 1962, 5
[58]Ibid.
[59]Anon, 1898, 6
[60]Pawson and Brailsford, 1862, 124

change at the same time, when the division into Naylor, Vickers & Co. and Naylor, Benzon & Co. occurred.[61] A limited company was formed four years later.[62]

d. Diversification and Growth During Recessions

Newton identified an interesting varition on the theme of company growth which had effects on the demand for land for expansion. She found that the five companies on which she conducted case studies had defended themselves from the recession of the mid-1870s using a number of tactics, including diversification of their products. In two cases at least, this led to physical expansion. The Park Gate Iron Co. (which became the Park Gate Iron & Steel Co. after it took up the Siemens process in 1881)[63] had expanded due to normal business growth and extension of its product range in 1841, when it acquired the existing Holmes Works, Rotherham, and again in 1849 when it bought land opposite its Park Gate establishment to build an iron plate plant.[64] Further expansion took place in 1870. During the depression in the 1870s the company came under pressure and decided to borrow from the bank to purchase Dodds Works, Holmes in 1875, 'to give greater facilities for production'.[65]

A similar course was pursued by Sam'l Fox & Co., who added a new Bessemer mill to their Stocksbridge Works in 1877 to produce steel boiler plates. When a further cushion against the slump was needed, a railway spring department was developed in 1879, taking advantage of the availability of a partner from a Sheffield spring makers which had gone out of business.[66] In both cases we see that it was not essential for the economy to be growing to create conditions which might generate a perceived need for changes to production facilities which might in turn have an impact on the scale and location of works.

v. Further Centrifugal Movement

This type of centrifugal move was not confined to transfers from the west of the town to the East End. In the mid 1850s, John Machen moved from Love Street to Wadsley Bridge Steel Works. Here, the firm[67] had more space to expand, and sidings connections from the MSLR. Given that the site was so far from the town

[61]Scott, 1962, 5
[62]Anon, 1898, 2
[63]Newton, 1993, 296
[64]Ibid., 293-6
[65]Ibid., 303
[66]Ibid., 333-5
[67]Machen, Miller and Machen by 1858

goods stations the firm must have selected the location at least in part because it offered the opportunity for direct rail access.[68]

a. Hadfield's (2)

As the century progressed, pressure on space in the Lower Don Valley led to movement further eastward. As reported earlier in this chapter Robert Hadfield started producing steel from the Hecla Works, Newhall Road in 1872. As the company history records:

> At last it became evident that the available area of the site of the Hecla Works was insufficient for the expansion demanded by the ever increasing volume of business, and it was consequently resolved that about 80 acres of land should be acquired at Tinsley, about four miles from the city, for the erection of new premises.[69]

Want of a railway connection also motivated this move. Robert Hadfield told the Parliamentary Committee on the SDR that the pressure to obtain rail access was forcing the firm to consider migrating in 1896.[70]

Ground was broken in August 1897 and the new East Hecla Works opened in March the following year.[71] More light is cast on the process by Main. Robert Hadfield Senior had died in March 1888, at which time the company was employing 500 men at Hecla Works. Steel castings production was expanding but the production of armour plate had not yet been mastered. A year after his father's death, Hadfield Junior wrote that the firm was 'under a cloud'.[72] This followed Hadfield's decision to replace some of his father's managers and to float the company. At the same time his own experiments in steel alloys were beginning to give Hadfield's a technological edge which produced benefits not only for the order book but also through the licensing of Manganese and Silicon Steel technology to other manufacturers.[73] Although some nine years elapsed between the changes in management and ownership and the move, these innovations and the rate of adoption of technical change were among the factors leading to swelling order books, the demand for more space, and the increase in

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[68]Barraclough, 1976, 68-9; White's Directory 1852, 315
[69]Hadfield's Steel Foundry Co. Ltd., July 1905, 5 and 7
[70]SCSDR, MofE, HL1896, QQ.791-3
[71]Hadfield's Steel Foundry Co. Ltd., July 1905, 5 and 7
[72]Main, c.1949, 4-3
[73]Ibid., 4-3 to 4-14

employment to 4,000.[74] East Hecla Works was also well served by direct rail connections which no doubt brought relief to the problems of access.

b. Jowitt's

Jowitt's, having set up in Savile Street in 1848, removed to Royds Works. 'These proving inadequate to the requirements of a rapidly extending business, the firm erected Scotia Works, in 1864', in Warren Street.[75] An interesting example of a firm moving only a few streets on each occasion, remaining close to the Midland Railway's goods station and therefore relocating, one presumes, purely to have sufficient space to grow.

vi. The Influence of Ownership

Changes in ownership could precipitate relocation. In 1871, Hampton and Radcliffe went into steel production in Rotherham. The next year they were taken over by the Phoenix Bessemer Steel Co. Ltd. which transferred the business to Ickles Rolling Mills near Templeboro' in 1874.[76] In 1873 the Phoenix Company went into liquidation.[77] In 1875 its assets were purchased by Henry Steel, who founded Steel, Tozer and Hampton.[78] Here we see both a relocation and a common way for new firms to select a location - by buying out an existing company either as a going concern (as in the case of Vickers) or after liquidation. This strategy was obviously successful, for between 1916 and 1919, Steel, Peach and Tozer built the largest single integrated steel plant in the area. The Templeboro' Steel Mills were situated on Fitzwilliam land on the Sheffield/Rotherham border. Designed to meet the pressing need for munitions, the mills included high capacity melting, rolling, cogging and billet plants and stretched for half a mile along the length of the Don Valley beside the Great Central's Sheffield and Mexborough branch railway. The logistics of a plant on this scale were only feasible with direct rail connections and the Mills possessed extensive sidings. Because it was a green field site halfway between Rotherham and Sheffield with little local housing, the tramways built between 1903 and

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[74]ibid, 4-19
[75]Pawson and Brailsford, 1879, 222
[76]This company had taken over the Phoenix Works in Rotherham from William Owen who had operated there since 1832. As the Owen's Patent Wheel, Tyre and Axle Company it had registered as a limited company in 1864 and had been the fourth local company to take up the Bessemer process alongside Brown's, Cammell's and Sam'l Fox. By 1870 its Bessemer capacity was four times that of Fox's - Erickson, 1986, 145-6
[77]Ibid.
[78]Steel, Peach and Tozer and United Strip Bar Mills, 1949, 14

1905 which connected the site to the homes of its workforce were also an essential locational factor.[79]

vii. The Effect of Trading Practices and Patterns

Another type of organisational issue seems to have added to good communications to influence the building of the Holmes Steel Works in Rotherham to the north east of Sheffield. This was the desire to avoid the controls exercised on manufacturers in Sheffield itself. According to Barraclough:

> The site was taken over by Peter Stubs, file maker of Warrington, in 1842, four years after the building of the Sheffield to Rotherham Railway ... It is said that Peter Stubs wished to make himself independent of the Sheffield merchants and he toured the area, looking at transport facilities. His final choice gave him the canal, to bring in his raw material supplies of iron from Hull ... and the railway to take away his product and provide him with local coal... [80]

There is also evidence that moving into new areas of the Sheffield Trades could lead to a demand for new premises. Samuel Osborn and Co. were founded in April 1852 at 182 Broad Lane to be a merchant dealing in files. In 1856 or 1857 they began to melt steel at 56 Carver Street and at Pea Croft , and at a Tilt and Forge in Philadelphia.[81] A further move followed in 1868 when Osborn purchased the Clyde Steel and Iron Works in the Wicker from Shortridge, Howell & Co. Ltd. The availability of substantial converting and refining furnaces in an integrated works proved to be the foundation of Osborn's success in manufacturing Mushet's Tungsten Steel.[82] It is interesting to note that in 1873, only three years after beginning to make Mushet Special Steel and five years after relocating, Osborn's went into voluntary liquidation with debts of £72,000 and were only saved from closure by the support of the company's creditors who preferred to leave Osborn trading and recover their debts over the next ten years.[83] This provides another illustration of the risk involved in both relocation and adoption of new technologies, coinciding in this case with a serious recession in the industry.

viii. Incremental Relocation

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[79]Lodge, 1985
[80]Barraclough, 1976, 28
[81]Seed, 1952
[82]Tweedale, 1986, 58
[83]Ibid.

Sometimes the process of relocation seems to have been incremental. Thos. W. Ward's move to the Albion Works began in 1887 when a part of the site was rented for storage (the company was mainly engaged in the scrap steel trade). In 1891 part of the property was purchased and in 1902 adjoining land was added for offices.[84]

xi. <u>The Experience of Other Industrial Sectors</u>

There is evidence that this process of expansion and relocation was common to other Sheffield trades as well as the steel industry. What was to become the Sheffield Smelting Company Ltd. was begun in 1760 by John Read, a silver refiner. In 1770 he bought the freehold of a small area of land in Green Lane, Crookesmoor to carry on his business. In 1783 he took a lease of farmland at Royd's Mill, Attercliffe which he appears to have used as an agricultural estate. Early in the nineteenth century the firm expanded. The premises at Green Lane were let and Joseph Read improved the house in Attercliffe, while taking a lease of Royd's Mill as a factory in 1808 from the Duke of Norfolk. Subsequent leases led to considerable expansion on the site, to the extent that the works stood in the way of the street improvements proposed by the Duke, and a long negotiation ensued to enable new leases to be granted so that Windsor Street could be laid out.[85]

This may be one of the few examples which has emerged of the location of a works based on subjective factors such as convenience to the owner's place of residence. Before the introduction of the factory system dwellings and workplaces were not necessarily in separate locations, so this could have been a relatively normal reason for a location decision. What might have been less usual was the separation of the Reads' dwelling from their workplace in 1783. We also see evidence that there was probably little advance planning of the relationship between factory development and street layout by the Dukes of Norfolk at the start of the century. More will be said of this in Chapter 10.

Pawson and Brailsford's <u>Guide</u> provides other examples of companies in various sectors relocating to accommodate growth. In the first decade of the nineteenth century Wostenholm's, manufacturers of spring knives, were based in Garden Street, then Broad Lane and then 'did a limited trade at Rockingham Works, Rockingham - street,[86] and afterwards removed to Washington Works, which, as

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[84]Thos. W. Ward Ltd., 1953
[85]Wilson, 1960, 10 & 35
[86]Constructed before 1815

his business attained large dimensions, he from time to time greatly extended'.[87] The engraving in Pawson and Brailsford's Guide shows the Washington Works to be a three and four storey establishment by 1879, illustrating the fact that the cutlery trades (which tended to hand finish small products) were often able to extend and intensify their use of sites by adding additional floors to their premises - something which industries such as steel making, relying on heavy plant to product bulky products, could do only to a much more limited degree.

In the file trade, William Hall of Alma Works, Barker's Pool originally had premises in Porter Street 'but was compelled by the extension of their business to provide a factory on a much larger scale'.[88] At the same time the opportunity was taken to provide proper ventilation for the file cutters, a trade associated with lung disease caused by the metal cuttings flying from the files during manufacture. The company also concentrated a large number of file cutting benches in one factory, and the engraving shows a three storey building. Pressure of business, together with organisational and limited technological change (file cutting machines were not used) are associated with this move.

Spear and Jackson, described by Pawson and Brailsford as saw manufacturers (though also appearing as steel converters and refiners in the directories) had removed twice by 1879 following their original establishment over one hundred years previously is Gibralter Street. The moves were 'to meet the increase of business', and of course, by 1879 their Etna Works stood in Savile Street, adjacent to the railway.[89]

x. Local Taxation and Economic Rationality

In 1864, Marsh Bros. were forced to close their Ponds rolling mill and one of their forges by the extension of the Midland Railway to Chesterfield through the Sheaf Valley. They had to put their steel rolling out to contract at some cost and inconvenience.[90] This led ultimately to a decision by Marsh Bros. in around 1895 to purchase the Effingham Steel Works and Rolling Mills Company Ltd. An undated and unsigned memorandum in the Sheffield Collection shows that economising on intra-urban transport costs was an important factor, along with

[87] Pawson and Brailsford, 1879, 257; Tweedale, 1986, 75-6
[88] Pawson and Brailsford, 1879, 263
[89] Ibid., 279
[90] Wire, for example, cost £3-0s-0d a ton to roll in 1870, of which 30/- represented profit to the roller; it was difficult to get work done on time during periods of peak demand; and quality was hard to control - Transcript of Arbitration Proceedings, June 1870, SC Marsh 64, Evidence of Mr. Edwin Fox

technological improvements and tax savings, in the decision to take a particular set of premises:

> I believe that by putting down a cold-rolling Plant of the latest pattern, we shall be able to turn out a better article than other firms such as Habbershons, Effinghams and others - who have, in a great measure, old fashioned and worn out Plant. The difference which Habbershons gain by not having to pay such high taxes as those at which our Machinery would be rated and also by their having cheaper water conveniences, will be fully counterbalanced by the saving to us of carting expenses - viz., taking our steel, and the time spent in loading and unloading, which amounts altogether to at least 5/- per ton.[91]

An additional benefit would be a space saving at the Ponds Works, because the File workshop and hardening shop could be transferred to the Effingham Works. The advantage in taking over an existing factory as against trying to rent a new site was considered.[92] The capital purchase price for the Effingham Works and plant of £5,000 seems to have been regarded as favourable by comparison, even with an additional requirement for new plant of £3,500.[93]

The influence of local machinery taxation on the location decision is both intriguing and tantalising. The practice of charging rates on industrial machinery grew up during the late 1880s. It reflected an argument between landowners and householders on one side and capitalists on the other about where the costs of city management should lie, with industrialists believing the charges were a tax on labour. Attempts were made in Parliament between 1887 and 1890 to abolish the taxes, but they were finally done away with only after the First World War.[94] Sheffield Council resolved in June 1888 to petition in support of the Rating of Machinery Bill. The Bill was supported mainly because it would introduce uniformity to a system operated with no definite rules in various parts of the country. It was suggested that only primary motive power should be taxed. The rating of machinery was also supported by some Councillors because machines displaced labour and it was therefore unfair to expect workers to pay higher domestic rates while machines went untaxed. The opposite viewpoint - that taxing machines also taxed labour because machinery created new jobs - was also put.[95] Unfortunately, neither the author nor the Sheffield City Libraries Local Studies Librarian (who kindly assisted the search) could unearth any

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[91]SC, Marsh Bros. Collection
[92]The memorandum states that the firm could not rent 'suitable room' for carrying on a mill with 10 rollers at a less rental than £250 per annum
[93]Ibid.
[94]Offer, 1981, 204
[95]Sheffield Independent, 14 June 1888

detailed information about machinery rating practices in Sheffield. As Habbershon's works were situated at The Holmes in Rotherham, one assumes that machinery was taxed at a lower rate in that town than in Sheffield. The precise differential remains uncertain. What this episode shows is another example of apparently rational economic deliberation being applied to the location process, taking account both of relative costs between locations and of the comparative competitive advantage of a location in the light of the situation of rival firms.

xi. Twentieth Century Developments

Although the trend for relocation of steel plants seems to have moderated by the end of the nineteenth century, it did continue into the twentieth. Darwins Ltd., for example, began business in 1774 and were based in Carlisle Street until 1890. Originally tool merchants, they later made alloy steels, alloy castings and precision castings. In 1900 they moved to Rockingham Street and then to Fitzwilliam Works, Sheffield Road, Tinsley in 1924/25.[96] W.T. Flather's introduction of the bright drawn steel bar generated such demand that the company relocated from the town centre to Tinsley in the 1900s.[97]

xii. Firms Which Did Not Relocate

Of course, not all companies which carried on a steady trade moved premises. Hoole's Green Lane Works manufactured stove grates from 1795 until at least 1862 without intermission except for rebuilding in around 1860.[98] By 1879, Hunter and Sons had been producing knife blades at the Talbot Works for over 100 years.[99] Messrs. Burys and Co. took over the Regent Works from Mr. John Bedford in around 1859. Bedford had founded the works twenty years before that.

In 1865, Burys transferred ownership of the works into a limited company and by 1879 the company had 'made large additions to their premises' which covered an area of over six acres.[100] The works were situated on Penistone Road, Philadelphia to the north of the town centre. They had no direct rail connection but produced 'blister, shear, crucible and spring steel in large quantities for the

[96] Sheffield City Libraries, Catalogue of Industrial Records
[97] Lodge 289.14, 1985
[98] Pawson and Brailsford, 1862, 174
[99] Pawson and Brailsford, 1879, 258
[100] Ibid., 220

general trade as well as for their own manufactures'.[101] They were a good example of a medium sized company which was able to expand without recourse to new premises. Like other companies they maintained a diverse product range; as well as 'raw' steel they manufactured files, saws, edge and engineer's tools, hammers, miner's picks, steel plough plates, knives for reapers, choppers and other agricultural implements. All manufacturing processes were encompassed in the works[102] and they were almost an archetype for concerns which would have distributed products in small units rather than in bulk and would therefore have gained little advantage for the product distribution end of the production process from location by the railway.

xiii. The Consequences of Mistimed Relocation

There were adverse consequences for firms in the expanding industrial sectors if they did not manage to keep pace with growing trade by relocating or extending their premises. Marsh Bros. began their company in the Park and then transferred to Porter Street when their quarters became too cramped.[103] In 1827, they moved to bigger premises in the Ponds. However, they were unable to build a converting furnace on these premises, so they 'bought the lease of a warehouse, yard and wharf on the canal in Bernard Road called the Navigation Works'.[104] Between 1830 and 1836 they were able to lay down four cementation furnaces there.[105] In 1847, a spring works was added at Dyers Croft, adjacent to the Ponds Works. In 1850 the Navigation Works was sold. In 1852, Dyers Croft was sold and the firm expanded into Upper and Lower Ponds Forges,[106] the firm presumably finding concentration on fewer sites more efficient, even though they lost their direct connection to the canal, and were further from the Midland Goods Yard in the Wicker. During this period before 1852, Pollard reports that:

> Ponds Works, together with the Navigation Works, Dyers Works and the Sheffield Croft property formed a self-contained whole, carrying out the complete range of processes from the import of the Swedish Iron to the packing of the Sheffield goods ... the firm's efforts were chiefly directed towards the production of tools and cutlery ... These goods required much skilled labour and little capital, and in their production a larger scale of operation was no advantage, while their manufacture was hamstrung by tradition and subject to very slow technical improvements only. Once a firm had grown to encompass all the

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[101]Ibid.
[102]Ibid.
[103]Pollard, 1954, 16
[104]Ibid., 17
[105]Barraclough, 1981, App.FF, 8
[106]Pollard, 1954, 17

> various products made of fine steel, it could merely add one small workshop to another, multiplying the difficulties of management and supervision without any corresponding superiority over the small man ... Marsh Brothers and Co. were reaching the limit of efficient size by 1852.[107]

Pollard goes on to describe the rise of the giant steel manufacturers, freed from the limitations on scale imposed by the Huntsman process. For a time, he suggests, Marsh Bros. were among the companies involved in the take off from small scale production.

> For a number of years they shared the rich rewards of the steelmakers who could combine quantity with the guarantee of quality ... until a number of factors, among which the limitations of their site was the most important, combined to eliminate them from the race of the giants.[108]

This, then, was the fate of the steel company which failed to keep reorganising and rationalising its operation, management and siting. Although Marsh Bros. continued to operate as a middle ranking steel company, they never gained the heights of the major firms and had to go on bearing additional costs deriving from the organisational diseconomies which Pollard describes.

xiv. Environmental Factors in Industrial Location - The Ability to Cause a Nuisance

Like most nineteenth century industrial processes, the Sheffield trades were heavy producers of pollution, much of which was likely to cause a nuisance. The growth of the steel industry, with its massive smelting and forging processes, the general application of steam engines as a power source, and the development of railways[109] all meant that Sheffield's industrial base was a particularly potent source of noxious effluents.

a. Smoke

For a city which had relied traditionally on trades generating atmospheric pollution, it would be simplistic to assume that smoke was the sole, or even the main, determinant in the growth of industry down wind in the East End. We saw earlier that the city centre was ringed with steel works from the mid-century onwards. Many of these must have been on freehold land, outside the control of

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[107]Ibid., 28-9
[108]Ibid.
[109]Especially after the Midland Railway perfected the firebox brick arch to enable coal to be burnt instead of coke - Nock, 1968, 61

landlords who might enforce covenants against nuisances, as we shall see that the Norfolk Estate did in some parts of the town. If there was limited scope for landowners to control smoke problems, what did the municipal authorities do to limit emissions? Smoke was an issue for the Improvement Commissioners for Sheffield from early in the nineteenth century. The Sheffield Police Act, 1818 stated that any person 'burning coals for converting them into cokes' without using a flue to carry off the smoke, or burning them even with a flue except between 10 p.m. and 6 a.m. would be liable to a fine not exceeding 60/-. The Act also required steam engines to consume their own smoke, with a £50 fine for offenders.[110] Attempts were made to enforce the Act. Three fines were administered in 1819. The assumption that engines could consume their own smoke was optimistic. In 1820 the Commissioners set up a committee to investigate how this might be accomplished. It was claimed that a new 'patent smoke consumer' could do the job inexpensively.[111] Two years later the local paper reported that proprietors of engines not complying with the Act would be indicted. A small number of fines ensued. In August 1827 a warning notice was served on Messrs. Greaves. In August and September two meetings were held between the Smoke Committee and engine proprietors, with no noticeable result. The Committee was still deliberating on the technology of smoke consumption. It reported finally in November 1828 that:

i. Smoke might nearly, if not entirely, be consumed;

ii. Firemen could control fires to minimise smoke production;

iii. Poor design of the proportions of fireplaces to boilers to engines contributed to excessive smoke production.[112]

The report seems to have given the authorities new resolve. In December 1829 the Police Commissioners sent a circular to all engine proprietors warning that they were determined to prosecute offenders from 1830 onwards. This seems to have been justified. In 1830, when Cobbett visited Yorkshire he called the town 'Black Sheffield', though he acknowledged the need for the blackness to enable production of tools for farmers to till the land.[113] It was decided that the Commissioners would watch the chimneys of the six worst transgressors and ballot to determine which should be prosecuted as a test case. The lot fell to Messrs. Greaves but they forestalled the action by installing smoke consuming

[110]Shaw, 1959
[111]Ibid.
[112]Ibid.
[113]Cobbett, quoted in Coleman, 1973, 50-1

equipment and mitigating the nuisance. Not all engine owners were so compliant. By September 1831 only three of twelve firms indicted had complied with their abatement notices. In the same year an attempt to prosecute the Soho Wheel failed because of a legal technicality[114] and because nobody from the locality could be found to swear that they considered smoke from the Wheel to be a nuisance. According to a statement made twenty years later, when the question of smoke bye-laws was under discussion, 'The Commissioners failed so signally that for several years they did not touch the subject again'. Instead they confined themselves to requiring the raising of chimneys to a minimum height. Consideration was given to serving a notice on Messrs. Vickers in August 1834, but the Law Clerk advised that the Police Act was only effective against engine chimneys. As this was not the source of the nuisance at Vickers, no action was taken.[115] In his 1840 poem 'Steam at Sheffield' Ebenezer Elliott, the 'Corn Law Rhymer' makes it abundantly clear that the smoke (and noise) nuisances remained an evil, though like Cobbett he thought it a necessary one.[116]

In May, 1844 the Town Council turned its attention to the subject of smoke. It discussed the possibility of introducing a bye-law similar to one adopted in Leeds enabling a fine of 40/- to be imposed for each week that a nuisance persisted. Sheffield Council decided not to proceed. One councillor even considered that it was 'not conducive to the health [probably the economic health] of this town to remove the smoke'.[117] There were strong vested interests at work. For example, one of the worst causes for complaint in 1848 was a flour mill owned by Alderman Clegg, who was later to chair the Council's Health Committee.
Some proceedings were taken in the 1840s but it was not until the early 1850s that the Council gave the subject serious attention again. In May 1852 the Smoke Committee recommended the appointment of smoke inspectors to monitor emissions on a regular basis. This proposal was deferred by the Council because of financial considerations. In July, a resolution to introduce smoke bye-laws was made. These were disallowed by the Government. A revised set was made in October 1853 and came into force in September 1854.[118] Unfortunately for those seeking cleaner air in the town, the bye-laws had considerable drawbacks. They required that:

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[114]It being argued that it was only necessary to reduce smoke to the level which would have been possible with the unsophisticated smoke consumption techniques available at the time of the 1818 Police Act
[115]Shaw, 1959
[116]Trade makes thee rich then ... murmur not /Though Trade's black vapours ever round thee rise .../Thou canst not see, unnumbered chimneys o'er/From chimneys tall the smoky cloud aspire/But thou can'st hear the unwearied crash and roar/Of iron powers, that, urged by restless fire/Toil ceaseless day and night yet never tire - Elliott, quoted in Coleman, 1973, 71-2
[117]Shaw, 1959
[118]Ibid.

> ... every fire-place or furnace employed or to be employed within the Borough of Sheffield in the working of an engine or engines by steam, shall be constructed or altered so as to consume or burn the smoke arising from such fire-place or furnace or the combustibles used therein ... [119]

If any engine furnace was used negligently, or built in such a way that it did not consume its smoke, there was a fine of 20/- for the first offence, 40/- for the second, and £5 for subsequent offences.[120] Constables were given a right of entry to inspect furnaces.[121] Not only did the bye-law fall short of the mark by failing to address the question of industrial smoke sources other than steam engines, it also contained what looks to be a clause designed as a palliative to the influential manufacturers who had so far defied the anti-smoke legislation and who seem to have delayed progress towards introduction of new bye-laws. The clause was a proviso that '... the words 'consume or burn the smoke' shall not be held in all cases to mean 'consume or burn all the smoke' ...',[122] and allowed the Justices to remit fines if the offending furnace was constructed '... to consume or burn as far as possible all the smoke arising ...' so long as the furnace had been carefully attended.[123] While it would have been unreasonable to expect all smoke to be consumed, this proviso would surely have given manufacturers a substantial loophole when faced with prosecution.

It is hardly surprising, then, that Pollard notes that the bye-law was ineffective in reducing the problem and quotes <u>The Builder</u> of 21 September 1861:

> A thick pulverous haze is spread over the city and the sun even in the long day is unable to penetrate, save by a lurid glare ... [124]

When the Chesterfield Extension of the MR opened in February 1870, an observer noted that the view of the city from the new elevated station in Attercliffe Road was obscured by 'dense smoke, clouds of steam and belching furnaces'.[125]

There was no change for the better by 1875, when the <u>Sheffield Telegraph</u> visited the Yorkshire Engine Works at Meadow Hall, starting out from Brightside:

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[119]Sheffield Council, 1871, 3-4
[120]Ibid.
[121]Ibid., 5
[122]Ibid., 3-4
[123]Ibid.
[124]Pollard, 1969, 13
[125]Batty, 1984, 40

> Hereabouts everything is gloomy and unlovely; not even on 'Night's Plutonion shore' could the prospect be blacker or more repellant ... Not all the efforts of all the housewives in Brightside could keep the doorsteps free of dirt; it insinuates itself everywhere ... Smoke is king at Brightside; it is a despotic monarch, and it does what it pleases. It envelopes the entire district as in a cloak; it sinks down on the house-tops and into the streets ... [126]

Clearly the bye-law had little effect on the scale of pollution, for the article continues 'There is a tradition that a law was once passed to oblige manufacturers to consume their own smoke; they would have to have large appetites if they could consume all the smoke they occasion at Brightside'. Proceeding to Meadow Hall itself, the Telegraph found:

> ... manufactories all round - on the cliff and in the valley. These buildings are of different sizes; some are small, some are large, but all are - smoking. The coke-ovens belch forth a black challenge to the skies; the puddling furnaces send up a vast column of thick sulphurous vapour, the top of which is lost in the clouds; the foundries load the atmosphere with stifling odours ... A pleasant place, truly - the Garden of Paradise of iron and steel manufacturers.

Even the originators of this nuisance seem to have been exasperated by it. The Managing Director of Edgar Allen and Co. Ltd. wrote to Mr. Allen (then abroad) on 27 February, 1891:

> ... The fogs here every morning are atrocious. Frequently one cannot see a horse and cart 5 yards off! One ought to be well paid for living in such an - I won't insult it by calling it an atmosphere! ... [127]

Towards the end of the study period W.H. Thomas, one of the managers of Jessop's, concluded a description of their Brightside Works by saying that:

> I am afraid that I have been somewhat handicapped in my attempt to describe the Works by the absence of one of the essentials of a Steel Plant and that is the atmosphere of smoke which must be seen and tasted to be believed.[128]

Given the intensity of the smoke problem, and the fact that the town centre was ringed by industrial plants, with factory development also spreading along the Upper Don Valley to the north and, to a lesser degree up the Sheaf Valley to the

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[126] Sheffield Telegraph, 28 October 1875
[127] Edgar Allen & Co., Director's Private Letter Book 1, 1883-92, SC MD 3970-2
[128] Thomas, 1913, 59

south, it seems probable (as Rex implies) that the impact of this type of pollution must have been at least as much on residential location decisions as on industrial. Those with choice - the middle classes in Broomhill and surrounding areas and the better off working classes in areas such as Walkley - selected the higher ground to the west and south west for their homes and kept these suburbs almost entirely residential.[129] There, they had the advantage of the 'pure and invigorating' west winds from the 'lofty moorlands' of the Peak District.[130] Cannadine concludes that in Sheffield the combination of prevailing winds blowing smoke eastwards and the attractions of the Peak District to the west was the best explanation for the development of industry and poor quality housing in the East End.[131]

b. Water Pollution

The ability to pollute the air was, then, a necessary precondition for selecting an industrial site So too might be the ability to foul the town's watercourses. By the mid-century the main rivers were heavily polluted with both commercial and domestic wastes.[132] The Town Council did little to remedy matters, only deciding to introduce a combined sewerage system in 1884. Complaints about river pollution continued into the 1890s.[133]

The value of being able to pollute freely was emphasised in the arbitration between Marsh Bros. and the MR over the closure of part of their Ponds Works by the railway's Chesterfield Extension and the adverse consequences on their remaining works of the changes wrought in the area by having a main line station on the doorstep, with the consequent improvements in the quality of the neighbourhood. Asked by Counsel whether the company was still free to clean its goits and weirs, Theophilus Marsh, the Senior Partner replied that before the railway extension:

> The place was really and practically in the country, now they are in the centre part, in fact almost the best part of Sheffield. Formerly we might throw our refuse which was accumulated there on the banks of the feeding goit and now it is entirely enclosed.[134]

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[129]Pollard, 1969, 23
[130]Pawson and Brailsford, 1879, 50
[131]Cannadine, 1980, 405
[132]Pollard, 1969, 15
[133]Briggs, 1971, 237
[134]Transcript of Arbitration Proceedings, June 1870, SC Marsh 64

Marsh went on to say that three principal streets now served the station and whereas before, the company could stir up the mud in the dams and discharge their contents, they felt they could no longer do so:

> Of course that (discharging the dams) created considerable exhalation of an unpleasant odour, but if you were to do that now I suppose the Railway Companies or the authorities of the town decidedly complain ... We did not pollute the stream but on the other hand the water in the Reservoir is certainly not clean water.[135]

The company also felt it could not make smoke so freely now that it was encroached upon by the town. The subject was returned to in examination of Frederick Fowler, a surveyor, who considered that the value of Marsh's business at the Ponds was enhanced by the ability to pollute. The examination produced a lively exchange:

> Mr Fowler Those works as I have already said I have known for many years. I have known that it was a place that was exceedingly well known throughout the town where the greatest nuisances were to be found. The nuisance of the Ponds was a very well known matter. I look upon that as a valuable privilege for Mr. Marsh for commercial purposes
>
> The Umpire It is the first time I have ever known a nuisance considered a privilege
>
> Mr Pollock (Counsel) Q. If you displace Messrs. Marsh so that they have to go 'further afield' would they 'fare worse'?
>
> A. They would
>
> Q. In the sense of not being able to find a place where they would not be attacked for causing a nuisance?
>
> A. It was the best place in Sheffield for carrying on a nuisance. It was so well known and seemed to be acquiesced in by everybody - the ponds and all those goits - the clearing out and the dirty water being notorious ...
>
> Mr Pollock ... a nuisance being there for so many years becomes hallowed and respected as it were.[136]

Although Marsh Bros. no doubt sought to play up the value of their 'right' to pollute, to maximise financial benefit from the arbitration, there is a rational case underlying their evidence. The Ponds was certainly considered one of the most

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[135] Ibid.
[136] Ibid.

noisome parts of Sheffield by more objective observers.[137] As the civilised activities of the central area began to invade, and improvements were made, pressure would grow to deal with polluters - a blind eye could no longer be turned by the authorities. The image of the town from its new principal approach would begin to take precedence over commerce's desire to dispose of its waste products in an unfettered manner. This would no longer be a suitable location for this type of firm and reorganisation or relocation of all or part of the operation might ensue, as it did for Marsh Bros.

c. Noise

Noise was also a by-product of industry, especially forging; rolling; and manufacturing shear steel, which required heated lengths of blister steel to be beaten together under a tilt or forge hammer.[138] Tilt hammers are described as working with 'incessant, deafening noise quite irritating to unaccustomed ears'.[139] The Sheffield Telegraph described the noise in the wheel shop of the Yorkshire Engine Works as:

> ... terrific, for a couple of steam hammers are constantly dealing thundering blows to the masses of metal placed beneath them. In the boiler shop, such a hammering ... it is as though Vulcan and all his assistants had come to earth to deafen our ears with their superhuman clanging.[140]

Although the effect of noise from factories on their neighbours was not covered by the bye-laws, it did sometimes concern landlords seeking to enforce covenants in ground leases. The Norfolk Estate occasionally took steps to deal with noise problems when complaints were received (see below). The Fitzwilliam Estate may have done so too, for when Edgar Allen & Co. extended their works in 1900 (see Chapter 12) they wrote to their solicitors to clarify a clause in the draft lease:

> ... Covenant 12. No doubt this is a proper covenant as to any offensive trade being carried on on the land, but suppose we erect steam hammers thereon, would they be considered offensive? You will remember that Whitworths of Manchester and Moser and Sons of London were compelled to remove their hammers, and it was a very costly business to them.[141]

d. Conclusions About Nuisance

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[137]Pollard, 1969, 15
[138]Pawson and Brailsford, 1879, 205
[139]Ibid., 212
[140]Ibid.
[141]Edgar Allen & Co., Directors Private Letter Book 2, 6 February, 1900, SC MD 3971

There was clearly an advantage to polluting firms to be located where a nuisance could be made without annoying anyone able to take effective action requiring the manufacturer to mitigate the effects of the offensive activity. This would generally mean suburban locations away from more select residential areas and the better streets of the town centre, in parts of the town such as the Ponds (before the 1860s) or Brightside where pollution was more acceptable.

xv. Topographical Factors in Location Decisions

We have already observed that the physical geography of Sheffield would impose restrictions on laying out very large works, especially if they extended over several acres. The Upper and Lower Don Valleys and the Sheaf Valley would tend to be self-selecting as areas where giant works could be situated. At the same time, there was considerable industrial development on the hillsides of the town, and much experience of constructing smaller works in the steeply sided valleys of the surrounding area. The entrepreneurs setting up new large works in Attercliffe and Brightside probably had little notion of how massive their plants would become. When Charles Cammell created the Cyclops Works in 1845, the factory occupied four acres:

> ... and the covering of this extent of land with a huge manufactory appeared so bold a venture that many were startled and prognosticated that so rapid a progress could not be sustained.[142]

Although the new works needed big areas of flat land to accommodate large scale production techniques, their progenitors would not have expected that 20, 40 or even 80 acres would eventually be needed for expansion. With hindsight it is obvious that the Lower Don Valley offered the best opportunity for future growth, but in the 1840s the move from the traditional industrial quarters round the old town must have been a bold step and not necessarily an obvious location decision in spite of its topographical logic. This is not to say that the advantages to the town of the more level land on its eastern marches had not been recognised at the time, at least as a transportation corridor. The Sheffield Independent of 3 November 1838 opined on the subject of the Sheffield and Rotherham Railway that:

> If the principle of Mr. Stephenson's engineering be correct - the low level principle - then, certainly, the valley of the Don is the only line of outlet for the people of Sheffield.

[142]Pawson and Brailsford, 1862, 126

The Duke of Norfolk's Agents seem to have been aware that a level site was important to steel manufacturers, but that other factors might be traded off against this. In March 1856 they wrote to Mark Firth with a tracing of land at Parkin Wood, Ecclesfield, which he seems to have been considering for a new works. This may have been when the company was looking for a new site and ultimately settled on the Whittington Works near Chesterfield (see above). The Agent wrote that 'the land is not very flat, but it adjoins the Railway and on this account has some advantages - coal abounds close by'.[143] Mark Firth does not seem to have felt that these advantages of communications and ready supplies of raw materials justified locating a plant at Parkin Wood since there is no record of Firth's setting up there.

The topographical limits on the direct connection of works to the railway and the ability to find level factory sites were discussed by the 1864 House of Lords Committee on the MR's proposal to run its new main line down the Sheaf Valley en route to Chesterfield. Charles Cammell gave evidence that works were likely to be built 'on the low level', so a line at that level would be most convenient for existing and new works. John Hobson, a cutler, said that 'the high level of the MSL prevents any large works being established along it as compared with the low level Midland Company', and because the steep rise of the valley sides to east and west limited the amount of level ground available, Counsel to the Committee questioned the assertion by other witnesses that new works would 'spring up' along the line.[144] The needs for the potential to make a rail connection at the same level as the works, and to have a sufficiently large, flat site were clearly well understood by this date.

a. <u>Ground Conditions</u>

There were other topographical difficulties which had to be considered. The developer of a new works had to deal with variable ground conditions. The Lower Don Valley was low lying and marshy, with heavy clay soils. A contemporary observer recalled how the waggons bringing large stones to build Firth's Norfolk Works would sink deep and become stuck in the clay in wet weather.[145]

Firth's handled this at the Norfolk Works by using the clay for brick making, and gradually back filling the flooded brickpits with clinker and ash from their furnaces. This process was quite drawn out. The workmen at the new plant had to move about for some time using inclined planks until enough ash had been

[143] ACM/LB/D/346
[144] HLRO, Evidence, MR (Chesterfield to Sheffield) Bill, HL1864, Vol.19, 10, 75 & 90
[145] Marshall and Newbould, 1924, 10

produced to form a decent floor.[146] The West Gun Works of 1863 required foundations built of 5,000 cubic feet of stone on 4,800 feet of wooden piles.[147]

Hadfields initially occupied an area of 20 acres at their new Tinsley site, out of a total of 80 acres. This had to be raised by an average of six feet at the start of construction work in August 1897. This does not seem to have delayed building. East Hecla Works was opened in March 1898 with the factory 'nearly all erected and the machinery ... started for manufacturing purposes'.[148] Edgar Allen & Co. had to fill at least part of the 12 acre site they were leasing and purchasing as an extension to their Tinsley works in 1899 (see Chapter 12).

b. Flooding

Groundworks were a cost to be borne once only in carrying out new construction. During the operation of a works, flooding could be a recurrent difficulty. The Ponds area and the low-lying streets on both banks of the Don above Lady's Bridge were often flooded.[149] There seems to have been a persistent flood problem for works in the Lower Don Valley - a penalty to be set against the benefits of extensive areas of relatively level land. An extreme example of the difficulties this could create is to be found in October 1875 when heavy floods affected the Don Valley. The Independent reported that the flooding problem had been alleviated by construction of the Sheffield and Rotherham Railway embankment in the late 1830s. Previously 'the floods rolled fiercely along between Tinsley and Rotherham Weir head, unimpeded by any obstacle',[150] though presumably an impediment themselves to urban development on the flood plain. The 1875 floods were heaviest from Brightside down to Rotherham. Traffic stopped on the MSLR. Vickers works were flooded to the level of their second floor weigh room. They had to cease production and the workforce made for higher ground. Building work on a new factory opposite Vickers was halted as the water overspread the brick fields. Power was lost at the Suffolk Works. On the Porter, works were flooded several feet deep. There were explosions at some steelworks and colliery workings were inundated.[151] The effects on Osborn's Clyde Works were 'disastrous'.[152] The deterrent to locating on an undrained flood plain caused by the risk of flooding may have been a factor which put off smaller scale land uses. The burgeoning steel industry, with its

[146] Ibid.
[147] Tweedale, 1986, 33
[148] Hadfield's Steel Foundry Co. Ltd., July 1905, 5
[149] Pollard, 1969, 15
[150] Sheffield Independent, 25 October, 1875
[151] Ibid., 23 October, 1875
[152] Ibid., 21 October, 1875

need for large sites, was able to overcome the problem by making the investment in landfill necessary to reduce the risk of flooding to a tolerable level.

c. Water Supply

While the negative effects of a site on a flood plain may have restricted the market for such land at least to some degree, the steel manufacturer could not afford to be too far divorced from a substantial source of water. The primary determinant of industrial location before the introduction of steam power was access to a site which could draw on enough head of water to drive machinery. This limitation was greatly reduced by the steam engine - a factor recognised at the time:

> Formerly the great motive power in our manufactories was the water abounding in numerous streams, and this is still utilised ... But the water power ... is as nothing in comparison with the enormous steam power now employed in some of our larger factories.[153]

We saw earlier in this chapter that the value of water powered mills was in decline. The same witness at the Marsh Bros. arbitration commented that improved land drainage was another factor in making water power less reliable by diverting supplies.[154] Although the liberating effect of steam power opened up far more potential sites to industrial development, steam engines still needed a water supply. This was not dependent on the pressure produced by a head of water in the way that a water wheel was. Nevertheless, substantial volumes of water could be consumed. Manufacturing processes such as rolling also used water.[155]

Making provision for adequate supplies of industrial water is a subject which recurs regularly throughout the Duke of Norfolk's Land Agents' letter books from 1841 to the end of the nineteenth century. In a letter setting out the terms of a lease to Firth's on 7 February, 1850, for example, the tenant is required to pay £70-0-0 towards the cost of a conduit from the Don to serve the works and to contribute to its future repair; to pay 3/- per horse power per annum for water; and to return it above Royd's Weir when used, laying iron pipes in the street to achieve this.[156] This type of clause is a feature of all subsequent recorded industrial lettings. The payment for water rights was often complicated, since

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[153]Pawson and Brailsford, 1879, 47
[154]Ibid.
[155]Ibid., 236
[156]ACM/LB/B/308

they did not necessarily reside with the ground landlord at the time when leases were granted. For example, Beet and Sons had to pay Vickers for the use of Don water.[157] Letter book D, in particular, contains a number of letters to various tenants about disputes over water rights, the correct diameter to be used for pipes, and other matters relating to goits supplying water to factories.

The question of ensuring adequate water supplies to the Duke's industrial estate exercised the forethought of the Duke's Agent. In December 1856 he wrote to solicitors:

> In the township of Brightside Bierlow the Duke of Norfolk has much property contiguous and near to the Sheffield and Rotherham Branch of the Midland Railway and on this property many Works moved by Steam Power have already been erected, and other parts of this Estate are adaptable to this purpose ...

The Duke had arranged with the tenant of Royd's Mill, which held the water rights from its days as a corn mill[158] to allow extraction of water for those works from the Don for a rent, so long as the water would be returned to the river above the mill after use. The letter continues:

> It is now deemed advisable to make provision for an ample supply of Water for such Steam Engines and Works as may in all probability be erected on this part of the ... Estate.

The letter concludes that arrangements will be made to pipe the used water from these new works back above Royd's Weir.[159] Apart from providing evidence that by the mid-century the Dukes had a policy of planning for industrial development in the East End, this letter shows how much had to be done to make sure enough water was accessible to make the Duke's land suitable for industry.

The Don was not the only source of industrial water. The canal company sold water to the works along the banks of the navigation. The Duke's Agents were instrumental in arranging this. In July 1853, Marcus Smith wrote to the navigation company to enquire about taking a supply from the canal for neighbouring development sites:

> Will you be good enough to inform me whether the River Dun Co. will enter into an arrangement with the Duke of Norfolk or his Lessees for a permanent supply of water from the Sheffield Canal for the use of Steam Engines on His Grace's Estate ... A party now about to build near the Canal is wishful for a supply

[157]ACM/LB/B/648
[158]ACM/LB/A/265/Lady Day 1845 - renewal of Lease
[159]ACM/LB/D/628

> previous to his laying pipes from the River to which he must have recourse if he cannot have a permanent arrangement with the River Dun Co.[160]

The company asked for more information about the amount of water required. The Agent could not be specific, though wanted to give the impression that he expected significant development of factories in the vicinity, because he forecast that 'engines to the extent of 1, 2 or 3 hundred horse power may be placed near the Canal within a very short time ...'. The charge for water was based on the horse power of the engines supplied.[161] In this letter, Smith showed how keen the Estate was to create the right conditions for as much industrial development as possible in the area, by implication suggesting that transport advantages alone were not a sufficient incentive to locate by the canal at this time:

> I would remark that whatever encouragement you can offer to the erection of works on the banks of the Canal will tend to increase the revenue of the Canal by reason of the traffic thereon to such works.[162]

The canal did become a source of industrial water. Cocker Bros. paid £13-0-0 per annum to the Sheffield and South Yorkshire Navigation Company for a 5" diameter inlet pipe. They added a 6" pipe to serve the condenser for a steam generator in March 1911. For this they had to pay £22-0-0, the Navigation's General Manager writing:

> That is the very lowest we could take, and I offer this on the distinct understanding that you give us all the traffic you possibly can. I ought, in the best interests of the Company, to charge you the full rental of £28.[163]

An acceptable water supply, then, was an essential prerequisite of an industrial site even after the relative decline of water power. In spite of the abundance of water in Sheffield, ensuring such a supply for large works involved complex legal and hydraulic arrangements, often rooted in historical rights over water deriving from the previous era when access to water power was of great value, and rights to draw enough water to run a mill were jealously guarded.

Table 6.1

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[160]ACM/LB/C/276
[161]ACM/LB/C/280
[162]Ibid.
[163]Letter and draft agreement dated 4 March, 1911 retained by Messrs. Cocker Bros., catalogued as SC SYRO S60 Cocker Brothers Limited 3/3

Firms Surviving Between Directories and Changing Address or Adding Addresses to Directory Entries

Date	No. of Firms	% of All Survivors
1797 - 1814/15	3	42.85
1814/15 - 1822	5	25.00
1822 - 1828	7	30.43
1828 - 1837	7	28.00
1837 - 1841	15	34.09
1841 - 1852	17	39.53
1852 - 1861	23	34.85
1861 - 1871	20	25.64
1871 - 1879	29	27.62
1879 - 1891	23	15.23
1891 - 1901	2	1.22

CHAPTER 7

GOODS TRANSPORT IN SHEFFIELD

In Chapter 2 the relationship between urban goods transport and micro-location decisions was discussed. In this chapter we assess how:

i. Accessibility to regional and national markets might influence which side of Sheffield attracted particular industries;

ii. The ease of use and physical capacity of intra-urban transport systems, including the time added to production by local transportation and terminal activities;

iii. The financial costs of transportation and the extent to which they might be perceived by industrialists as marginal costs in location decision making; associated factors would be the pricing structures offered by the transport sector, the degree of competition between transport suppliers, and whether producers or customers paid transport costs.

Once the inter-urban carting and packhorse systems began to be supplemented by canals and railways, there were five ways for manufacturers to obtain supplies and distribute products:

i. Through the transport companies' own terminal facilities - the Sheffield Canal Wharf and the railway goods stations and freight yards;[1]

ii. From private wharves on the canal, or sidings belonging to the manufacturer in the railway freight yards, which were not connected directly to the factory;

iii. Through privately owned or rented warehouses of other manufacturers, stockholders or private carriers, whether adjacent to the canal or railways, or elsewhere in the town;

iv. On private wharves or sidings within the curtilage of factories connected to the canal or railways;

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[1]Identified in Chapter 5 above

v. Through continued use of surviving traditional inter-urban carrrying services.

These modes can be grouped. Modes i-iii required an intermediate cart trip to deliver goods from the transport terminal to the factory. Mode iii would also be likely to involve some additional costs for getting the goods from the terminal to the intermediate warehouse, and demurrage. There would be a profit for the merchanting company. However, it still falls into the group of terminal modes which did not allow immediate delivery within the works. Mode iv enabled delivery direct to the works and, in the case of more advanced plants with a good internal rail system, direct to the production floor. Mode v enabled direct delivery, although carriers also continued to operate from the town's inns until late in the century.[2] This mode would not have been significant for large volumes of industrial traffic after the mid-century.

An essential question is the extent to which there was a substitution effect between these modes. This would have been affected by a number of factors:

i. Did manufacturers have a choice of delivery mode, or was it determined by the transport undertaking?

ii. Was there a money cost difference between modes?

iii. Were there other costs or advantages such as economies of scale or the ability to retain flexibility of delivery which might have affected choice of mode?

iv. The ability of the firm physically or financially to hold stocks in the quantities necessary to justify direct delivery to the factory.

v. The physical size or volume of traffic which could be accommodated through any particular terminal mode.

1. <u>Access to Regional Markets and Suppliers</u>

This aspect of the location equation is particularly difficult to assess for Sheffield. The steel industry was located in a concentric zone around the town centre, but with a growing emphasis on the Lower Don Valley as a home for large scale producers. To the extent that the river valleys also acted as communications

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[2] E.g. <u>Sheffield Red Book</u>, 1877, 48-50

corridors, one could say that the large producers at least followed a trend towards facing their regional markets and suppliers. Unfortunately, because the topography of Sheffield was such a constraining factor it is hard to give precise weight to the regional markets hypothesis in isolation as a reason for choice of location.

The limited evidence available from company records suggests that as trade with regional, national and international markets increased through the nineteenth century, there were many destinations for Sheffield goods. There was also an important internal market for iron and steel traded between stockholders and manufacturers of metal goods within Sheffield itself. This was in addition to substantial volumes of coal, casting sand, refractory materials and so on from local sources and more distant parts.

Coal came from the Norfolk pits east of the town centre, the Fitzwilliam mines to the north east of Sheffield and other coalfields in South and West Yorkshire; refractory materials from local Pennine sources but also from further afield, as in the case of casting sand supplied from France to Edgar Allen & Co.[3] Iron was imported from a number of overseas sources, most commonly through Hull. Doncaster's received iron through east coast ports such as Tyne Dock, Sculcoates, Stockton-on-Tees, West Hartlepool, Grimsby, London, Newcastle, Sunderland and Whitby as well as local stockholders. Scrap came from Bristol. Coal and coke came from local merchants but also from Rotherham, Orgreave and Dronfield, and enquiries were made about supplies of coke from Durham; charcoal came from Manchester and Salford.[4]

Destinations (or ports of lading) for Doncaster's finished goods included London (especially Poplar Station for London Docks), Lancaster, Birmingham, Bingley, Chesterfield, Hull, Coleford, Glos. (Mushet's Titanic Steel Co.), Liverpool, St. Helens, Sunderland, Crigglestone near Wakefield, Leeds, Warrington, Masboro', as well as several works in Sheffield.[5]

At around the same time, between 1865 and 1868, Seebohm and Dieckstahl were shipping goods on the Midland Railway to Newcastle, Glasgow, Colchester, Wisbech, Belper, Bridgewater, Edinburgh, Sunderland, Exeter, Salisbury, Bury, Liverpool, Southampton, Gloucester, Winchester, Reading, Steeton near

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[3]See Chapter 12 below

[4]SC LD369, 9 July 1869, 12 July 69, 26 Aug. 69, 3 Aug. 69, 14 Oct. 69, 23 Feb. 70, 2 Mar. 70, 30 Aug. 70, 2 Sept. 70, 21 Oct. 70, 22 Dec. 70, 30 Dec. 70, 24 Feb. 71

[5]Ibid., 2 Jul. 1869, 5 Jul. 69, 9 Jul. 69, 7 Aug. 69, 17 Aug. 69, 5 Oct. 69, 16 Nov. 69, 8 Dec. 69, 25 Feb. 70, 16 Apr. 70, 5 May 70, 20 May 70, 25 Aug. 70, 27 Oct. 70, 22 Dec. 70

Rotherham, Birmingham, Bury, Salford, Liverpool, Keighley, Bedford, West Bromwich and Little Eaton; and on the MSLR to Bury and Liverpool.[6]

In 1896, destinations for goods from the large manufacturers were just as diverse. The SCSDR heard from Vickers, Firth's, Hadfield's and Jessop's that UK destinations for their products (in eastern England only) included London Docks, Hastings, Lincoln, Norwich, Colchester, King's Lynn, Rochester, Ipswich, Grantham and (to the south) Southampton Docks and Basingstoke. Coal was taken from the Derbyshire, Nottinghamshire and Dukeries coalfields.[7]

Given this geographical diversity in destinations for finished goods, it is difficult to conclude that any one suburban location would have given optimal access to all potential regional markets. Essentially, Sheffield firms needed to be able to communicate with all points of the compass. An orientation to the east of the town would, though, have had greater advantage in the assembly of raw materials because it would favour access to Hull, the East Coast ports and London, and would also have been better placed for supplies of coal and iron which came mostly from eastern areas. The penetration of the railways through Sheffield eventually meant that break of bulk points in the goods stations and sidings gave access to all destinations from most parts of the town, but for bulk deliveries of local raw materials the East End would remain the best choice.

2. <u>Warehousing and Stockholding</u>

i. <u>Steel Merchants</u>

In the decennial review of directories (see Chapter 5), the business of steel merchant is not categorised separately until 1871, when seven companies are listed, all in or close to the town centre.[8] By 1891, 39 Steel Merchants appeared in the Directory.[9] Of these, nine were also manufacturers and traded from their factories, mostly in the western industrial suburbs around Philadelphia, or near the town centre. A further five identified offices both in the town centre and at other premises which were presumably their stores. Two of these were based at railway goods stations and two others were near goods stations. All these manufacturers and merchants were located in areas associated with manufacturing, or within easy reach of such areas by road.

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[6]SC Aurora 585
[7]SCSDR,, MofE, HL1896, QQ 357, 364, 464, 623, 625-6, 634, 776, 778-9
[8]White, 1871, 362
[9]White, 1891, 799

The remaining firms listed in the directory gave office addresses in the central business district. They may not have held stocks locally but simply acted as brokers.

ii. Iron Merchants

Iron merchants were a more significant potential attractor than steel merchants, being suppliers of one of the bulk inputs to steel production. Figures 7.1 - 7.3 show the location of iron merchants in 1822,[10] 1852 and 1898,[11] In 1822, the majority of the 14 merchanting companies were based in the central part of town, around the cathedral and West Bar, with the remainder in more suburban locations and two out of town companies without local representation.

This pattern had not changed much by 1852. Only three firms survived from 1832, all out of town companies. Most iron merchants were based in what was now becoming the central business district, especially in High Street and around the cathedral. There were 23 merchants, but White's also lists 25 'Iron, Steel, Metal, Wire etc. Dealers'. These latter favoured locations in what was now the outer periphery of the centre, bordering on the inner suburbs. Four firms had located north of the Don close to the MR's Wicker Station. Four others were near the canal basin.

By 1898 the position had altered substantially. Of 52 companies, only three survived from 1852. There was a strong concentration of company offices in and just off High Street (shown on the map as an interlinked cluster), but many firms had premises near the railway goods stations or canal basin. Four had a central office and a suburban address too, suggesting one base for administration and another for stockholding. The most extensive example of this was George Turner, with addresses at Park Goods Station (MSLR), Pond Street near Queens Road Goods (MR) and Harvest Lane near Bridgehouses Goods (MSLR), and a 'chief office' in Bank Street in the centre.

[10]Baines' Directory
[11]White's Directories

This demonstrates:

a. an attraction of the merchant stockholding function to the goods termini;

b. that any steel firm seeking close linkages with merchant stockholders would need to locate near the railway goods yards. The locational pull of railway facilities and the stockholding function is indistinguishable.

iii. Coal Yards

In 1840, substantial volumes of coal were still arriving in Sheffield by road. Of 1,040 waggons counted on the busiest route through the Park on a Friday during a recession, most were carrying coal.[12] Nevertheless, from the evidence in this chapter and elsewhere in this thesis it is clear that the canal basin was an important source of coal stocks after 1820, and that this role passed to the railway goods yards during the second half of the nineteenth century. Contemporary maps show the large size of the coal depots stocked by the Duke of Norfolk's Park Colliery (Broad Street and later Blast Lane depots), Nunnery Colliery (the Soap House Depot) and Salmon Pastures in Attercliffe, served by a tramroad from Nunnery. Gannister was also available from a works adjacent to Salmon Pastures.[13] These yards were close to the MR's Brightside Mineral Yard[14] and MSLR's Nunnery Goods Sidings. Again, the attraction of the coal depots would be inseparable from that of railway goods facilities.

iv. Inter-Trading

The steel manufacturers appear to have acted as merchants for each other to a far greater extent than is indicated in the directories. The clearest evidence of this comes from Doncaster's letter books. Between 1869 and 1871, Doncaster's supplied Swedish iron to Hargreave Smith & Co., Thos. Jowitt & Co. (a regular customer), John Askham of Broad Lane Works, Austin and Dodson of Cambria Works, Vickers, and Samuel Newbould & Co.[15] Iron was purchased from Firth's (regular suppliers), Marsh Bros., Jessop's (regular suppliers and the only one of these firms to advertise as iron merchants) and Thos. Jowitt & Co. Springs and spring steel were bought from John Brown's and Marriott & Atkinson and scrap from Thos. Ibbotson & Co. In March 1870, Doncaster's ordered iron from Weiner

[12]Holland, 1843, 81
[13]Barraclough, 1984, Vol.2, Fig.10
[14]Ibid.
[15]SC LD369, 9 Jul. 1869, 22 Jun. 69, 14 Oct. 69, 16 Nov. 69, 3 Nov. 70, 30 Jan. 70, 18 Jan. 70, 8 May 71, 5 Feb.70, 19 Oct. 70, 2 Nov. 70, 16, 19 & 21 Jan. 71

& Co. in London to sell on to the Sheffield market. In October 1870, iron was ordered to be made ready from Firth's warehouse to be resold to Sheffield customers by Doncaster's.[16]

v. Conclusions on Merchanting

It is difficult to separate the business of local merchant from that of local manufacturer. To the extent that there was a separate merchanting function it was often exercised by companies with local offices but not necessarily local depots - raw materials being ordered and shipped direct from the original supplier with the merchant acting as middleman. The locational relationship for firms engaged in the dual role of merchant and manufacturer would have been symbiotic and characterised by the general grouping normally deriving from common interest in exchange of goods and services. For other merchanting firms the effect cannot be separated from that of the railway and canal termini.

3. Local Transportation

i. Road Transport of Goods

The economic and physical growth of Sheffield was reflected in the increase in the number of people employed to transport goods. In Chapter 5 the growth of the railway and canal workforces was charted. A similar trend is shown by the Census data in Appendix 3 for the trades engaged in carrying goods about the town and further afield by road - Carriers, Carters, Waggoners and Draymen and women. Each decade shows a significant increase, often doubling and never falling below a rise of one quarter in the number of employees. The trend for Porters, Messengers, and Watchmen fluctuates more but still shows a considerable rise over the century, from 91 in 1841 to 2,811 in 1891 and 2,618 in 1901. Carting was, then, a most important means of conveying goods. The arrival and expansion of railways did nothing to diminish its scale. The figures tend to support the proposition in Chapter 2 that short haul work from stations more than adequately replaced long haul traffic as a source of business for carters.

The figures for porters and errand boys are important because the most basic form of transport remained hand carriage. Kellett reports evidence given to a Select Committee on Birmingham's railways describing 'the small masters

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[16]Ibid., 27 Jul. 1869, 10 Aug. 69, 16 Oct. 69, 21 Feb.70, 7 Mar. 70, 8 Sept. 70, 15 Jul. 70, 4 May 70, 12 Aug. 70, 5 Jul. 70, 30 Aug. 70, 23 Dec. 70, 2 Mar. 70, 9 Mar. 70, 27 Apr. 70, 8 Jul. 70, 19 Nov. 70

bringing in their manufactures "on their backs and in carts to the neighbourhood of Snow Hill" [Station]'.[17] The use of human carriage and the hand cart in Sheffield is confirmed by the presence of a two wheeled barrow in an inventory of Marsh Bros.' rolling mill from 1853[18] and the delivery of two small loads of bar iron from Seebohm and Dieckstahl 'per our boy'.[19] Prints in the local guidebook show workers carrying loads on their shoulders and rolling grindstones through the streets, and attest to the ubiquity of the handcart and barrow.[20] Photographs from later in the century show that human haulage continued to be important.[21]

It was, however, the horse which provided the principal motive power on Sheffield's streets throughout the study period, notwithstanding the increasing importance of mechanical traction after the introduction of the steam road engine. Horsedrawn carts, waggons and drays also feature in many contemporary prints and photographs.[22] Given the importance of carting for local goods distribution, how effective was it at meeting the needs of manufacturers, and did they provide their own cartage or buy services from independent carters?

They seem to have done both. As with merchanting, steel producers also seem to have provided carting for other manufacturers, hiring out spare capacity on their carts. The SCS&RR heard that the rolling mill company Knowles & Browne, steel manufacturers Habershon's, and merchants and manufacturers Ibbertson's all used their own teams of horses and carts to carry for other firms such as Spear and Jackson on a daily basis.[23] In the late 1860s, Seebohm and Dieckstahl were using their own waggon, independent carters, and carts belonging to steel and tool makers Joseph Peace and Davy Bros. Other purchasers sent their own carts or boys to collect their steel.[24] Manufacturers of medium size and larger seem routinely to have had an equestrian establishment. Marsh Bros.' accounts for their Navigation Works included a horse and cart from 1834-6.[25] Firth's bought a horse in 1844, two years after they were established.[26] The Marsh Bros. inventory of 1853 includes stables.[27] Doncaster's Letter Book for 1869-71 makes

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[17]Kellett, 1969, 12
[18]SC Marsh 16-30
[19]SC Aurora 585, 17 & 18 Feb. 1868
[20]Pawson and Brailsford, 1862, 121, 140-1, 159
[21]E.g. handcarts in Firth's Iron Yard - Barraclough, 1976, 32
[22]See the above sources and Ed. Binfield et al, 1993, Vol.III
[23]SCS&RR, MofE, 1835, 40-1, 50
[24]SC Aurora 585, various entries in Day Book, February 1866 - February 1868
[25]Barraclough, 1981, App.FF, Table B
[26]Marshall and Newbould, 1925, 9
[27]Ibid.

several references to 'our carters', engaged in daily journeys to and from the goods stations and to various suppliers and customers. The carter's role was more than simply a driver. There was also a responsibility to count bars of iron or steel to be transported; the load and the cart had to be weighed; it was the carter who reported short measure or short weight.[28] Doncaster's had their own horses.[29] The company also depended on carting provided by others. In the case of a charcoal delivery, the supplier was criticised because:

> You quoted us the charcoal delivered. Your invoice says 'Carr. paid to our works' but we have had to cart it from the railway ourselves. Ought not the Co. to deliver it? We have it always delivered by others.[30]

In this case the MSLR should have carted the goods; a subsequent letter complains to the railway company that this was not done.[31] In other cases, purchasers sent their own carts to collect goods.[32] Hadfield's also had their own carts in 1896, but employed private carters as well.[33]

It seems, then, that there was no single consistent carting practice in Sheffield. Carting was undertaken by a mixture of the manufacturer's own equipage, that of other manufacturers, independent carters and the railway companies. Only one carter's records survive in the Sheffield Archives and these confirm this picture. The main business of Chas. Brammall & Co. of Oughtibridge (just outside the town), was the quarrying and manufacture of refractory materials including ganister, silica bricks and a patent compound for furnace linings.[34] Brammall's Carting Book for November 1882 - January 1885 shows that the company had four one horse carts with four carters leading them, though horses were also worked in pairs on occasion.[35] On their outward journeys they usually carried ganister, furnace floor plates and silica bricks. To provide a return load, coke, manure, iron hoops, rails, pipes, coal, lime, straw, poles and timber would be carried.[36] Paving and edging stones and setts were transported around Sheffield for the Highway Board. Flagstones were delivered to a steel company from the Park Station. Firms served by Brammall included Firth's, Cammell's,

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[28]SC LD369, 9 Jul. 1869, 27 Jul. 69, 19 Aug. 69, 1 Sept. 69, 16 Nov. 69, 23 Feb. 70, 25 Feb. 70, 16 Mar. 70, 21 Oct. 70, 18 Aug. 70, 24 Aug. 70, 30 Sept. 70, 10 Oct. 70, 12 Nov. 70

[29]In September 1869 they purchased the contents of a haystack from a farmer in Grenoside, while in November 1870 a horse was purchased in Doncaster - Ibid., 6/9/69, 24/9/69, 9/11/70

[30]Ibid., 7 Oct. 1870

[31]Ibid., 10 Oct. 1870

[32]E.g. ibid., 22 Dec. 70

[33]SCSDR, MofE, HL1896, Q.855

[34]White's Directory, 1889

[35]SC Bram47

[36]Ibid.

Bessemer's, Brown's and Vickers. It is not clear how much of this trade was to deliver Brammall's own goods, but these deliveries and the other work undertaken are all costed by individual trips. One assumes carriage was charged separately in all cases, even on delivery of Brammall's products and could thus be identified clearly as an element of costs of production. The carting side of the business produced an income of about £36-0s-0d a month in 1883 and £45-10s-0d in 1884.[37] Unfortunately the costs of the carting establishment are not available. It can be assumed that it provided a useful additional source of income to the company. The activities of Brammall's demonstrate the difficulty in identifying a specific and separate local goods transport sector in the nineteenth century. They show the ad hoc nature of much of the carting industry.

a. The Effectiveness of Carting as a Transport Mode

We will return to the money cost of local carting and its effect on the production function once we have considered the role of private sidings later in this chapter. At this point, however, it is appropriate to consider the limitations imposed on firms by the capacity of the horse drawn cart. As noted in Chapter 2, there were physical limits on what could be carried in carts, waggons, drays and trolleys. The introduction of the traction engine helped to provide greater pulling power, but at the cost of flexibility. The horse was ready to pull in short order. A steam engine had to be fired up, or kept idle in steam at some cost in coal consumption. Traction engines did become an important means of haulage. In 1882 (just over twenty years after their development as practical machines) the Council had to petition the Local Government Board about the nuisance they caused and introduced Locomotive Bye-Laws and Regulations to limit the speed of traction engines and ban them from the more salubrious streets in the town centre between 9 a.m. and 5 p.m.[38]

The internal combustion engine solved the problem of flexibility, but made little impact during the study period. In spite of steam haulage, the horse remained dominant to the extent that an industrial crisis resulted when 3,000 carters went on strike in 1911[39] and again when many horses were drafted into military service during World War I. This led T.W. Ward's to the bizarre expedient of

[37] Ibid.
[38] Borough of Sheffield, 1882
[39] Ed. Binfield et al, 1993, Vol.III, 50

using Lizzie, a circus elephant, to pull a dray for three years during the conflict,[40] while Thomas Oxley Ltd. used an elephant and two camels.[41]

The most obvious limitation imposed by the horse and cart was on the size and weight of what could be carried. For commodities such as coal it would have been preferable to carry as much as possible in one trip, but the alternative was to employ multiple trips. This would have added time and cost penalties to deliveries but was the only resort for firms without rail or canal facilities. Loads of iron and steel could usually have their bulk broken down into 'bundles'. Loads were, by definition, devised so as not to exceed the weight limits imposed by the capacity of carts, but often they do not seem to have approached the practical limits of the medium. In the first six months of 1840 Marsh Bros. issued carriers notes on 162 days for a total of 146 tons 12 cwts. 3 qrs. 8 stone of goods taken from their works. The heaviest single load was 17 cwts. 0 qrs. 25 stone - the average only a little over 1 cwt. 1 qr.[42] Weigh bills for the same year show incoming loads of 18-28 cwt.

Doncaster's, who had no direct rail connection, also relied on carting for all incoming and outgoing freight carriage. The letter books indicate that incoming deliveries of iron could total 15, 20, 30, 40, 60, 100 or over 120 tons and outgoing deliveries of steel could be up to 20 tons. Individual cartloads were much smaller - 'each load was weighed by us to 21 cwts exact'; 'we have only got up 2 loads say 2.5 tons full, from the Railway'; 'we are wanting 3 loads (say 4 tons) ... tomorrow'; a series of ten loads weighed on Doncaster's cart weighing machine averaged about 29.8 cwt per load, with a maximum of 31 cwts. 0 qrs. 20 lbs.[43] Assuming the implied maximum cart load of 1.5 tons, it would have taken seven journeys to bring up a ten ton order from the station, 14 trips for a 20 ton load and 67 trips to handle 100 tons. Seebohm and Dieckstahl equally were dealing in small unit loads, varying from 19 lbs of file steel by hand up to 20 cwts by cart.[44] Chas. Brammall's carts seem to have carried maximum loads of about 2 tons 16 cwts.[45] In 1896 it was usual for Firth's to bring single cart loads of 3 tons of iron from their wharf to the Norfolk Works.[46]

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[40]Neville and Benson, 1981, 32
[41]Ed. Binfield et al, 1993, Vol.III, 54
[42]SC Marsh 28(4)
[43]SC LD369, 27 Sept. 1869, 30 Jan. 70, 12 Feb. 70, 2 Mar. 70, 9 Mar. 70, 15 Jul. 70, 22 Aug. 70, 12 Nov. 70, 5 Dec. 70, 12 Dec. 70, 20 Feb. 71
[44]SC Aurora 585
[45]SC BRAM47, 12 Nov. 1884
[46]SCSDR, MofE, HL1896, Q.552

Larger loads were moved by both horsepower and traction engines. In 1875 the Prince and Princess of Wales visited Firth's Norfolk Works and saw in action a steam hammer whose anvil block weighed 160 tons. It had taken three weeks to move the block the 150 yards by road from the foundry where it was cast to the forge shop.[47] Trolleys hauled by many horses were in frequent use for heavy loads in 1896.[48] As late as 1920, a pamphlet published by Sheffield Council illustrated traction engines towing two carts, each loaded with a 21.25 ton rudder casting produced by Firth's, across open moorland at Langsett en route for Salford Docks.[49] Such loads were not uncommon. For most large and medium sized firms the capacity of the horse drawn vehicle must have been a major constraint.

b. <u>Time Added to the Production Process by Carting</u>

There is not much evidence from such a diffuse and poorly documented industry about the time penalty imposed on businesses by the need to use horse drawn transport. Unlike London, there does not seem to be evidence of serious delays caused by traffic congestion in Sheffield, albeit that we have already recorded efforts by various public bodies to improve streets in the central area. Contemporary photographs do not show crowded thoroughfares. Before the SCSDR in 1896 the local MP, Emerson Bainbridge, could not describe the streets as obstructed even by the heaviest goods:

> Q.92 How does it [heavy castings and forgings] reach their [the MSLR's] goods station? - Generally by having trollies with a great many horses carrying the heavy weights ...
>
> Q.93 But it is the case that there is a very large amount of carting of heavy traffic with big trollies and long teams of horses through the streets? - There is.
>
> Q.94 Amounting to a considerable obstruction in the streets?
> - I should not call it quite an obstruction; ...
>
> Q.95 Do you consider that placing your station in Attercliffe on the level in the immediate vicinity of the works would be a great advantage as relieving that pressure on the streets?
> - I said just now that I do not consider the question of pressure on the streets very important ... [50]

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[47] Tweedale, 1986, 35
[48] SCSDR, MofE, HL1896, QQ.92-3
[49] Sheffield City Council, 1920, 23
[50] SCSDR, MofE, HL1896, QQ.92-5

The time taken carting loads around the streets was regarded as a problem by manufacturers. In Sheffield the tyranny of distance was compounded by adverse topography. In 1870, Doncaster's were negotiating with Jessop's about who should pay carting costs on iron supplied by Jessop's, and whether it should be stored at Jessop's Brightside Works or the canal wharf. Doncaster's were steel manufacturers based in the eponymously named Doncaster Street just west of the town centre.[51] The factory was convenient for Bridgehouses Station on the MSLR which lay a few streets away across the Corporation Street Bridge over the Don. The premises were not connected to a railway. The negotiation with Jessop's features again later in this chapter. For now we note Doncaster's comment that because of the distances involved 'our carters can only lead 3 loads a day from Brightside - tho' they fetch 7 loads in the same time from the Canal Wharf'.[52] The distance to the Wharf was about two thirds of a mile (1.07 km) and to the Brightside Works about three miles (4.83 km). Doncaster's estimated the additional cost of carting from Brightside at 1/6d per ton[53] (about 8d per ton mile).

In 1896 the secretary of Firth's advocated the time advantages of shorter carting distances and the avoidance of inclines to the SCSDR[54]. It seems that there were perceived and actual benefits in removing the time and convenience costs imposed by carting. This was one of the principal advantages gained by having private canal wharves or railway sidings.

ii. Private Terminal Facilities

It is difficult to find out much about the use of private canal wharves. The Sheaf Works' wharf was described as:

> ... a great convenience as the Swedish iron which they use in large quantities is carried from that place direct to the works and landed there.[55]

Factories such as the Navigation Steel Works also had private wharves.[56] In Chapter 6 of this thesis the existence of canal arms to colliery wharves and the development of canalside iron warehouses by steel companies is described. We

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[51] White's Directory, 1871
[52] SC LD369, 15 July 1870
[53] Ibid., 17 June 1870
[54] Ibid., QQ.466-78
[55] Pawson & Brailsford, 1862, 151
[56] Ibid., 1862, 151 & 164

do not know on what terms the wharves were held and whether they attracted favourable carriage rates.

In the case of private railway sidings there is better information. A collection of nineteenth and early twentieth century legal agreements between railway and steel companies was preserved at British Rail's Eastern Region Record Office at York,[57] together with plans of most of the railway routes through Sheffield, surveyed and revised by the railway companies between 1884 and 1921,[58] which include information about the private sidings then in operation. Combining these data with large scale OS maps, the Norfolk Estate records and directory information it is possible to chart the private sidings which existed by 1914. 66 can be traced, of which all but three can be located accurately. Figure 7.4 shows the distribution of private sidings in Sheffield. From this plan and its associated list of sidings we observe that:

a. The greatest density of sidings was in the Lower Don Valley, concentrated in the area where the largest steel companies were located. It is immediately apparent why the steel companies complained of congestion given the number of sidings crammed into so short a distance.

b. Although there were other types of company using private sidings, the majority served steel, iron and heavy engineering firms.

c. Not all private sidings served works directly. A few firms, including Vickers and T.W. Ward, owned or rented sidings in the railway companies' goods stations or sidings. Goods would still have to be carted from there to the factory. One assumes the benefit to the firm was the ability to marshall, receive and despatch whole trains, or to keep goods in trucks without paying demurrage.

d. Some of the larger companies had sidings from more than one railway company. The most extensive was Hadfield's East Hecla Works which had sidings from the MSLR and a further seven from the SDR.[59]

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[57]BRERO/24028

[58]BRERO Plans: MSLR, Sheffield, Tinsley & Aldam Junction, Surveyed 1887; London & North Eastern Railway, GCR Section - Woodhead Station to Woodbourne Junction, 1884-1920, Engineer's Office, Marylebone; MSLR, Sheffield Station - Gainsborough Section, Henry Fowler, Surveyor, 1884; MR, Chesterfield & Sheffield Branch, Land Plan, Surveved by P.S.M.McCallum, Estate Agent, Derby, 1906-6; MR, Sheffield & Rotherham Line, Land Plan, Surveyed by W.H.Clay, Estate Agent, Derby, 1916

[59]Two worked by the MR, two by the MSLR, two for rubbish and one for works use only - Batty, 1984, 63; PRO/MPS 5/274

e. Most private sidings were built where the surrounding land was more or less level with the railway, but not all. The Chesterfield Extension of the MR ran on embankment and viaduct for most of its course through south Sheffield. The siding serving John Gregory & Co.'s (later Marriott Wood) brick works had a relatively steep 1:60 incline from the main line down to the works[60] which must have been difficult to work. There were similar problems on the SDR at Tinsley. Hadfield's East Hecla Works was reached down a gradient of 1:40, with a maximum permitted train of 8 wagons loaded or 10 empty at no more than 5 m.p.h. Access to Firth's Tinsley Rolling Mills was almost as constrained.[61] At the SDR's goods station in Attercliffe, sidings were run across surrounding streets to serve neighbouring factories.[62] By 1914 almost every opportunity had been exploited to accommodate the demand for private sidings.

The chronology of sidings development is less clear. The BR collection of legal agreements was not complete. It covered mainly the MR. The earliest dated from 1852 for Frankish Bros., whose works were taken over by John Brown & Co. Firth's had an agreement in 1854, with five subsequent agreements up to 1915. Cammell's opened their works in Brightside in 1845 but their first preserved sidings agreement dated from 1897, although early illustrations show the factory had rail connections from the start.[63] The NMR Goods Committee approved connections to Orgreave Colliery and Woodhouse Mill in September 1841 and September 1842, subject to the companies paying for the junctions and watching and maintaining them but the agreements do not survive.[64] Preservation has not been systematic and agreements were altered, renewed or amended over time.

- <u>Legal Arrangements for Private Sidings</u>

The right of adjoining firms to connect to the railways was enshrined in the legislation which established the railway companies' powers. Clause XLV of the MSLR's Act of 1837 stated that nothing must prevent adjoining owners and occupiers from laying down collateral branches at their own expense to serve their lands and mines. The railway could not charge for traffic once it passed onto private sidings. There was no obligation to permit sidings from railway works and depots. Sidings with a gradient of more than 1:200 were excluded.[65]

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[60]BRERO/24028
[61]Batty, 1984, 63
[62]PRO/MPS 5/274
[63]Barraclough, 1984, 61
[64]PRO/RAIL 530/9, 89 & 153
[65]HLRO, Local and Personal Acts, 7 Will IV & I VICT, Vol.I, Cap.xxi, MSLR Act, 1837, 526

The construction and operation of sidings was governed by legal agreements with individual firms.

The earliest surviving agreement with Frankish Bros. set the pattern for most of the agreements with the MR. It provided that:

i. The steel company should construct or pay for the construction of that part of the siding which lay on its own land;

ii. The MR should construct and pay for those parts of the siding on its land;

iii. The steel company should pay for all signals;

iv. The steel company should pay the cost of maintaining, lighting, watching and working the siding;

v. The MR should provide all staff to work the siding at the steel company's expense;

vi. The MR should be able to use the siding at any time for temporarily shunting any of its traffic, even if not intended for the steel company's works.[66]

There was no clause requiring the steel company to use the MR's route for its traffic, nor any clause requiring the MR to grant concessionary carriage rates.

An agreement in 1870 between the MR and the Cardigan Iron and Steel Co. typifies the standard agreement twenty years on. It was similar to earlier documents except that the steel company had to pay the whole cost of building the siding, the railway company was permitted to extend the siding to serve other works and there was provision to allow removal of the siding by the MR.[67] The first evidence of a traffic clause occurs in 1893, when Renton & Co. (then owners of the Cardigan Works) were obliged to 'send goods by the Company's route as far as possible' and also paid 1/- p.a. nominal rent for the use of the MR's land.[68] Firth's first accepted a traffic clause in 1895. The definitive form of the clause came in an agreement of 1915, also with Firth's :

> The Limited Company [i.e. Firth's] shall during the continuance of this agreement consign all their traffic intended for places upon the Railway Company's route and shall when the traffic is intended for stations beyond the Railway Company's railway consign the same as far as possible by the Railway Company's route and also shall as far as they are able to control the same order all inwards traffic intended for the said works to be

[66]BRERO/24028/22 Nov.1852
[67]Ibid., 27 May 1870
[68]Ibid., 1893

> consigned by the Railway Company's route and will pay therefor unless otherwise agreed the rates tolls and other charges in operation from time to time to and from the Sheffield Station of the Railway Company with no deduction or abatement whatsoever the Railway Company undertaking that their charges for such traffic shall not exceed the charges of any other Railway Company for the like services.[69]

In this case the steel company was agreeing to pay a station to station goods rate. If the MR operated the station to station principle (as discussed in Chapter 4) to include carting to and from firms which were not connected to its lines, there would have been no marginal carting cost difference between a works connected to its own sidings and one which was not. We return to this subject later in this chapter. It is also worth noting the MR's agreement not to charge more than other railways. Although this would not have stopped them from charging less, the cumulative effect if all railways had agreed similar clauses would probably have been to arrive at common prices between all companies for comparable services. That the MSLR and GCR used similar traffic clauses is apparent from an agreement between the GCR and Edgar Allen & Co. described in Chapter 12 below. The SDR also discussed such a clause with Edgar Allen's.

Private sidings gave benefits other than money cost savings. The volume of goods which could be moved in and out of a works by train was considerable. Sam'l Fox & Co. received 52,000 tons of coal a year in 1883.[70] Vickers were consuming about 116,000 tons of coal per annum in 1895. Firth's used 40,000 tons of coal and 15,000 tons of coke. Jessop's brought in 40-50,000 tons of coal and 20-30,000 tons of coke and passed a total tonnage of about 150,000 in and out of the works in raw materials and finished products.[71] It is difficult to imagine movements on this scale being accommodated easily or economically by horses and carts.

There were other advantages, including the availability of special trucks to carry heavy or specialised loads.[72] Hadfield's were still in their Hecla Works in 1896. It had no rail connection, so that coke and pig iron had to be carted to the works. This led to money costs, but also to the degrading of the size of the coke by the friction of loading and unloading during transhipment. The pig iron had to be taken from the railway siding to be kept on a piece of vacant ground until needed, because there was no space in the works for storage. This meant 'we have two cartages, which is a serious addition to our expenses'. Having said this,

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[69]Ibid., 1915
[70]Newton, 1993, 333
[71]SCSDR, MofE, HL1896, QQ.322, 448 & 620-2
[72]Ibid., QQ.648-58

the annual carting cost for the pig iron was only about £260, which cannot have been a serious problem for a firm in a high added value business like steel castings.[73]

Hadfield's had problems maintaining the quality of artillery shells in transit because of transhipment damage:

> ... some of these shells weigh half-a-ton each and the driving bands are very liable to damage through transit. If we could load them direct into trucks in our works it would be a great advantage to us.[74]

Such advantages were not always exploited to the full. Nevertheless, comparison of the relative sizes which Sheffield works had reached by the end-of-century Ordnance Survey (Tables 7.1 and 7.2) demonstrates a correlation between area covered (a reasonable surrogate for physical scale, though not necessarily financial turnover) and access to the railway.

The tables show that most works without rail connections were three acres or less in extent. The majority of rail connected sites were greater than six acres. Most of these were bigger than ten. We can conclude this section with Charles Cammell's opinion that 'works on a large scale can only be established where there is a railway line'.[75]

iii. Impediments to Good Communications

Although the canals and railways brought enormous improvements in the efficiency of goods transport, the new transport technologies were not without problems, which could have affected industrialists' perceptions of them and might have influenced location decisions. Operational inefficiencies seem to have been an irritant for industrialists. Many derived from the lack of personal attention to goods necessitated by the scale of traffic on the new systems, congestion caused by lack of capacity or inefficient management of goods traffic, and pilfering.

An early example of these difficulties is provided by a letter from Spear and Jackson to Judd's of Birmingham on 10 December 1813:

[73]Ibid., QQ.799-800
[74]Ibid., Q.794
[75]HLRO, Evidence, MR (Chesterfield to Sheffield) Bill, HL1864 Vol.19, 30

> I sent by you 8 Bdles steel ... have just received a letter ... complaining of 2 Bdles being loose without bands and a deficiency in weight ... If this is the case will thank you to make it good ... I have already had many complaints of (indec.) in you not forwarding Goods in (indec.) time and that you let them lie at the wharfs unattended ... [76]

a. Infrastructure Problems on the Canals

The reliability of the navigations was a problem. As early as the 1770s, water taken by a new rolling mill at Thrybergh led to shortages which stopped boats on the Don Navigation.[77] By the end of the century, shortage of water further down the navigation forced improvements.[78] When the Sheffield Canal opened in 1819, the Don's towing path (which was under the control of the river navigation company) was not extended above Rotherham. The canal company asked in 1817 for the path to be made up to Tinsley to connect with their own towing path, but had to wait until 1822 for it to be constructed.[79] Even by 1835, William Vickers (of Naylor Vickers & Co.) could tell the Lords Committee on the Sheffield and Rotherham Railway Bill that firms were inconvenienced by having to send teams of horses to unload vessels at Rotherham because shoals made it difficult to bring fully laden keels up to the Sheffield Canal.[80] In winter, delays of several weeks could inconvenience industrialists when the waterways froze.[81]

If the infrastructure of the waterways was unpredictable, so too might be the individuals who operated the keels. A letter to the traffic agent of the Silkstone Colliery near Barnsley dated 24 August 1833 records that:

> After Scargill came back from Thorncliffe he came to me for a Man to get Out the 52 pipes i ordered hepworth to go immediately to assist before they got the pipe Out he went in to the cabbin Abused his wife in a Shockin Manner took from her 1 ten pound Note Off he went to Tom and Jerry Shop then Downe to Windles Tingle Bridge Burnt his Shirt abused his wife and has never Arrived at his Vessel since all this I had from his Wife how she is to get to Gainsboro She nows not as he has left her with Out money he has never left Elsecar since May but trusted to her and boy to gainsboro and him drinking at Elsecar if Any way can be Done to Convey Your goods I should be thankfull ... [82]

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[76]SC SJC 67
[77]Hadfield, 1972, 78
[78]Ibid., 209
[79]Ibid., 211
[80]PRO/RAIL/1067/10, 16
[81]SC LD369, January 1871
[82]SC CR 135-140

b. Organisational Problems on the Railways

On the railways, freight traffic[83] developed slowly because of 'the individualistic attitude of the separate railway companies' and the fact that:

> The organisation of freight traffic required specialised knowledge and different techniques. It was necessary to be acquainted with the trades of the district and with their traffic needs - the pattern of arrival of goods at depots and stations and their diverse destinations.[84]

The new railway companies lacked expertise in these areas and did not have the personal contacts of existing carriers.[85] The railways tended to organise only slowly to deal with these issues. One of the main railways serving Sheffield, the Midland, only replaced divisional control of traffic with a centralised system from 1909.[86] Railway companies often dealt with not understanding local traffic by appointing established firms of carriers such as Pickfords and Chaplin and Horne as their agents.[87]

A number of letters from Daniel Doncaster and Co. for 1869-71 refer to losses and delays arising from failures in the transport system, many from difficulties at the goods stations. These delays agitated Doncasters and their customers. On 9 July 1869, the company wrote to William Cobby, the MR's Superintendent and Goods Manager[88] to complain that he had advised them that a load of iron had arrived at Sheffield Station - '... We wanted the iron very much and sent down for it several times - and were told at length that the advice was a mistake'.[89] On 22 November 1870, the firm wrote to the MSLR: 'We have your advice of 7 Casks and loose steel ... from Bristol - This steel has been wandering about the country 20 days to our customer's great annoyance'.[90] The goods arrived with 'The casks ... broken, only one out of the seven being nearly whole'.[91] This followed a similar delay from the same source in May 1870.[92] Similar difficulties arose with the delivery of coal and charcoal. Local delivery and terminal arrangements can be pinpointed as the source of these holdups.[93]

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[83]Which only accounted for about 35% of receipts in the early 1840s
[84]Pollins, 1971, 60-61
[85]Ibid.
[86]Nock, 1957, 144
[87]Ibid.
[88]White's Directory, 1871
[89]SC LD 369
[90]Ibid.
[91]Ibid.
[92]Ibid., 5 May 1870
[93]Ibid.

On 30 August 1870, Doncaster's invited the Fence Colliery Company of Rotherham to send a truckload of Orgreave Picked Hard coals because '... we wish to try whether it will suit us better to have it by rails than carted direct from the Pit - if we have the coals sent by Rail, can we rely on having them regularly at the Station?'[94] The experiment did not meet with success. The steady flow of trucks which was essential to regular melts in the furnaces was interrupted several times. On 30 September 1870 the manager of the Fence Colliery received a complaint:

> There is a fault either at the Colliery or on the part of the Railway (we do not know which) about the delivery of our Coals. The truck charged 28th had not arrived yesterday - and we lost two journeys of our carters in sending to enquire and also were unable to fire off a furnace in consequence.[95]

The solution was to order stock in advance. The colliery was instructed to send off two or three trucks at once in addition to the standing order of a truck every other day.[96] This does not appear to have resolved the problem. On 6 October Doncaster's wrote:

> The Wagon No.71 sent off from Orgreave Sep 30th has just arrived at Park Side but on the other side of the Main Line - so that we cannot get to it and are told that it is uncertain whether it can be got at tomorrow ... May we have a distinct undertaking whether or not we shall be able to depend on a regular delivery per rails. We cannot go on as we are doing constantly sending messengers or carters without result.[97]

On 30 November the firm gave up using the railway, informing the Fence Colliery that in addition to persistent short weight:

> ... we continue to have such diffy with delays in receiving wagons that we wish you to discontinue sending more in this way until further notice - we are getting a few of your Coals thro' your agent ... at Neepsend which is very near to our works ... [98]

It is questionable whether the company's choice of transport mode for such a short journey was a sensible one. As Kellett points out:

> ... for the small scale producers operating on short runs and small quantities from ready built factories or workshops in the

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[94]Ibid.
[95]Ibid.
[96]Ibid.
[97]Ibid.
[98]Ibid.

> Victorian cities' inner districts the linkages between them were of a complexity which made them quite unsuitable for short-haul by the railways. The small, miscellaneous loads ... the frequent need for trans-shipment for further processing after a short journey, the heavy terminal charges, made the railways slow and uneconomic for the local movement of goods.[99]

Although Doncaster's might be regarded as closer to the middle order of company size, the same principle seems to have applied at their scale. This was, perhaps, a middle ground where the benefits of location by the railway were in an uneasy balance compared with those of being in an established manufacturing quarter - the firm being unable to move the volume of freight needed to justify the former location, but suffering the inconvenience of having to transport significant loads from the termini by cart as a consequence.

c. <u>Freight Handling Facilities in the Later Nineteenth Century</u>

In the closing years of the century the problem of delays and congestion was still complained of, despite the growth in the number and size of freight handling facilities. The Lords Committee on the SDR Bill, sitting in May 1896 was told by John Uttley, Firth's Company Secretary, that:

> From the railway point of view ... we are choked up there at the Norfolk Works where our Siemen's furnaces are and we have very limited siding accommodation. We have only a limited frontage at that point in Saville Street, and we have only two lines of rails, and this has to accommodate both incoming and outgoing material.[100]

When asked if the creation of a new junction on existing lines at Killamarsh would solve the difficulty of gaining access to the Dukeries Coalfield, Uttley replied 'We might have a communication, but we should be going into the same crowded sidings which we have at the present time' and '... the congestion in these sidings is too great to contemplate without anything like hopes of improvement in the future'.[101] Later, he stressed again the need to expand sidings capacity within Sheffield:

> ... my experience is that it [managing traffic in the sidings] is very difficult; in fact, I believe, to-day we shall have trucks in the Midland sidings which were invoiced at the end of April, and I know that in signing cheques and getting accounts passed my

[99]Kellett, 1969, 349
[100]SCSDR, MofE, HL1896, Q.452
[101]Ibid., QQ.570 and 572

> chief clerk complains incessantly, 'I cannot pass this, for a few trucks that are out; they have got jambed in'.
>
> 603 You mean after the traffic has actually come there and got on to the siding you cannot get the traffic out, and that delays you? - It is not all a single train for us; it is mixed up with other people's, and it has to be sorted.[102]

Interchange between railway companies was also a source of delay. William Burdekin, the Secretary of Jessop's, complained of delays in the transfer of traffic between the Midland and MSLR at Grimesthorpe Junction.[103] Jessop's also experienced long waits for the use of special trucks for large loads.[104] Lost loads and shortfalls in deliveries were also common. Many examples occur in Doncaster's correspondence.[105]

d. Organisational Problems in the Steel Companies

Not all errors lay at the door of the wharfingers and railway agents. The steel companies were not always systematic in stock control and management of deliveries. Doncaster's placed a good deal of reliance on their carters to obtain information about the arrival of goods at the wharf and goods stations, to weigh and count loads, and to 'administer' deliveries. Sometimes this led to mistakes. So, on 16 March 1870, a customer received an apology that his request to hold back an order for iron had not been observed because:

> Our Carters delivered the Steel Yesterday afternoon from our furnaces in Copper Street and we were not aware that they were so occupied until this morning when we were amazed to find that the steel had gone.[106]

On 21 October, a bar of chisel steel from an order going to Delft was accidentally left behind by Doncaster's carter and had to be sent on by passenger train.[107]

[102]Ibid., QQ.602-3
[103]Ibid., QQ.687-93
[104]Ibid., QQ.645-52
[105]E.g. 7 & 10 Aug.1869; 1 Sept. 1869; 2 Mar.1870; 10 June 1871; 10 Mar. 1871 et al
[106]Ibid.
[107]Ibid.

e. Conclusions About Impediments to Communication

The problems of productivity and effectiveness which beset the railways and canals (see Chapter 2) had practical negative effects on the day to day operation of Sheffield businesses. A significant amount of managerial time must have been spent pursuing lost and delayed cargoes, trying to keep to production schedules when raw materials were held up in congested and poorly managed termini or sidings and making excuses to customers for late deliveries.

What is less clear is whether this would have affected location decision making. If one mode of transport or one or more carrier had been particularly inefficient it might have repelled firms. If there was a route which offered an outstandingly good service it might have exerted a locational attraction. However, the honours for inefficiency were divided relatively evenly between transport modes and companies. The lack of a direct railway connection left medium size steel companies prey to the minor (but cumulatively aggravating) inconveniences of trying to move quite substantial quantities of material in small unit loads through transport systems which were under the control of others, while keeping stock in trade to a minimum to avoid straining capital and storage space. The transport systems had to deal with many similar loads and the potential for confusion and dishonesty was immense. In such circumstances the temptation to move to a site with its own private and secure sidings would have been considerable. Yet the companies which did so continued to experience delay and inconvenience. Wagons were still inaccessible in the confusion of the marshalling yards. Special trucks were difficult to get hold of. The inability of the canals and railways to keep pace fully with the expanding scale of freight traffic seems to have had an almost equal effect on users of goods stations and private sidings. On balance, we can conclude that inefficiency in delivery for medium and large scale companies would increase the pressure to move to a rail served site, but the consequences might have proved disappointing for manufacturers who expected to be free of the diseconomies caused by the inefficiencies in canal and railway freight operations.

iv. Distortion of the Local Transport Market by Railway Carting Practises

We now turn to the question of whether or not the carting and distribution practices of the railway companies followed the lines described in Chapter 2 and Appendix 1 and distorted the local transport market in Sheffield, perhaps influencing location decisions.

The two earliest Sheffield railway companies planned different approaches to offering carting services. Vignoles, the engineer of the SAMR reported in November 1836 that:

> With regard to the cost of carriage of merchandise ... as this company will not be liable to the heavy expense of collecting and distributing the same from and at each Terminus ... the outgoings on this head will be confined to the actual cost of transport between the two towns ... [108]

The NMR, by contrast, provided a cart and horse at its Sheffield Station in the Wicker. This was not a great success, for the minutes of the S&R/NMR Joint Station Committee of 4 March 1841 record that:

> The retaining of a horse and cart employed on the station for collecting and delivering goods was then considered, when it appeared that the expenses exceeded the earnings, and that it is advisable that a contract should be made with some respectable carrier for the porterage at the station for such goods in the future and the horse and cart dispensed with. Upon which Mr. Vickers upon behalf of the S. & R. Ry. Co. offered to relieve the N.M. Ry. Co. of the cartage and delivery in the town of Sheffield of the S. & R. goods by receiving the horse and cart and man under the entire charge of the S. & R. Ry. Co., provided they have the privilege of carting to and from the town at the ordinary carriers' rates any N. Midland Goods not passing through carriers hands where the consignee declines to cart them himself.[109]

Competition was provided by a number of carriers such as Pickfords and Wheatcrofts who were based in the Sheffield Goods Warehouse alongside the S&R.[110] Although concessionary rates were not offered for cartage, the NMR Goods Committee's minutes for 1842 record that there were special rates for short distance local goods traffic by train provided that wagons were not full of longer distance cargoes.[111]

Little evidence was found about Sheffield's railway carting services between this very early stage in railway development and the latter years of the study period. We know from the Doncaster letter books that in the mid-century the railway companies offered carting services alongside Pickfords and local carters. It is not until 1896 that firmer information becomes available. The SCSDR took evidence

[108]PRO/RAIL 1075/69 - Prospectus for the SAMR
[109]PRO/RAIL 530/10,- Minutes of the Sheffield Station Joint Committee of the S&RR and NMR, 1840-4, 82,
[110]Ibid.
[111]PRO/RAIL 530/9, - Minutes of the Proceedings of the Goods Committee of the NMR, 165

on the operation of railway carting services from representatives of Vickers, Brown's, Firth's, Hadfield's and Jessop's, and from William Pollitt, the General Manager of the MSLR. The new line was opposed at this stage by the MSLR. Counsel for the MSLR spent a long time cross-examining the witnesses about the benefits of having private sidings, and whether sidings from the SDR would really give any advantage over existing arrangements with the MSLR and MR. From the often convoluted cut and thrust of the examination a number of points emerge and these are summarised below:[112]

a. Those steel companies represented at the Committee which already had railway sidings (that is all except Hadfield's) placed greatest emphasis on an anticipated reduction in delays resulting from relief of congestion in the Midland Railway sidings, and the expected fall in inter-urban freight rates which should result from the competition brought about by direct access to the GER. In effect, they said they expected to be able to achieve both economies of convenience and money cost savings. Counsel for the MSLR could do little to show that there were not congestion problems, but none of the witnesses would say under pressure that they had any serious complaint against the MR or MSLR, other than inconvenience caused by overloaded sidings. Counsel did demonstrate in examining William Pollitt, the General Manager of the MSLR, that increased competition was unlikely to lead to improved station to station freight rates. Pollitt explained that:

> A new [railway] company coming where there are already three or four other companies existing is supplied with the rates from that place to all other places where they can carry and they adopt them unless it can be shown that the distance is so much shorter that they are obliged, to keep within the law, to reduce them.[113]

In other words, freight rates had been cartelised and no price competition existed.

b. Those representatives of steel company management who were not directly engaged in production appear to have had shaky knowledge of the operation of the local freight distribution system. There was considerable debate between the MSLR's Counsel and John Uttley, the secretary of Firth's about the company's carting practices. Uttley could not say how much of Firth's finished product was carted away from the works and how much went direct by rail, even though he knew large castings were sent by

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[112] All the evidence is taken from SCSDR, MofE, HL1896, QQ.319-877 & 2220-2347
[113] Ibid., Q.2222

both road and rail. He was able to testify that about 4-5,000 tons of coal were carted into the works and that iron was brought up from Firth's canal wharf by road. He believed the shorter distance which goods would be carted from Attercliffe Goods Station would save Firth's carting costs, even though Counsel seemed to prove later that there would be no cost benefit because of the way the MR charged for carting. William Burdekin, the Secretary of Jessop's found himself locked in a similar argument. He contended that goods were carted to the MSLR's station at the railway company's discretion and that there would thus be a saving and greater convenience if the steel company's preference could be followed and goods loaded direct into railway wagons - all goods for the MSLR including freight to Hull and Grimsby were carted from the works to the station. Counsel showed there was cause to question the accuracy of Burdekin's evidence. We thus find that two senior professional managers who were divorced from the operational side of their companies lacked basic information or knowledge about intra-urban transport methods and costs. Both these firms were in established locations chosen before the professionalisation of management which might have caused this loss of corporate knowledge. Nevertheless, some decision makers later in the study period seem not to have had the knowledge or information to make informed decisions about one of the variables in intra-urban location decision making.

c. Uttley, Burdekin and Robert Hadfield did know the cost per ton of the non-railway local carting services they used, even though all were confused about the charging practices of the railway companies.

d. The evidence given by the manufacturers about what the railway companies charged for carting was complicated. It seems, however, that where a steel company such as Hadfield's did not have direct sidings access it would have to pay for carting from the station to the factory and that this could add 'a very serious amount' to carriage costs.[114] Although Uttley claimed Firth's paid the MSLR the station to station rate <u>plus</u> cartage, the MSLR's Counsel said that:

> ... all your traffic, whether it is carted or whether it is not, whether it goes by truck from your works or whether we, for our own convenience, cart to our adjacent goods station, we charge you precisely the same as if it was trucked in your works ... [115]

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[114]Ibid., Q.869
[115]Ibid., Q.486

The same practice was applied by the MR. Pollitt then gave the definitive position on carting from the railway company's standpoint:

> All those large works ... joining the Midland Railway have the convenience of having their traffic dealt with either in or out through trucks or by cart, and whether it is dealt with by a through waggon or by a cart is determined by the trader ... not by the railway company. If it does not suit him to send it by truck he sends it by cart and for this reason: The goods are in many cases in certain parts of the works where they do not immediately adjoin a siding and where a railway cart can be brought alongside and the goods loaded with the least possible cost of labour; and in such cases the firms themselves select to send their goods away in that form or to receive them in that form ... The firms send a comparatively small quantity of traffic away in loaded waggons; they get a large quantity of coal inwards.[116]

Pollitt went on to explain how the railway companies charged the steel firms:

> Then it might be said [manufacturers] ... get advantages in the cost of cartage [from building the new railway]. That again is fallacious; the rates for cartage in Sheffield as in every other large town are agreed by all the [railway] companies ... particular traffic is carted for any distance within the area, long or short, at exactly the same rate; ... if another station is brought within 500 or 300 yards of a new station they would have to pay the same cartage rate as they do today from the furthest station.[117]

Companies without direct siding connections seem to have paid the station to station rate plus a standard carting rate regardless of their distance from the goods terminus. Where a steel firm had sidings onto a railway and could thus direct traffic onto that railway's route, it paid the station to station rate. This led rival railway companies to offer these latter firms free carting to their goods station to ensure they obtained a share of the traffic. In spite of Pollitt's protestations to the Committee that traffic was exchanged through Spital Hill tunnel every day.[118] we have seen already that this route was totally inadequate. The MSLR had comparatively few private sidings. To obtain a reasonable share of goods traffic from Sheffield's largest manufacturers connected to the MR, it would have had little choice but to offer free carting. Companies such as the LNWR which only had a goods station and no track from which to offer private

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[116]Ibid., Q.2220
[117]Ibid.
[118]Ibid., Q.2336

connections would have been in a similar position. For this reason one cannot help but think that Pollitt was protesting too much when he returned to the theme of the choice of terminal facilities by manufacturers:

> ... the cartage or through truck is a matter of convenience determined by the manufacturer ... the goods which they want to send away or receive have to be taken from a point not immediately adjoining the sidings in their works because their works are so constructed that they cannot possibly have railway lines running all through, and they have large castings and other classes of goods made in different parts of the works not immediately adjoining a siding and in such cases, if they had to load them into a truck they would have to take them from that point to the waggon at their own cost; therefore they prefer that a railway cart should be brought alongside, seeing that there is no difference in the rate, and that it should be dealt with in a manner more convenient and at less cost to the firm themselves.[119]

This system meant that there were financial advantages for manufacturers in having sidings. The system evolved so that the railway companies were, in effect, prepared to carry some or all the cost of local distribution (or disguise it in their inter-urban freight rates) in order to gain market share from rival companies. Firms without sidings would have gained by moving to railwayside locations, but the quantum of financial gain may not have been enough on its own to justify relocation. Robert Hadfield reckoned his firm would save £6-700 p.a. on carting if he had a direct railway connection.[120] Although he told the Committee this sum was significant, Hadfield's were by then a substantial and highly capitalised company about to relocate to the massive East Hecla Works. One doubts if this saving could have justified such a move. Surely the economies of convenience and scale, and potential for expansion of output which could be garnered with better communications would have been more significant than a cost saving of this order?

v. <u>The Financial Cost of Local Haulage and its Place in the Production Function</u>

Finally we ask three questions about the money costs to firms of the journey from the freight terminal to the factory:

a. Were carriage costs paid by the manufacturer or by the supplier or customer?

b. Did manufacturers seek to minimise transport costs?

[119] Ibid., QQ.2341-2
[120] Ibid., QQ.870-1

c. What was the marginal additional cost of carting goods?

a. Who Paid Carriage Costs

If transport costs were not borne by the manufacturer, they might not be regarded as a significant factor in location decisions. This argument has to be introduced cautiously because all transport costs must ultimately be added to the final cost of a product to the consumer. In a rational economic system they should, therefore, be a part of the locational equation. If, however, the perception of the manufacturer were that these costs were not his or her problem but someone else's, or if the manufacturer did not have an accounting system which broke down costs in detail, then these costs might not have been perceived to be significant.

As with the other information in this chapter, the limited survival of documents means that the evidence is patchy, but there are some pointers in surviving manuscripts. Spear and Jackson did not pay carriage on saws delivered in the 1810s, though they did offer a 35% discount on list price which might have gone some way to alleviate carriage costs for the purchaser.[121] In general, Doncaster's seem to have paid the delivery costs on iron brought to Sheffield for them. This is apparent from letters to suppliers and transport agents.[122] There were exceptions to this rule. In June 1870, Doncaster's wrote to Jessop's to ask them to continue their practice of bearing the carting costs of iron supplied to Doncaster's:

> The selling of L Steel, competing as we have to with the low prices off'd by others, affords only a very small profit. We have felt the delivery of the iron by you, to be under these circumstances, a little help which we have been obliged for, & were sorry to receive your memorandum of the 1st inst. advising your intention to discontinue to do this. If the iron is kept at Brightside the distance to fetch is very great. Do you think delivery at Brightside can fairly be considered delivery in Sheffield? ... as we pay you the full rate of carriage from Hull up to the Sheffield Canal Wharf, have we not at least claim for the distance between your Brightside Wharf and the Canal Basin?[123]

Obviously this was a case where the supplier had been bearing hidden terminal costs, although the purchaser paid the long distance transport cost.

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[121]SC SJC 67, 24 Feb. 1814
[122]SC LD/369, 26 July 1869, 3 Sept. 69, 17 Mar. 70, 5 Dec. 70, 12 dec. 70 - there are several other examples in the letter books
[123]Ibid., 8 June 1870

On the whole, Doncaster's did not bear the cost of transporting finished goods to customers. There are several letters quoting customers the cost of steel with carriage as an additional item.[124] On a couple of occasions prices were quoted inclusive of delivery, but this was unusual.[125] It was explained in a letter to the Government of South Australia in May 1870 that Doncaster's trade was usually for delivery in Sheffield or at a railway station, so quoting free on board at a port was problematical.[126]

Marsh Bros. allowed for delivery of iron to their works in calculations of the cost of spring and cast sheet steel in 1854-5, with transport taking up about 2% of the cost of producing 21-23 WG cast sheet steel and 1.3% of thicker 29 & 30 WG steel.[127] Similar allowances were made for file steel (3.2%). In calculating the price of rolled crinoline steel, the cost of transporting it to a customer in Birmingham was included. This came to about 3% of the total production cost. However, because the steel had to be rolled by Sam'l. Fox & Co. at Deepcar, a further 1.5% of the total cost was made up of transport to and from their works. Production costs including 10% profit on all costs except carriage came to 67/- per cwt, but the price quoted inclusive of carriage was 70/-, a further mark up of almost 4.5% of the actual cost.[128] Steel for pen nibs had a transport cost to the purchaser of about 3.6% of total cost on a product with a profit margin of 12.5%.[129]

Marriott & Atkinson also allowed for delivery to customers in their cost books. In 1874 delivery in London added 3.5% to the cost of 1 cwt of the smallest sizes of annealed flat cast steel wire, though in this case without including a profit element in the costing.[130] On the large sizes the same flat rate of 2/- per cwt for carriage gave a percentage cost of up to 3%.[131] Getting mild cast steel wire to Grimsby consumed about 2% of production costs. The order concerned was going on to Paris and the transport costs from factory to factory came to 19% of total costs, to which was added 15% profit on the whole order including transport costs.[132] Carriage to Hull was costed on 36-44 gauge umbrella wire in December 1879 at 2.8% with no profit costed,[133] although a costing carried out in

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[124]E.g. Ibid., 11 Aug. 1869, 17 Aug. 69, 3 Aug. 69, 2 Dec. 69, 10 Dec. 69, 15 Nov. 70 and others
[125]Ibid., 6 July 69, 12 July 69, 1 Nov. 69
[126]Ibid., 4 May. 70
[127]SC Marsh 32-4, 1-5
[128]Ibid., 16 & 24
[129]Ibid.
[130]SC SYRO S60 2/4, 24 May 1874
[131]Ibid.
[132]Ibid., May 1874
[133]Ibid., 31 Dec. 1879

September had come out at 4.9% for the same commodity.[134] Carriage on ramrod wire came out at 3.3%. 17.5% profit was added to the whole cost including carriage.[135] Another order of flat mild cast steel wire in March 1874 also included carriage to Hull at only 1.5%, with a profit of 30% on the whole cost.[136] Square mild cast steel wire was costed at 1.6% for transport to Hull with a profit of 30%.[137]

As with carting, then, there were no consistent practises. Different firms adopted different approaches to costing (for example whether they counted profit against costs nett of transport costs or not) and to paying for carriage. The basic practice seems to have been to pay for the transport of inputs to the production process and to charge delivery to customers (though Doncaster's did expect suppliers of scrap steel to pay delivery to their factory[138]). This was not a hard and fast rule. Proving that there can be no generalisations, the Secretary of Firth's told the SDR Select Committee that:

> ... incoming traffic is paid for by the deliverer. We receive all our goods carriage paid and delivered to us ... in the case of going out the railway company ... charge us the station rate and the carted or delivered rate ... [139]

Firth's seem to have perceived by 1896 that only the cost of outgoing traffic concerned them. This was something of a reverse from the situation described by the evidence referred to above. It may represent a shift in trading practises or the idiosyncratic behaviour of one large consumer of raw materials who could dictate terms to suppliers. Without further evidence it is impossible to do more than conclude that each individual firm would have had its own perspective (and not necessarily an economically rational one) on whom it believed bore transport costs.

[134]Ibid., 8 Sept. 1879
[135]Ibid., March 1874
[136]Ibid., 31 Mar. 1874
[137]Ibid., 20 Mar. 1874
[138]SC LD369, 11 Aug. 1869
[139]Ibid., QQ.587-9

b. Did Firms Try to Minimise Transport Costs?

From the slight evidence available it is difficult to conclude that firms always sought the least cost solution to transport problems. Doncaster's often tried to get reductions on transport bills[140] but they did not always use the cheapest transport mode. In August 1869 they wrote to a customer in London:

> We have sent the steel ... by Earle, Hall & Earle to be forwarded by their boats to Harrison's Wharf, London, via Hull ... This is the cheapest way of sending we know ... [141]

This was the cheapest form of carriage yet Doncaster's often used the railway, which must have been more costly. A customer was told in June 1871 that water carriage would save 6d per cwt. on a load of spring steel going to London.[142] The need for speed and security must often have been more important than the money cost of transport. This seems to be confirmed in an earlier order to carriers '... to send us by Rails without delay 5 Tons of 3 x 5/8 and 1 Ton each 1.5 x 0.75 x 2 sq. The remainder may be forwarded by Canal'.[143]

There seems no reason to doubt that all manufacturers would have a production function which would tend towards least cost transport, but balanced against this tendency would be other factors. These might lead to higher transport costs to achieve some other saving or simply to secure business based on the ability of a firm to deliver faster than its rivals, even if at a slightly higher production cost. The very limited evidence points to optimisation of the overall production function rather than an absolute requirement to minimise transport costs.

c. The Marginal Additional Cost of Carting

Did it really matter to manufacturers that local carting added to their marginal costs? Did they even account for these costs separately? The cost books already referred to do not distinguish between local carriage and the long distance stretch of the journey. Apart from costing the price of individual items in a company's order book, firms also accounted for costs and income in balance sheets. In the case of Marriott & Atkinson, several handwritten balance sheets were retained by Cocker Bros. None of these distinguish between local and long distance haulage. In 1880, the company spent £1,035-17s-8d on carriage out of

[140]Such as the instruction to their shipbroker to seek a waiver of demurrage charges by the NER - SC LD369, 24 Feb. 1871
[141]Ibid., 10 Aug. 1869
[142]Ibid., 13 June 1871
[143]Ibid., 5 May 1871

total expenses of £11,970-1s-1d (or 8.6% of costs). The firm showed a loss of £941-16s-8d for the year, so it could be argued that transport costs could have been of marginal significance. However, the firm was owed £1,062-15s-7d in bad debts and had allowed customers £532-9s-1d in discounts, so there were other marginal areas which could have been addressed more easily than essential transport.[144] Also, the company had already carried out separate accounting exercises for each of its departments before putting costs into the profit and loss account. Some of these may also have included carriage accounts, so it is very difficult to get at the real relationship between transport costs and the overall production function.

It is rare to find evidence of what was being charged per mile by carters, rarer to find how much this represented as a proportion of transport costs and rarest of all to find any accounts which show carting costs as a separate element of total production costs. No evidence seems to exist which would allow us to assess the importance of carting costs taking into account both costs and revenue.

Table 7.3 shows that carting costs per mile for which evidence exists remained relatively stable throughout the study period, though perhaps they tailed off a little in the last decade. Alternatively these lower costs may simply reflect the market power of the very large firms giving evidence to the SCSDR. Carting costs seem to have represented about 6-10% of total transport costs and, in the case of the Marsh Bros. data which are the only examples of full costings of steel production which contained separate identification of carting costs, this is a very small proportion of overall production costs.

Although it is difficult to generalise from such small samples, it does seem reasonable to speculate that local goods distribution would have been a relatively insignificant element in production costs, and less susceptible to variation by the producer than profits or discounts, which would have been easier vehicles for controlling prices while firms were in surplus. On the truss spring order referred to in Table 7.3, for example, Marsh Bros. costed for a discount of 12.5% on cost.[145] Other costings show a standard profit margin of 10% in 1858.[146] Doncaster's offered 2.5-5% discounts on list prices.[147] Moreover, carting distances may have added to the time penalty of local distribution but they do not seem to have been sensitive so far as cost was concerned. In 1835 J.

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144 SC SYRO S60 Cocker Brothers Limited, accounts dated 1880, not catalogued separately; copy in author's possession
145 Ibid.
146 E.g. SC Marsh 34, 24
147 E.g. Ibid., 23 Aug. 1869

Singleton, a timber merchant who used his own horses and carts admitted to the SCS&RR that once goods were loaded onto the cart, carriage costs for as much as half a mile extra on a journey made no material difference.[148] In 1896, a similar situation applied, because the railway companies did not make different charges for different lengths of cart journey.[149] This would have helped to ensure that carting costs would probably have been perceived as a relatively fixed and unalarming element of costs, which might help to explain why they do not usually feature as a variable in surviving cost plans and seem to have been absorbed into other costs.

4. Conclusions

Although we have been dealing with ephemeral data, they point to consistent and logical conclusions:

i. The major benefits of co-location next to canals and railways would not have been in money cost savings on extremely marginal local carting costs so much as the benefits of being able to increase the scale of production over the limits imposed by road transport in carts. The ability to store large volumes of raw materials securely within the works was also prized.

ii. This would help to explain why it took time to fill railwayside sites. A relatively small number of large firms existed which could benefit from these economies of scale. For most firms, carting services were probably adequate if awkward.

iii. The perceived benefits of moving to a railwayside site would have been high for large companies before they moved. The reality would have been disappointing because of railway congestion and the fact that many items ended up being carted by the railways because they could not organise direct rail deliveries efficiently.

iv. Direct rail transport was more important for incoming bulk raw materials (especially coal) from East Midlands and West Riding sources than for iron, much of which came by canal, or finished goods. This, together with the diversity of destinations for goods, suggests the 'regional markets' hypothesis does not hold good for Sheffield steel but that a variation - the 'regional suppliers' hypothesis - is valid.

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[148] Ibid., 75-7
[149] MofE, SCSDR, HL1896, Q.492

Table 7.1

Sizes Reached by Larger Steel Works in Sheffield, 1902/5

This table lists the majority of larger works in the steel and associated sectors named on the 1902-5 OS 1:2500 maps, except Templeboro' sites from the 1921 map, for which specific dates are given. A number of small riverside rolling mills have been omitted. For consistency of comparison, all measurements are scaled from the maps, even where other figures for site areas are available (e.g from Norfolk Estate records or company histories). All areas are approximate.

Works (Steel unless otherwise stated)	**Owner (where known)**	**Area (acres)**	**District**	**Rail/ Canal Conn-ected**
Vulcan Forge & Rolling Mills		1.43	Alsop Fields/Highfield	No
Baltic	J.Beardshaw & Sons	1.30	Attercliffe	Canal
Canal		0.96	Attercliffe	Canal
Carbrook Forge & Steel (1.26 acres by 1903)		5.97	Attercliffe	Rail
Chantry (Stove Grates)	Originally Robertson & Carr, then Woodhouse & Rixson, then Carr Bros. & Webster	1.20	Attercliffe	After SDR was built
Continental	Jonas & Colver	1.65	Attercliffe	After SDR was built
Crescent		0.98	Attercliffe	No
Crown Steel & Wire	Originally Messrs. Fairbrother & Co., then W.Parkin & Sons	1.03	Attercliffe	No
Dannemora Branch	Seebohm & Dieckstahl	1.10	Attercliffe	Canal
Effingham Steel Works & Rolling Mills		0.52	Attercliffe	No

Works (Steel unless otherwise stated)	Owner (where known)	Area (acres)	District	Rail/ Canal Conn-ected
Fitzalan (Wire)	Cocker Bros.	1.84	Attercliffe	Canal
Greenland Branch		1.89	Attercliffe	Canal
Hecla	Hadfield's	2.62	Attercliffe	No
Huntsman	Huntsman & Co.	0.92	Attercliffe	Near but not on canal
Park House (Springs)		1.10	Attercliffe	Canal
Park Iron (Steel Making Plant & Machinery, Boilers etc.)	Davy Bros.	1.49	Attercliffe	No
Sheffield Steel & Iron	Brown, Bayley & Dixon	10.54	Attercliffe	Rail
South Yorkshire Iron	S.H.Burrows	6.75	Attercliffe	Rail
Universal Steel		1.01	Attercliffe	No
Vulcan Foundry		0.68	Attercliffe	No
Aetna (Saws, Files, Edge Tools, Agricultural Tools)	Spear & Jackson	1.43	Brightside	Rail
Albion Engineering		2.94	Brightside	No
Atlas	Brown's	19.92	Brightside	Rail
Bessemer	Bessemer's	2.41	Brightside	Rail
Brightside	Jessop's	19.20	Brightside	Rail added later

Works (Steel unless otherwise stated)	Owner (where known)	Area (acres)	District	Rail/ Canal Conn-ected
Brightside Boiler & Engine	W.Griffiths & Sons, previously Hawksley & Wild	1.57	Brightside	Rail
Carlisle	Kayser, Ellison & Co.	2.85	Brightside	Rail
Cyclops	Cammell's	12.00	Brightside	Rail
Don	Hobson, Houghton & Co.	1.43	Brightside	No
Harleston Iron (Stove Grates)	Marshall, Watson & Moorwood	2.30	Brightside	No
Midland Steel & Iron	Savile Street Foundry & Engineering Co.	1.00	Brightside	Rail
Norfolk (extended further by takeovers later in 20th century)	Firth's	12.42	Brightside	Rail
Norfolk Bridge		1.10	Brightside	No
President (Saws, Edge Tools etc.)	Moses, Eadon & Co.	1.38	Brightside	Rail
River Don (extended either side of Don later in 20th century and Attercliffe Common Works added on former SYR)	Vickers	39.70	Brightside (Grimesthorpe)	Rail
Grimesthorpe	Cammell's	17.79	Brightside (Grimesthorpe)	Rail

Works (Steel unless otherwise stated)	Owner (where known)	Area (acres)	District	Rail/ Canal Conn-ected
Spital Hill Works (Shears & Edge Tools)	Lockwood Bros./John Sorby & Sons (single firm trading under two names)	0.59	Brightside	No
Wicker Iron (Steam Engines)	Walker, Eaton & Co.	0.84	Brightside	No
Cravens Carriage & Wagon (Railway Equipment)	Craven Bros.	8.26	Darnall	Rail
Darnall Works & Attercliffe Forge Works (includes open land)	Sanderson's	4.30 & 5.70	Darnall & Attercliffe	After SDR opened (Atter-cliffe only)
Bow (Land Chains and Measuring Tapes)	Chesterman & Co., later Rabone Chesterman	2.21	Ecclesall	No
Hardypick (Picks and Mining Tools)	Hardy Patent Pick Co.	3.64	Heeley	No
Meadow Hall Iron	Crowley's	4.27	Meadowhall	Rail
Sheffield Tube (Steel Tubes - 2.75 acres developed by 1902)	Howell & Co.	5.82	Meadowhall	Rail
Yorkshire Engine (Steam Engines)	Yorkshire Engine Co.	6.20	Meadowhall	Rail
Globe	Ibbotson Bros.	2.73 & 2.32	Millsands/ Kelham	No

Works (Steel unless otherwise stated)	Owner (where known)	Area (acres)	District	Rail/ Canal Conn-ected
Green Lane (Stove Grate)	H.E.Hoole & Co.	0.70	Millsands/ Kelham	No
Kelham Island Rolling Mills	Kelham Island Rolling Mills Co.	1.74	Millsands/ Kelham	No
Millsands Forge & Rolling Mills	J.Kenyon & Co.	2.25	Millsands/ Kelham	No
Adelaide	Taylor Bros.	0.53	Neepsend	No
Clifton		2.12	Neepsend	No
Converting		0.69	Neepsend	No
Eagle	W.K.&C.Peace	0.83	Neepsend	No
Lion	J.Bedford & Sons	1.16	Neepsend	No
Mowbray		0.35	Neepsend	No
Toledo	J.H.Andrew	2.30	Neepsend	No
Sheaf (Files, Edge Tools, Steel & Springs)	Originally Greaves' Cutlery, then Turton's	4.00	Park/Attercliffe	Canal
Regent & Philadelphia (includes open land)	Burys	2.22 & 4.13	Philadelphia	No
Rutland		3.80	Philadelphia	No
Industry Tool		0.53	Pitsmoor	No
Merchant Tool		0.46	Pitsmoor	No
Woodside Tool		0.23	Pitsmoor	No
Ponds Forge	Marsh Bros.	2.85	Ponds	No
Ponds Works	John Adwick & James Cam	0.38	Ponds	No

Works (Steel unless otherwise stated)	Owner (where known)	Area (acres)	District	Rail/ Canal Conn-ected
Sheaf Island	W.Jackson & Co.	0.83	Ponds	No
Simplex Motor (1906)	Sheffield Simplex Motor Car Co.	10.10	Templeboro'	Rail
Standard Steel (1911)	W.T.Flather	3.86	Templeboro'	No
Templeboro' Mills (1916-9)	Steel, Peach & Tozer	66.57	Templeboro'	Rail
Templeboro' National Projectile Factory (First World War Munitions)	Firth's	20.72	Templeboro'	Rail
East Hecla (40.97acres developed by 1905)	Hadfield's	73.47	Tinsley	Rail
Imperial (4.29 acres developed by 1905)	J.Edgar Allen & Co.	21.60	Tinsley	Rail
Tinsley Rolling Mills (1908)	Firth's	16.57	Tinsley	Rail
Tinsley Steel, Iron & Wire (& Steel Rope)	Cooke & Co.	9.18	Tinsley	Rail
Clyde	Osborn's	1.98	Wicker	No

Table 7.2

Relative Sizes of Works by Type of Goods Access, Based on Table 7.1

Acres	0.1 - 1	1.1 - 2	2.1 - 3	3.1 - 4	4.1 - 5	5.1 - 6	6+
Works With Rail Access	1	5	-	-	1	3	13*
With Canal Access	1	5	-	1	-	-	-
With Neither	16	8	11	3	2	-	-

Table 7.3

Carting Costs as a Proportion of Transport and Total Costs from Available Data[150]

Company	Date	Cart-er	What Carried	Total Cost per Ton	Trans-port Cost per Ton (d)	Carting cost (d per Ton)	Carting as % of Transp ort Costs	Carting as % of Total Costs
W.Ibbertson	1835	Self	Grindstones from Wickersley		151.25	12	7.93	
n/a	1839	S&R	Pig Iron & Iron Blooms local			12		
n/a	1839	S&R	Rod & Sheet Iron local			18		
n/a	1839	S&R	Coals local			12		
Daniel Doncaster & Co.	1870	MSLR	Charcoal? local			20.5		
Marsh Bros.	1883	n/k	Spring Steel to Liverpool	2021	122	12	9.84	0.59
Marsh Bros.	1886	n/k	Bamboo Spring Steel to Liverpool	2794	192	12	6.25	0.43
Marsh Bros.	1896	n/k	Watch Spring Steel to Goole		145	12	8.28	
Marsh Bros.	1896	n/k	Truss Spring Steel to Goole		145	12	8.28	
Firth Bros.	1896	Thom-pson	Coal from Firth's Wharf			8		
Jessop's	1896	MSLR	Steel Forgings to MSLR Depot			10		
Hadfield's	1896	n/k	Coal from Broughton La.			8		

* Ten exceeding 10 acres

150 RAIL 1067/10, 48; Abell, 1977, 86; SC/LD369, 10 Oct. 1870; SC/Marsh 34, Jan. 86; SC/Marsh 34, Nov. 83; SC/Marsh 64; SCSDR, MofE, HL1896, Q.539; Ibid., QQ.854-5; Ibid., Q.758

Figure 7.1 (following page)

Locations of Sheffield Iron Merchants, 1822

B - Canal Basin

Figure 7.2 (following page)

Locations of Sheffield Iron Merchants, 1852

Iron Merchants	=	Black Dot
Iron, Steel, Wire, etc. Dealers	=	Open Circle

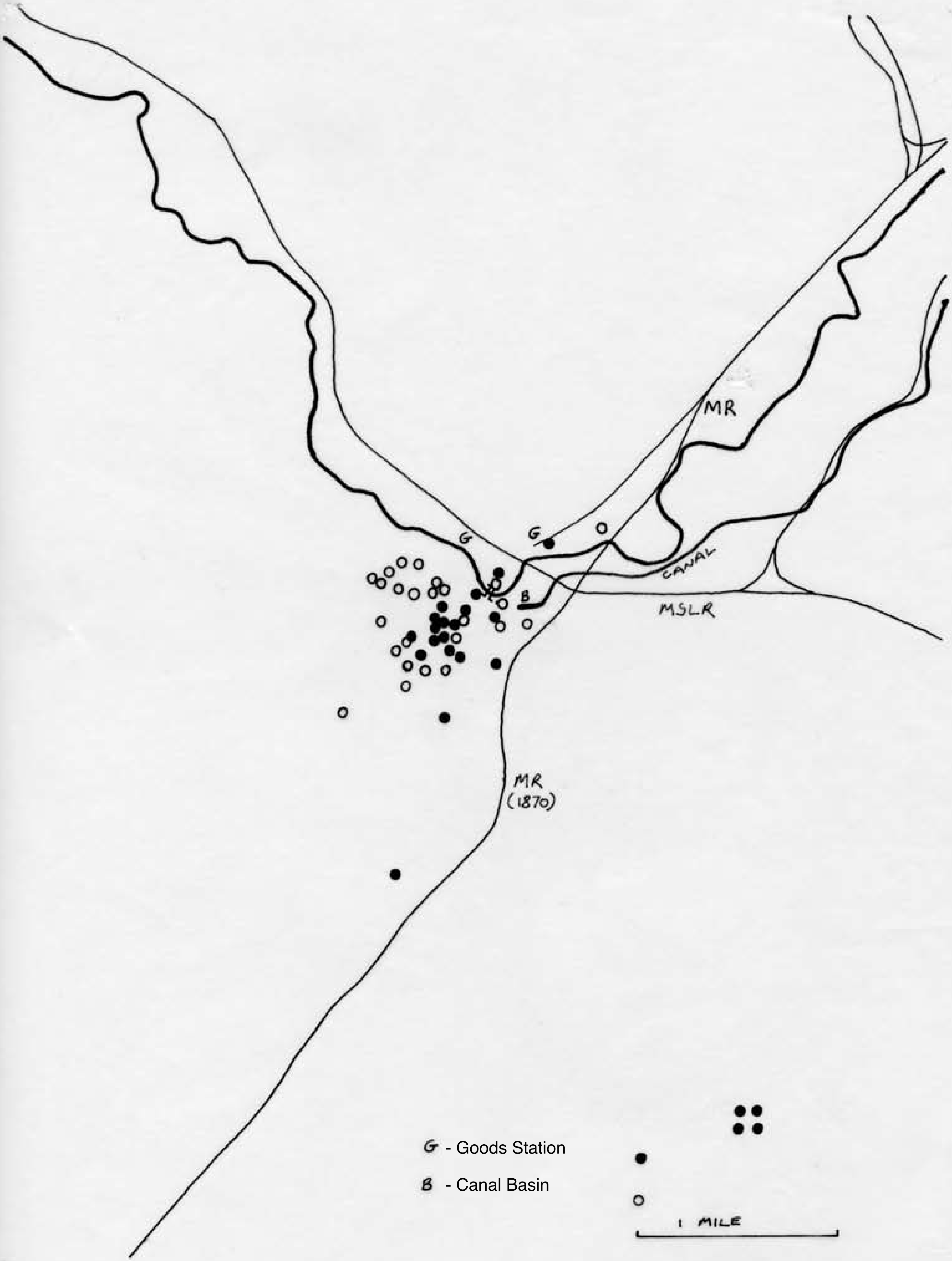

MR
G
G
B
CANAL
MSLR
MR
(1870)
G - Goods Station
B - Canal Basin
1 MILE

Figure 7.3 (following page)

Locations of Sheffield Iron Merchants, 1898

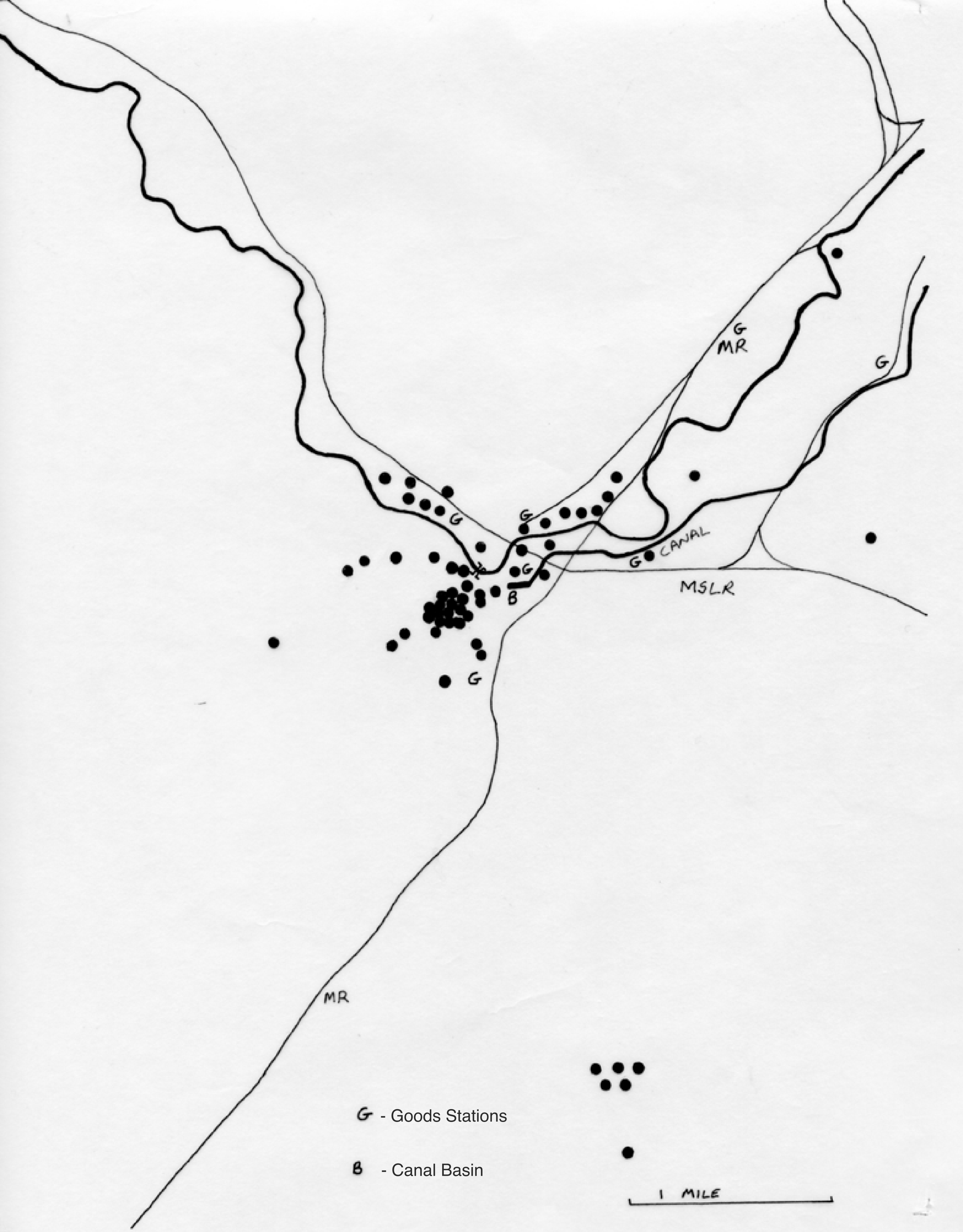

G
MR
G
G
G
CANAL
G
G
MSLR
B
G
MR
G - Goods Stations
B - Canal Basin
1 MILE

Figure 7.4 (following page)

Locations of Private Railway Sidings in Sheffield

Figure 7.4

Private Railway Sidings in Sheffield, 1915 - Key to Ownership

No.	Company or Nature of Works	Railway
1	Joshua Moss & Gamble Bros., Wadsley Bridge Works	MSLR
2	Brick Works	MSLR
3	Neepsend Gas Works	MSLR
4	Brick Works (siding from Neepsend Locomotive Depot)	MSLR
5	Sheffield Corporation, Rutland St. Depot	MSLR
6	Whiteways Cyder Ltd., Charlton Iron Co. and Samuel Smith's Wicker Mill (sidings in MR Wicker Goods Depot)	MR
7	Kayser, Ellison & Co., Carlisle Works (originally Messrs. Wilson)	MR
8	Spear & Jackson Ltd., Aetna Works	MR
9	Henry Bessemer & Co. Ltd., Bessemer Steel Works	MR
10	Thomas Firth & Sons Ltd., Norfolk Works	MR
11	John Brown & Co., Atlas Works (includes sidings constructed originally for Frankish Bros. and J. Sales's Carriage Works)	MR
12	Moses Eadon & Sons, President Works	MR
13	Savile Street Foundry & Engineering Co. Ltd., Midland Works (originally Clay Cross Iron Co., John M. Stanley & Co., then Midland Iron Co.; taken over by Firth's)	MR
14	W. Griffiths & Sons, Brightside Boiler & Engine Works (originally Hawksley & Wild and taken over by Firth's in 1915)	MR
15	Cardigan Iron & Steel Company, Cardigan Works (originally Humphrey Turner & Co. and taken over by Firth's in 1915)	MR
16	Chas. Cammell & Co., Grimesthorpe Works	MR
17	Grimesthorpe Gas Works	MR
18	Vickers & Co., River Don Works	MR
19	John Crowley & Co., Meadow Hall Iron Works	MR
20	Yorkshire Engine Co. Ltd.	MR
21	Sheffield Corporation Sewage Works	MSLR
22	Howell & Co. Tube Manufacturing Works	MSLR
23	Hadfield's Steel Foundry Co. Ltd., East Hecla Works	MSLR
24	Hadfield's Steel Foundry Co. Ltd., East Hecla Works	SDR
25	Henry Cooper & Co. Ltd.'s Steel Works	SDR
26	Vickers & Co., River Don Works	SDR
27	William Jessop & Sons Ltd., Brightside Works	SDR
28	Thomas Firth & Sons Ltd., Tinsley Rolling Mills	SDR
29	Edgar Allen & Co. Ltd., Imperial Steel Works	MSLR
30	Edgar Allen & Co. Ltd., Imperial Steel Works	SDR
31	William Cooke & Co. Ltd., Tinsley Iron & Steel Works	SDR
32	Tinsley Park Colliery	SDR
33	William Cooke & Co. Ltd., Tinsley Iron & Steel Works	MSLR
34	Thomas W. Ward Ltd.	MSLR
35	Tinsley Park Colliery	MSLR
36	Vickers & Co. (2 sidings in Broughton Lane Goods Yard)	MSLR
37	Mr. Peter Newton	MSLR
38	S.H.Burrows & Sons, South Yorkshire Engine Works	MSLR
39	Brown, Bayley & Dixon	MSLR
40	Sanderson Bros. & Newbould, Attercliffe Steel Works	SDR
41	Jonas & Colver Ltd., Continental Steel Works	SDR
42	William Atkins & Co.	SDR
43	Woodhouse & Rixson, Chantry Steel & Crank Works	SDR
44	Chas. Cammell & Co., Cyclops Works	MR
45	Homelight Oil Co.'s Oil Gas Works	MR
46	Saw Mills	MR
47	Sheffield Corporation, Olive Grove Works	MR
48	Havelock Bridge Works	MR

49	Laycock Engineering	MR
50	J.Gregory & Sons Brick Works	MR
51	Nunnery Colliery	MSLR
52	Craven Bros. Carriage & Wagon Works	MSLR
53	Sheffield Wire Rope Co.	MSLR
54	Brick Works	MSLR
55	Varnish Works	MSLR
56	William Jessop & Sons Ltd., Brightside Works	MR
57	T.W.Ward (siding in Grimesthorpe Sidings)	MR
58	Pitsmoor Coal Co. (siding in Brightside Sidings)	MR
59	Park Colliery	MSLR
60	Hodkin & Jones, Queens Road, Highfield (possibly siding in Queen's Road Goods Depot)	MR
61	Webster & Co. (later T.W.Ward) (siding at Millhouses Station)	MR
62	Askham Bros. & Wilson (siding not within works, which was some streets away in Napier St.)	MR
63	Sheffield Corporation, Lumley Street Depot	MR

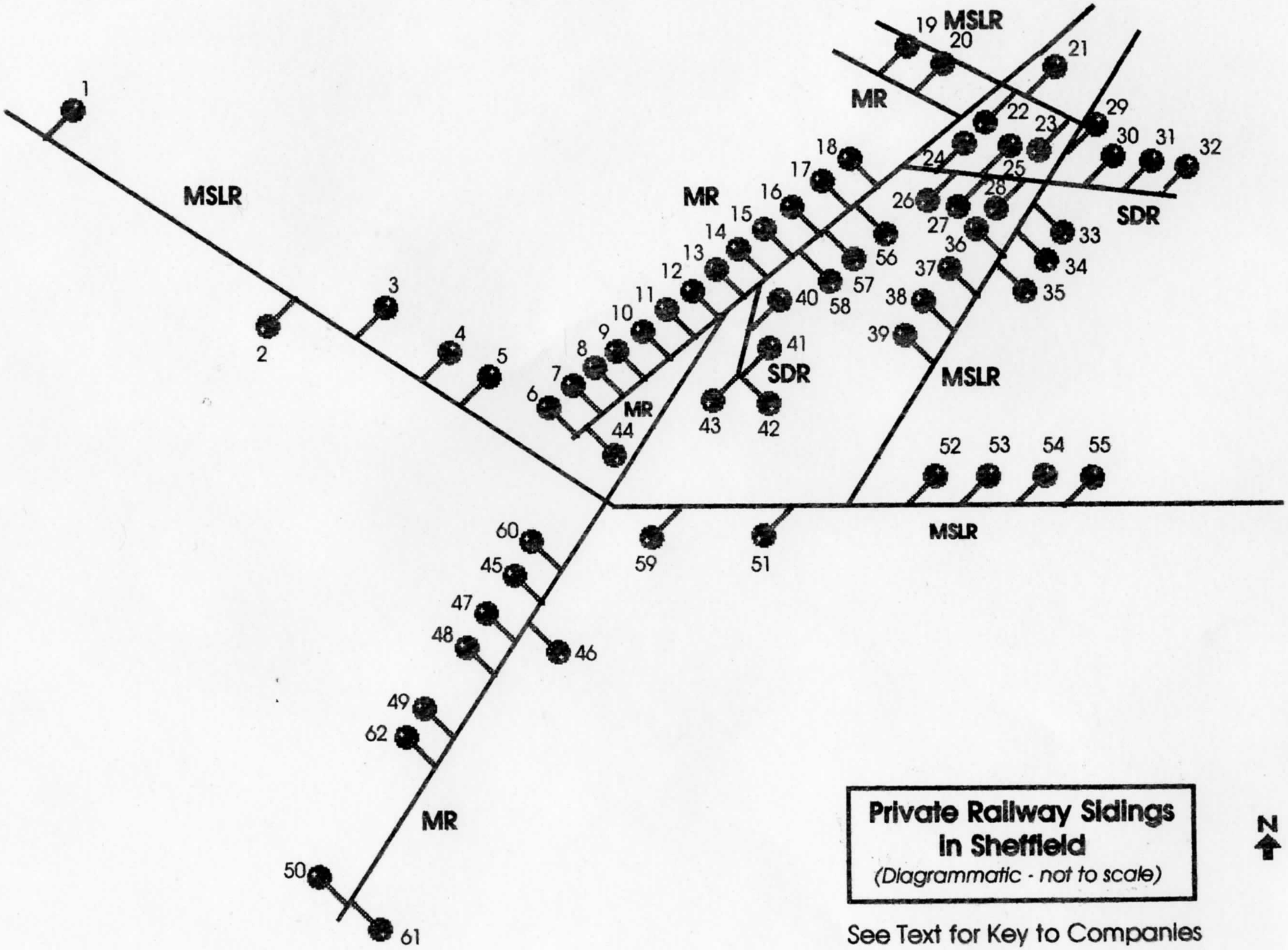
Note:

Three sidings agreements exist for which the precise location of the sidings could not be traced:

Patriotic Building Society	1878
Gregory & Bramhall	1894
Sheffield Industrial Waste Disposal Co., Tinsley	1915

Sources:

BR/24028.
ACM/LB/J/475-8 & K/329.
OS 1:2500, 1903 (Godfrey Edition).
PRO/MPS 5/274.
BR/Plan of MSLR - Sheffield, Tinsley & Aldam Jct., Surveyed 1887, Rev'd. up to 1921.
BR/Plan of LNER GC Section - Woodhead Station to Woodbourne Jct., Surveyed 1884, Rev'd. up to 1920.
BR/Plans of MSLR - Sheffield Stn. - Gainsborough Section, Surveyed 1884, Rev'd. up to 1912.
BR/MR Chesterfield & Sheffield Branch Land Plan, Surveyed 1906-7.
BR/MR Sheffield & Rotherham Line Land Plan - Wicker Station to Tinsley, Surveyed 1916.
Batty, 1984, 63.



Private Railway Sidings in Sheffield
(Diagrammatic - not to scale)

See Text for Key to Companies

CHAPTER 8

PASSENGER TRANSPORT

1. The Walking City

In Chapter 3, access to a suitable workforce was listed as one of the factors likely to influence industrial location. In Chapter 5 we saw that Sheffield's pool of skilled labour was one of the most important reasons why manufacturers continued to develop their businesses there.[1] The ability to move skilled workers to and from their place of work was an important issue for those selecting factory sites.

As the heavy industries grew, they also created a demand for semi-skilled and unskilled labourers.[2] Many were employed on a casual contract basis.[3] This may help to account for the fact that so many chose to live in the East End. Not only was housing provided to a standard they could afford in 'monotonous rows of cheaply run-up cottages for the new labour force'[4] but as in the Liverpool Docks (see Chapter 3) the need to be handy for the factories to ensure inclusion in a team when work was available would have been important - '[Sheffield's] poorest housing [was] for day labourers within easy distance of the factory gates'[5] and '... the workman wanted to live near his place of employment so as to shorten his walk to work in the morning and the walk of his wife and daughter carrying his dinner to him at midday ...'.[6] That this was a real consideration was shown when the Sheaf Works were flooded by the breaching of the Sheffield Canal in 1854. 'A poor woman, wife of George Barker, the engine tenter ... had brought her husband the provisions which he would require during the night ...' and became trapped by the flood until Barker rescued her.[7] This requirement may have become less important for employees of the larger firms over the years. Firth's Norfolk Works were equipped with a kitchen in the 1850s which provided for senior clerks and managers.[8] Later in the century J. Edgar Allen & Co. had a cook at the Imperial Steel Works in Tinsley, an area well away from most habitations (see Chapter 12 below). The importance of this factor was offset by the use of the lunchbox by many (perhaps most) workers. Though difficult to

[1]Pollard, 1969, 159
[2]Ibid., 226-7
[3]Ibid., 163
[4]Ibid., 5
[5]Gladstone, 1976, 15
[6]Pollard, 1969, 5
[7]Sheffield Independent, 18 Feb. 1854
[8]Marshall and Newbould, 1925, 12

document, the taking of 'bait' to work is recorded by miners and engineering workers as the most common form of eating,[9] and was probably equally so in Sheffield steel works.

- <u>Home-Work Linkages</u>

Passmore's analysis of the employment linkages of 1,716 workers from 29 firms disrupted by the floods caused by the collapse of the Dale Dyke Dam in 1864 supports the assumption that the majority of workers around the mid-century lived within easy walking distance of their place of work (see Table 8.1).

Thus, around 51% of the claimants lived less than half a mile from work, about 70% within 0.75 mile, and only about 16% further than one mile away. Despite Passmore's caution about the unscientific selection of this sample, it does seem to provide good evidence for close employment to home linkages in the period before construction of the tramways. The sample also provides a good breakdown between the light and heavy trades. At the steel companies affected by the flood[10] 58.83% of the workforce lived within 0.5 mile of their workplace, 78.53% within 0.75 mile and only 8.82% more than a mile away.[11] This compares, for example, with only 43% of grinders living within 0.5 mile of their place of employment.[12] File workers showed a similar pattern to grinders.[13]

Using the directories for 1852 and 1872, Passmore also traced the employment linkages of industrial proprietors. As was noted briefly in Chapter 5, there were strong linkages. In 1852, 81.5% of the cutlery proprietors sampled and 55% of steel refiners and converters lived within half a mile of their works. In 1872 these numbers had fallen to 65.2% and 45.9% respectively (see Table 8.2).

There is evidence here of a change in employment linkages and a movement by the manufacturing class away from their workplaces. Given the observation of the growth of Sheffield's western suburbs in Chapter 5, this should come as no surprise. Sheffield remained a relatively small town even by 1870, so it is not essential to assume that changes in modes of transport necessarily contributed to this trend. Nevertheless, the middle classes at least began to adopt methods of personal transport which, even if not guaranteed to increase the speed of their

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[9]Burnett, (ed.) 1974, 103, 310
[10]Brown's, Cammell's, Naylor-Vickers, Earl Smith and John Charles
[11]Ibid., 122-3
[12]Though many of the grinders were probably self-employed outworkers who would have had their own premises or rented space in a hull - Ibid.
[13]Ibid., 124

work journey, would announce their status, and allow dry head and feet in inclement weather. It is to these modes of transport that we now turn.

2. Personal Transport - The Horse as Traction

For those who could afford one, the horse, either ridden or pulling a carriage or trap, was the next step up from pedestrianism. Vickers, although he does not identify the source of his information, states that 'Even the early well-to-do industrialists either walked or rode on horseback and it was not until the year 1800 that private carriages were seen on the Sheffield streets. Even then, there were only two.[14] The first occasion of a Master Cutler being driven to the annual Cutlers' Feast in his own carriage was in 1806'.[15]

The suspension of carriages before the invention of elliptic springs in 1804[16] can hardly have been suited to Sheffield conditions. With growing prosperity, however, more manufacturers could begin to afford the £200 a year which The Spectator reckoned in 1837 were necessary to run a private carriage with coachman and groom.[17] After 1820:

> Successful masters whose fathers had a generation earlier lived as a matter of course over or next to their workshops now kept a horse and moved out from the ... scenes of industry to the new middle-class residential areas.[18]

By 1822, three Coach Builders advertised in Baines' Directory.[19] The number of private carriages in the town was on the increase throughout the century. Whilst evidence of the total number is not available, one can look at the statistics in the censuses for 1851-71 in Table 8.3, when Domestic Coachmen and Grooms were listed as a separate occupational category

In 1881, the two figures were combined, and there had been an increase to a total of 335 employees in these two categories. After that, they are merged into wider categories of employment. Nevertheless, the pattern is clearly one of steady growth in the number of private coachmen (and hence, one assumes, coaches) with a burgeoning sometime in the 1870s, probably coinciding with increased prosperity in the steel industry and the growth of suburban living.

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[14]One belonging of Mr. Shore of Tapton Hall and the other to Mr. Greaves of Page Hall
[15]Vickers, 1972, 9
[16]Copeland, 1968, 133
[17]Ibid., 133
[18]Pollard, 1969, 6
[19]Ibid.

This takes no account of privately owned and self-driven vehicles, of which there must have been a good many. For example, in 1864, John Gunson, Engineer of the Sheffield Waterworks Company is recorded as commuting to the works of the ill-fated Bradfield Reservoir in his gig.[20] Certainly they were common enough by the 1890s when Mr. Woodward wrote to Mr. Edgar Allen that 'Marshall has been here this morning for money (for Mrs. Allen) and I understood him to say that Mrs. A. was waiting in the trap for him ...'.[21]

By 1917, it was possible to pick up second hand carriages very cheaply in Sheffield.[22] Prices were low compared with the results of sales held at the beginning of the twentieth century in other towns,[23] where figures of 30 gns. seem to have been the lower end of the price spectrum. Of course, the condition of the carriages in the Sheffield auction is not known, war conditions prevailed, and the motor car was becoming the dominant form of middle-class personal transport, so that the market for horse-drawn vehicles was probably already in decline. Even so, the purchase of a private vehicle was clearly affordable by more people by the 1900s.

i. <u>Hackney Carriages</u>

Visitors or residents without their own equipage could hire a horse from a postmaster, or a hackney cab. It is unlikely that these vehicles would be used regularly for journey to work. The first Hackney Carriage was introduced in Sheffield in 1793 - before the date of the first private coach. In 1832 a cab stand was provided in the High Street. In 1841 cabs were allowed to ply for hire.[24] The statistics of employment from the Census in Table 8.4 show the gradual increase in this sort of trade over the century, although they include others involved in the horse-drawn passenger business. The number of coach and cab owners (Table 8.5) would also seem to have been on the increase, though the figures are

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[20]Amey, 1974, Ch.I

[21]J. Edgar Allen & Co., Director's Private Letter Book No.2, 29 Sept., 1892 - SC MD 3971

[22]On 10 July and 16Oct., 1917 Bush and Co. auctioned a number of carriages, and somebody pencilled in the prices fetched on a handbill now in the Sheffield Collection. The items were:

1 Square Fronted Brougham	- 12 gns.
1 Victoria	- 13 gns.
4-Wheel Dog Cart	- 15 gns.
2-Wheel Dog Cart	- 16 gns.
1 London Brougham, Rubber Tyres	- £24-3s-0d
1 Victoria	- 5 gns.
1 Canoe Shaped Landau	- 15 gns.

SC Handbill of Bush & Co. Carriage Auctions, 10 & 16/10/1917

[23]Quoted by Copeland, 1968

[24]Vickers, 1971, 9

confused by other categories. What is clear is that there was an increase in the availability of personal transport for hire later in the century.

It is not likely, though, that cabs were used for journeys to work on a regular basis. Typical fares in 1850 are shown in Table 8.6. At these prices none but the most affluent could have afforded the use of cabs twice daily.

ii. Omnibuses

The first move towards street based mass public transport in Sheffield came with the advent of horse omnibuses. This coincided with the opening of the Sheffield and Rotherham Railway in 1838. Two privately operated services ran to the Wicker station - one from the Glossop Road Toll Bar west of Sheffield in what was to become the suburb of Tapton near Broomhill, and one from the Moor south-east of the town centre. A novel characteristic of the new services was that omnibuses were timed to allow passengers to catch departing trains. This practice is not commonly reported in transport history literature at such an early date, although the railway companies did run their own omnibuses in some areas later in the century. There may have been a perceived need to integrate services in Sheffield because the railway station had to be situated on the eastern edge of the town, while many of its potential middle class customers had already chosen to live on the opposite side, in the new western suburbs. The omnibus fare was 3d.[25] By 1845 a route from the Haymarket to Heeley was established and this was joined in 1850 by a service to the Botanical Gardens in the suburb of Broomhall/Endcliffe. The first service from the town centre into the East End ran to Attercliffe in 1852[26] - around the time that the major steel works were beginning to take shape in Brightside. Another service ran along Penistone Road north-eastwards from the town centre in the same year[27] and served Shales Moor and Philadelphia where some of the larger new cutlery works were being built (works which would ultimately prove to be in the medium-large size range once the giant steel producers reached their full extent by the early years of the twentieth century),[28] to be followed by similar sized steel works and other factories by 1863.[29] The fare for all these services seems to have been 3d. A contemporary observer calculated that a skilled artisan in 1851 would have had no surplus income after paying for food, rent, union contributions, doctor's bills and school fees; and could well have been in debt if he had a large family and his

[25]Vickers, 1972, 10
[26]Ibid.
[27]Ibid.
[28]O.S. 6":1 mile, 1855, Pawson & Brailsford, 1862, 143
[29]White's Plan of Sheffield, 1863; Pawson & Brailsford, 1879, Advts. 40

wife did not work.[30] It does not seem probable that 2/6d per week for return fares would have been affordable for skilled workers, let alone the unskilled. Omnibuses must have remained a middle class luxury.

By 1862, eight omnibus proprietors provided services to the following destinations from the town centre:

Attercliffe
Heeley
Broomhill (3 services)
Cherrytree (Nether Edge)
Hillsborough
Owlerton
Ranmoor
Upperthorpe
Grenoside
Wadsley Bridge
Botanical Gardens
Dore, via The Moor
Holmesfield, near Dronfield south of Sheffield.[31]

All but the Upperthorpe (2d) and Ranmoor (4d) services operated on a flat threepenny fare.

At the introduction of the first tramway in 1873, the omnibus routes shown in Figure 8.1 were in operation. The majority still connected the predominantly middle class and artisan suburbs to the town centre, but largely working class areas such as Pitsmoor, Attercliffe and Carbrook were also served. The services to Attercliffe and Brightside do not appear to have survived the arrival of the trams. The Sheffield Red Book of 1877 no longer lists these routes and describes only the tram services.[32] Although omnibus services were frequent (for example half hourly to and from Heeley and three times an hour to and from Broomhill), the earliest start in the morning in 1877 was 8.00 a.m. from Heeley. In contrast, the Workmen's Tram Cars to Attercliffe and Carbrook ran at around 6.00 a.m. (see below), suggesting that the omnibus routes still provided little benefit for the mass of industrial workers.

[30]Pollard, 1969, 26-7
[31]Vickers, 1972, 12
[32]Sheffield Red Book, 1877, 47

3. Railborne Public Transport

i. The Railways

In Chapter 5 the local passenger stations serving Sheffield and its suburbs were mapped. There is little information about how useful these stations were for journeys to work. The intermediate station opened by the S&R at Grimesthorpe Bridge was not a success in attracting passengers travelling to the newly industrialising East End. It closed in 1843, only five years after the railway opened.[33] Admittedly, this was at a time when the S&R was in financial difficulty, locomotives were worn out and trains were frequently cancelled for lack of motive power.[34] Later, every new line brought local stations, which often seemed to be aimed at allowing services to be run in direct competition with those of other railway companies which already had passenger stations nearby.[35]

Subjective views on the utility of the railways for improving accessibility for passengers (and thus by corollary their potential to encourage suburban development) seem to have varied. The founder of a Sheffield Building Society told the Royal Commission on Friendly and Benefit Building Societies, 1871 that there were a considerable number of speculative houses unlet at Norton, a suburban village some three miles from the town centre, but that 'the railway [the MR Chesterfield Extension] is just opened which will make it a little better. It brings it a little nearer'.[36] Although the Duke of Norfolk's agents were convinced of the benefit to the estate's development of selling land to the MSLR for a station at Neepsend in 1881[37] the Duke himself (then Mayor of Sheffield) seemed far from convinced of the benefits of passenger services on the SDR. He told the Committee considering its Bill that he had not given much attention to the railway's passenger carrying potential because the real need was to carry goods.[38] Robert Hadfield thought there would be a benefit for passenger traffic, but principally for long distance services to the Dukeries and East Coast.[39]

In 1850 the MR charged 4d to go from Sheffield Wicker to Brightside 3rd Class or 8d 1st Class. The MSLR was more economical at 2.5d Third Class, 4d Second Class or 5d First Class to Darnall.[40] The railways followed rigid routes and did

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[33]Proctor, 1975
[34]Batty, 1984, 20
[35]Ibid., 51, 60
[36]RCFBBS, MofE, 1871, Repr. IVPFS, 196, Q.6844
[37]ACM/LB/P/328 - see Chapter 10
[38]SCSDR, MofE, HL1896, QQ.435-6
[39]Ibid., QQ.810-1
[40]Rodger's, 1850, 18-9

not even serve the southern suburbs until 1870. It does seem that suburban development was assisted in Abbeydale, Dore and Totley by the building of the MR Chesterfield Extension. This development became noticeable in the 1860s, but was accelerated in the late '70s by improved accessibility.[41] Even so, it is hard to show that the railways did much to change the average industrial worker's journey to work habits before 1914.

ii. Tramways

October 1873 saw the opening of the town's first horse tram route.[42] The line was owned by the Council but leased to a private company which operated the services, the Council being barred from running trams by the local tramway Act of 1872. The first route ran from Lady's Bridge to Attercliffe.[43] The route was extended to Carbrook in 1874 and in 1875 a second line was opened from the junction of Savile Street and Attercliffe Road to Brightside.[44] It may seem surprising that the first tramways did not emulate the horse buses and commence operations in the western suburbs. However, the steel industry was prospering and extending eastwards in the East End when the tramways were being planned in 1872 and, perhaps more importantly, roads in the Lower Don Valley were generally just as level and often broader than those to the west, so they presented fewer difficulties for the construction and operation of the tramways.

The 1872 Act permitted the construction of five routes.[45] In December 1875 the Sheffield Tramway Company wrote to the Council urging it to construct the outstanding routes because of the success of the Carbrook and Brightside undertakings. The provision of tramways through the narrower streets of the town centre was obviously a concern, because the Company proposed the means to deal with it by building frequent crossovers to allow trams to switch tracks to avoid carts standing at the roadside.[46] In 1877-8, lines were opened from West Bar to Hillsborough, and Moorhead to Nether Edge and Heeley.[47] The routes could not be joined until a new street was built through the town centre.[48] As the tram lines did not interconnect, they were linked by horse bus services.[49]

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[41]Dunstan, 1971, 29
[42]Tramway and Railway World, Vol.VIII, 2 Nov. 1899, 423
[43]Vickers, 1972, 16
[44]Ibid.
[45]Ibid.
[46]SC CA (5) 9
[47]Vickers, 1972, 16; Pawson & Brailsford, 1879, 116
[48]Ibid.
[49]Vickers, 1972, 17

a. Workmen's Tramcars[50]

It is generally difficult to isolate the effect of the introduction of public transport on journey to work patterns. In the absence of any contemporary class by class breakdown of patterns of use, only general speculation is usually possible, based on journeys per head of population, the proportion of average incomes which would have been taken up by bus and tram fares, and the usefulness of timetabled services to a town's workers. This problem is particularly noticeable in the years before municipalisation, and it is therefore interesting that a lone example of a Sheffield Tramways Company Traffic Receipts Book has been preserved from the year 1876.[52]

This book covers only the period 6th July to 12th September, 1876, and thus the data which it contains may not be fully representative of tramway use. The book covers only the summer period, when one might expect the trams to be less in demand than in the more inclement winter months, although Sheffield was not noted for the dryness of its climate even in the warmer part of the year. The Receipts Book records the takings from each journey made by each of the Company's tramcars between Sheffield, Attercliffe, and Carbrook near Tinsley. The most interesting feature of the book is that it records separately the journeys made each day by the Workmen's Cars between Sheffield and Attercliffe.

The Workmen's Car was introduced in March 1875 after pressure had been exerted on the Tramway Company.[53] Ordinary trams started from Carbrook at 8.00 a.m., Attercliffe at 8.10 a.m., and Sheffield at 8.40 a.m. in 1877[54] for a 2d fare - too late to be of use for journey to work for most workmen not on shift work. The fare was considered too high to attract workers. The Workmen's Cars offered a fare of 1d or 1.5d and were timetabled (again in 1877) to run from Tinsley at 5.50 a.m., Attercliffe at 6.00 a.m. and Sheffield at 6.25 a.m. The return journeys were timed at 5.05 p.m., 5.15 p.m. and 5.40 p.m. respectively. Reference to the maps of the developing tramway system suggest that it would be correct to describe the terminus as Carbrook rather than Tinsley. The 1876 Traffic Receipts Book refers only to a workmen's service between Sheffield and

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[50]The information on the Workmen's Tramcar was researched by the author and written up as a research progress note in 1977. It was first published with the author's permission in Caulton, 1980, 139-40

[51]The information on the Workmen's Tramcar was researched by the author and written up as a research progress note in 1977. It was first published with the author's permission in Caulton, 1980, 139-40

[52]SC CAS (20)

[53]Hall, 1977, 36

[54]Sheffield Red Book, 1877, 47

Attercliffe. This would suggest that the service was later extended, since non-workmen's cars running to Carbrook rather than Attercliffe are specifically identified in the book. Alternatively the 1.5d fare may have been for the Sheffield-Carbrook journey, but without specific reference to this alternative destination.

During the period covered by the book, the Workmen's Cars operated from Monday to Saturday inclusive for a total of fifty-one days. The information for the fifty-one days was aggregated and then averaged according to the fare paid and also for the total number of passengers per car journey. For passengers completing less than a full car journey, there is no way of identifying the points between which the journey was undertaken or the distance travelled. The results are set out in Table 8.7.

It is difficult to make direct comparisons between the figures for Working Men's Cars and those for ordinary Cars. Although ordinary journeys are numbered, several cars were used each day. It is therefore impossible to judge the time at which a car made any particular journey. As a rough comparison, on Thursday 6th July, 1876, Car No.1 made 16 return journeys (i.e. 32 total) between Sheffield and Attercliffe, and carried 470 fares (counting two halves as one full fare). This works out at an average of 14.688 passengers per trip, with a maximum of 28.5 and a minimum of one. Car No.1's journeys appear to follow a similar pattern over the period covered by the book. Thus there seems to be a significant difference between normal trams and Workmen's Cars.

The Workmen's Service was invariably provided by Car No.8.[55] This seems unusual since the other cars appear to have been used flexibly over the timetable. One explanation may have been a desire to keep the Workmen's Car segregated so that the normal clientele would not have to suffer grime deposited by workers. In cars with wooden slatted seats and straw on the floor[56] this would seem to be an unnecessary precaution and there may have been other, less class conscious operational reasons.

The most interesting point to emerge from Table 8.7 is that the Workmen's Cars were well used - an indication that there was a demand for public transport from the 'workman' even in the 1870s. It is by no means certain what class of workman was making use of the service, but it is probable that members of the working classes rather than the middle classes were predominant among the

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[55]Hall, 1977, 36, confirmed from the Traffic Receipts Book
[56]Vickers, 1972, 16

passengers, considering the timing of the service and its designation. Demand seems to have been stimulated because the service ran at the right time and the fare was low. Indeed, the rough comparison made earlier suggests that the Workmen's Cars were used a good deal more intensively than ordinary services. It is impossible to tell at what time between 8.00 a.m. and 11.00 p.m. the journeys of ordinary cars were made. Assuming a journey time of about twenty minutes,[57] however, a vehicle making thirty-two journeys a day would have evening journeys as its later numbers in the Traffic Receipts Book. In the case of Car No.1 on 6th July there appears to be a heavier usage in the evening than in the morning on that basis. On journeys 13-15 (i.e. six return trips Attercliffe-Sheffield-Attercliffe) over forty passengers were carried on each journey. The only other journey to approach this number is the first with thirty-eight fares. Only on the Sheffield to Attercliffe leg of journey 14 (28.5 fares) does the normal service carry anything like the average of over thirty passengers carried daily by the Workmen's Car. Such comparisons are very speculative but they do serve to emphasise the point that there was a suppressed demand for public transport from some parts of the working classes. The figures for Car No.1 also suggest that other classes were definitely commuting by tram.

The other point of interest is the preponderance of travellers at the 1d fare. Well over twice as many passengers were carried at this rate than the 1.5d fare. This either indicates that the trams were being used for comparatively short journeys (it is assumed here that most users of the Workmen's Car were travelling to and from work), or that there was a significant preference for the minimum fare and that passengers opted to travel part of their work journey by tram and the rest on foot. Given Passmore's findings and the proximity of much working class housing to factories in the Don Valley, the former may be the most likely explanation but some elements of the latter may also be involved. The indication of a preference for lower fares was apparently noted by the local authority, which reduced fares on taking over the system in 1896.

One interesting feature of the figures is the lack of any marked trend in the direction of travel, either in the averaged figure or when examining individual journeys. Rather than an outflow of workers from western Sheffield to factories in the Don Valley in the morning, with a corresponding return in the evening, the pattern of use seems to be relatively evenly distributed with perhaps a preference for the morning journey into Sheffield (average 48.864 passengers). Oddly though, a corresponding return peak does not occur on the Sheffield to Attercliffe service in the evening. The preference seems again to have been for travelling

[57]Sheffield Red Book, 1877, 47

towards Sheffield (average 39.627). The first figure is probably explained by the fact that a large number of works at this time were still near the city centre. The lack of a corresponding return would suggest that many travellers only used the trams for one half of their home-work-home journeys. As for the number of passengers travelling towards Sheffield in the evening, this balances fairly well with the morning average of 40.169 travelling towards Attercliffe. This might suggest a higher proportion of clerks or better-off artisans living to the west who could afford to travel both ways by tram.

The Traffic Receipts Book provides a useful if limited indicator of the demand for public transport, showing that at least some of the working classes were prepared to direct some of their income into their work-journey. This willingness led to the introduction of a similar Workmen's Car on the Heeley-Moorhead tram route when it opened in 1877.[58] The morning car on this route ran at 6.30 a.m. and the fare was 1d. This car was not designed to provide a through route for 'workmen' from Heeley to Attercliffe, since it left Heeley 5 minutes after the Attercliffe tram had left Sheffield. Again, the continuing presence of works close to the town centre probably explains why this occurred, with the majority of workers in the western suburbs probably working in skilled trades in the cutlery firms in the inner suburban ring. The Workmen's Cars cannot have been particularly profitable for the Tramways Company. For example, on Thursday 6th July, 1876, the Workmen's Car took 12/7d in fares out of a total for all cars of £23/4/11d. This compares favourably with takings on individual return journeys by Car No.1 (varying between 8/0d and 3/0d), but badly when compared with its total take for the day of £3/18/9d. Nevertheless the service was obviously popular with its patrons, and was the forerunner of a much more widespread use of public transport in the next century.

b. <u>Municipalisation and Electrification</u>

The Tramway Company's lease expired in July 1896. As the end of the lease approached, the Company had been less and less willing to invest in the tram services. The Council (after some Parliamentary misgivings) was granted the power to take over the services.[59] There were nine miles of track, 44 tramcars and 4 omnibuses in the establishment.[60] A deputation from the Tramways Committee visited towns in Britain and Europe to investigate improvements to traction. Electrification was decided upon. Simultaneously, the system was extended. A through route connected Moorhead to Lady's Bridge. New tracks

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[58]Vickers, 1972, 17
[59]<u>Tramway and Railway World</u>, Vol.VIII, 2 Nov. 1899, 424
[60]Vickers, 1972, 18

were laid to Walkley, Crookes and Intake and further additions were planned to go to Firth Park and Endcliffe. The first electric services ran to Nether Edge and on the original Attercliffe tramway (now extended to Tinsley) in September 1899.[61] Horse traction was eliminated from the system by 1902.[62] Further extensions took place into the western suburbs in the early 1900s.[63] The Sheffield and Rotherham systems were connected at Templeboro'/ Tinsley in 1905.[64] Figure 8.2 shows the system as it had developed by September 1913 when The Tramway and Railway World reported that it had a total route length of 40 miles and possessed 279 tramcars.[65] The Council reduced fares to 1d after electrification, with 0.5d fare stages.[66] This and the increase in route mileage led to a massive rise in the number of passengers carried.

In a research progress note, Timothy Caulton produced a comparison of tramway usage between London and Sheffield, based on annual journeys per head of population, detailed in Table 8.8. Traffic continued to grow in subsequent years, as Table 8.9 demonstrates.

The increase in passenger numbers consequent on improved speed and reduced fares undoubtedly enabled the extension of Sheffield's suburbs and allowed the town to grow beyond the limits imposed by the need for the mass of workers to walk to work. This was a deliberate policy - the Sheffield Council Tramway Committee saw that '... the system in Sheffield was capable of great development ... as to the opening out of new districts ...'.[67] In 1898 an Alderman made explicit the perceived connection between efficient, cheap tramways and finding better suburban housing locations for the working classes.[68] Caulton, in line with other writers, believes that Sheffield's '... mass suburbanisation process was directly related to the electrification of the tramway system after 1898'.[69] The cheap fares were certainly more affordable by better paid workers by the early years of the twentieth century, when adult steelworkers could earn between 3/- and 20/- per day and cutlers 30/- to 75/- per week.[70] With rents for working class dwellings ranging from 2/6d to 9/- per week and groceries and fuel a little below equivalent London prices[71] there is every probability that more and more

[61]Ibid.
[62]Hall, 1977, 45
[63]Ibid.
[64]Lodge, 1985
[65]Tramway and Railway World, 11 Sept. 1913, 200-1
[66]Vickers, 1972, 17
[67]Ibid., 2 November 1899
[68]Pollard, 1969, 185
[69]Caulton, 1980, 170
[70]Pollard,1969, 209 & 230
[71]Board of Trade, 1908, 411-4

working class people, including steel workers, could have become regular passengers travelling to work over greater distances on the extended tramways.

4. Bicycles and the Internal Combustion Engine

It is difficult to assess the effect of the mechanisation of personal transport on journey to work patterns because ownership and use of bicycles and early cars is not recorded. Bicycles seem to have appeared in Sheffield by the mid 1860s and to have become relatively common by the end of the decade.[72] In 1879, bicycle making was still 'quite a new industry' and there were four Sheffield manufacturers.[73] Cycling clubs became popular in the 1880s.[74] Motor cars were introduced around 1895.[75] On first registration of private motor vehicles in November 1903, the City and County Borough of Sheffield Register of Motor Cars included 92 motor and steam cars and tricycles and 31 motor cycles.[76] Even with growth after this date, the internal combustion engine can have had little effect on the overall pattern of journeys to work at this time. Plotting the addresses of registrations on a map of Sheffield shows an almost exclusive concentration of motor vehicles in the better off western quarters of the city (see Figure 8.3). Unfortunately, the register does not record commercial vehicles, so we cannot measure the effect of the steam or internal combustion engines on goods traffic before 1914.

Motor buses made no impact on journeys to work in the study period, as they were not introduced until 1913.[77]

[72]Vickers, 1972, 34-5
[73]Pawson & Brailsford, 1879, 294
[74]Binfield et al (eds.), 1993, Vol.III, 86
[75]Ibid.
[76]SC LZ/1
[77]Tramway and Railway World, 11 Sept. 1913, 200-1

5. Employment Linkages in Sheffield - Evidence from Three Steel Manufacturers

Sources were found which allowed a connection to be made between the residences and places of employment of three small groups of employees.[78] All worked for steel manufacturers. All date from 1883 or later. The three groups are not as large as the cumulative figures studied by Passmore, although they are closer in size to the numbers in the individual firms in his sample. Most of the workers identified here came from the clerical and managerial classes. Nevertheless, the data are of interest given the scarcity of such information and the glimpse they give of journey-to-work patterns. In all three cases, the addresses of workers were plotted on maps of Sheffield and the distance from residence to workplace measured. As with the studies by Passmore and F.W. Carter it was only possible to plot these relationships as the crow flies. No assumptions can be made about modes of transport, short cuts or other journey-to-work preferences. The data were, however, plotted on a base map showing the extent of the tramway system in 1913 and divided between addresses pre-1899 and post-1899. This can only be a limited surrogate for the number of workers who chose to live near tramways, as many of the employees concerned may already have lived close to a route where a tramway was subsequently built, or lived near an existing tramway before they went to work for the firms in question.

i. Cocker Bros.

The Cocker Bros. papers were discovered at the firm's premises by the author during the search for data about the steel industry, and later catalogued by the South Yorkshire Record Office.[79] The papers included a register of clerks and managers, giving their names and addresses (including changes of address) from 1886-1935, which was not catalogued separately by SYRO.

Cocker Bros. were wire makers and steel converters and refiners. The firm invented cast steel wire and an annealing process to make it pliable.[80] In 1886 when the register was begun, the firm occupied the Navigation Works, Effingham Street, beside the canal in Attercliffe; and premises in Nursery Street nearer the town centre. Their offices were in Nursery Street[81] until 1889. In the previous year the firm purchased Marriott and Atkinson's Fitzalan Works, with its plant and stock. Marriott and Atkinson had gone into liquidation. As their premises

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[78]The data for Cocker Bros. and Spear and Jackson employees were researched by the author and written up in research progress notes in 1976. They were published first in Caulton, 1980, 149-50 with the author's permission

[79]Cocker Brothers Ltd., Rules for Managers etc.

[80]Pawson & Brailsford, 1862, 163

[81]Ibid.

were next to the Navigation Works, it was natural for Cocker Bros. to buy them and consolidate on one site. From 1889 when Cocker Bros. changed their published address, it is reasonable to assume that the offices (and thus the managers and clerks) were in the canalside works.[82]

The homes of the employees are plotted on Figure 8.4, with concentric circles showing distances from the Nursery Street and Navigation/Fitzalan Works. Including moves of residence, 174 work journeys were evidenced. Of these, 127 could be identified with one or other works. The remaining 47 were uncertain between the two sets of premises. Table 8.10 shows what would have been the distribution of employment linkages if all 47 had worked at Nursery Street and, alternatively, if all 47 had worked by the canal. From this table we can observe that over 69.5% of employees whose workplace is known travelled more than 1 mile to work and over half these managers and clerks journeyed for more than 1.5 miles.

From the map it will be apparent that most of the clerks and managers lived within easy walking distance of a tramway once the network had been established after 1899. Of employees at Effingham Street before 1899, 23.68% lived within one mile of the works. This figure contrasts with 23.13% of those clerks and managers registered after 1899. Moreover, 63.16% of pre-1899 staff lived over 1.5 miles from Effingham Street, compared with 54.84% of post-1899 workers. Interestingly, this suggests that although a longer journey to work was the norm for Cocker Bros. clerks and managers, there was not necessarily an increase in the distances travelled after cheap trams and motor buses were widely available. These are, of course, very small samples and may not be statistically significant for the whole of this sector of the workforce.

ii. Spear and Jackson

Cocker Bros. were among the more successful and innovative of the medium sized specialist steel companies. Spear and Jackson must have been rather closer in scale to the industrial giants which shared railway access in the Lower Don Valley. The company specialised in making steel, saws, edge tools and spades.[83] As we saw in Chapter 6, Spear and Jackson were among the first manufacturers to move to the East End. From 1883-1906, the firm kept a ledger of clerks and managers.[84] Not all the records include addresses and these had to be obtained from White's Directories for the years in question. 105 addresses

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[82]Information based on manuscript company accounts
[83]Pawson and Brailsford, 1879, 279-80
[84]SC SJC 47-50

can be traced with reasonable certainty and these are shown in Figure 8.5. The employment linkages are shown in Table 8.11.

In this case it is clear again that most clerks and managers lived some distance from the works. Although the numbers of workers are not large enough to be statistically significant, it is worth noting in passing that 29.6% (19) of pre-1899 workers lived one mile or less from the Etna Works. After 1899, this percentage was 9.75% (4). The proximity of homes to tramway routes is also notable.

iii. Marsh Bros.

The final data cover 24 addresses of Marsh Bros. employees. Marsh Bros. were steel makers based by 1900 in the centre of Sheffield (see Chapter 6). The names and addresses are recorded in the Steel and Engine Wage Book[85] of Pond Street Works, close to the Midland Station. The addresses date from 1900-6, after the electrification of the tramways, though there is no way of telling when the employees moved into their homes. All worked in the Twist Drill Dept., but there is no information about their trades. It seems reasonable to assume that most were skilled artisans. The addresses are mapped in Figure 8.6. The employment linkages are set out in Table 8.12.

Once again we see a relatively small number of workers living within 0.5 mile of the works, but rather more within 1 mile than in the case of the clerks and managers of the other two firms. There is an interesting cluster of employees (16.67%) in Heeley, near the railway station. These workers would have had the choice of taking the train into the Midland Station or using the tram. There does not seem to be a strong clustering around the tram routes, although none of the workers were a long walk from a tram stop on the extended system.

[85]SC Marsh 40

6. Conclusions

There was little to encourage the average worker to move too far from his or her place of work until the last ten or fifteen years of the nineteenth century, with the exception of the limited services of the Workmen's Tramcars. Public transport was relatively expensive and did not travel much faster than walking pace. Its hours of operation did not match factory working hours. Passmore's study offers support for the closeness of home-work linkages until the mid-1860s. The evidence from the three firms reviewed above does seem to show that this pattern changed for at least clerical and managerial staff and probably skilled artisans. We might deduce as much from the growth of the western and north-western suburbs. No doubt public transport played its part in the breaking down of employment linkages. Though the evidence about the effects of municipally led changes in the tramway system after 1899 is ambiguous, this probably stems from the small sample size. Other factors could have been at work as well. For example, there were fewer jobs for clerks and managers. If they changed employer they would have had less likelihood of finding another position close to home than, say, a furnaceman. Even so, though the evidence from the three steel companies is not directly comparable with Passmore, it does offer a pointer to changing relationships between the location of homes and workplaces.

Although direct evidence about changes in journey-to-work modes among steelworkers is difficult to trace, it also seems rational to point to the coincidence in timing between the electrification and repricing of the tramway service, its extension, and the growth of the giant steel factories in Tinsley and Templeboro'. In particular, it is difficult to see how the East Hecla Works (1898), Edgar Allen's Imperial Steel Works (taken over in 1890 and extended in 1900), Firth's Tinsley Rolling Mills (1907-8) and Steel Peech and Tozer's Templeboro' Mills (1916-9) could have reached the size they did so far from the main residential centres without access by a cheap, rapid form of mass transport. Other relatively large factories also built on Fitzwilliam land on the Sheffield/ Rotherham boundary included the Sheffield Simplex motor car factory (c.1909), Flather's Standard Steel Works (1911) and the Templeboro' National Projectile Factory, built during World War I. The extension of the Sheffield and Rotherham tram systems to connect at Tinsley, and the availability of through services from Sheffield's eastern and western suburbs must surely have opened up a substantially greater labour market catchment area from which the thousands of workers in this largely industrial zone could be drawn. Although the East Hecla and Imperial Works were planned before 1899, contemporary maps show that it was only after the turn of the century that they reached their full extent.[86] The River Don Works also grew considerably in size after the study period.[87]

In summary, the eventual development of transport systems which could move many people locally at reasonable prices, reliably and quickly can be deduced not only to have enabled the extension of Sheffield's residential districts, but also its industrial suburbs after 1890.

[86] OS 1:2500, 1902, Sheet CCLXXXIX.13; Kelly's Directory Map of Sheffield, c.1930
[87] Ibid.

Table 8.1

Length of Journey to Work of Claimants in the Sheffield Flood Register, 1864[88]

Distance	Number of Workers	%
<0.25 mile	336	19.59
>0.25 mile	527	30.71
>0.50 mile	345	20.10
>0.75 mile	229	13.34
>1 mile	279	16.26

Table 8.2

Work Journeys of Industrial Employers, 1852 and 1872

	1852 %	1872 %
Lived at Works	52.65	41.09
<0.25 mile	16.00	11.01
>0.25 mile	10.29	9.56
>0.50 mile	6.12	10.00
>0.75 mile	4.98	7.61
>1 mile	9.96	20.72
Total numbers in sample	1,225	1,380

Table 8.3

Census Data for Domestic Coachmen and Grooms in Sheffield, 1851-71

Year	Domestic Coachmen in Sheffield
1851	11
1861	46
1871	55 (workers over 20 yrs. old only)

Year	Domestic Grooms in Sheffield
1851	21
1861	43
1871	45 (workers over 20 yrs. old only)

[88]Passmore, 1975, 120

Table 8.4

Employees in Non-Domestic Passenger Carriage in Sheffield

Year	Non-Domestic Coachmen, Guards, Post-Boys, Flymen & Cabmen
1841	69
1851	59
1861	168
1871	329 (over 20 yrs. old only)
1881	312
1891	1,322*
1901	1,023*

*Figure includes Grooms and Horsebreakers.

Table 8.5

Coach, Cab and Omnibus Owners and Omnibus Drivers in Sheffield

Year	Coach & Cab Owners	Both Categories Combined	Omnibus Owners, Drivers, Conductors
1841	5		0
1851	20		1
1861		13	
1871		41* (over 20 yrs. old only)	
1881		52*	
1891		74*	

* Figure includes Livery Stable Owners

This table gives a not altogether reliable picture of the increase in this sort of trade. For example, Vickers notes eight omnibus proprietors in 1862, operating sixteen routes, which would suggest somewhere between twenty and thirty employees in the bus trade - not allowing room for many Coach and Cab Owners or Livery Stable Owners in 1861 or 1871 - there must be confusion between census categories.

Table 8.6

Sheffield Cab Fares, 1850[89]

Midland Station to:

Assembly Rooms (Town Centre)	9d
Attercliffe Bridge	1/-
Broomhall	1/6d
Broomhill	2/3d
Ecclesall Church	3/3d
Endcliffe Crescent	2/9d
Eyre Street (Alsop Fields)	1/-

Table 8.7

Sheffield Tramways Company Traffic Receipts Book - An Analysis of Workmen's Car Journeys, 1876

From	To	Total Passenger Journeys (51 Days)	Average Number of Passengers per Journey	Fare
Morning Journeys				
Attercliffe	Sheffield	831	14.084	1.5d
		2052	34.779	1d
		2883	48.863	Both
Sheffield	Attercliffe	542	9.186	1.5d
		1828	30.983	1d
		2370	40.169	Both
Evening Journeys	-	-	-	-
Attercliffe	Sheffield	605	10.254	1.5d
		1733	29.373	1d
		2338	39.627	Both
Sheffield	Attercliffe	393	6.661	1.5d
		1611	27.305	1d
		2004	33.966	Both

[89]Rodger's, 1850, 20

Table 8.8

Tramway Usage in London and Sheffield, 1896-1902[90]
(Annual Number of Journeys per Head of Population)

	London	Sheffield
1896	113.3	16.6
1897	116.8	26.9
1898	118.9	29.0
1899	119.6	51.9
1900	126.3	91.4
1901	128.7	119.9
1902	136.0	137.1

Table 8.9

Growth in Number of Passengers on Sheffield Tramways, 1904-13[91]

Year	Number of Passengers (millions)
1904-5	63.95
1905-6	68.24
1906-7	73.97
1907-8	77.57
1908-9	76.36
1909-10	78.62
1910-11	84.50
1911-12	90.46
1912-13	96.33

[90] RC, London Traffic, XLI 1906, 127; G.S. Jones, Outcast London, 234; Sheffield Red Book, 1905; After T. Caulton c.1977
[91] The Tramway and Railway World, 11 Sept. 1913, 14

Table 8.10

Straight Line Distances from Residence to Workplace for Cocker Bros. Managers and Clerks, 1886-1935

	Nursery Street		Assume Those with Unknown Workplaces All Worked at Nursery Street	
	Number per Category	Percentage	Number per Category	Percentage
<0.5m	2	7.41	5	10.64
<1m	8	29.63	15	31.91
<1.5m	5	18.52	14	29.79
>1.5m	12	44.44	13	27.66
Total	27		47	

	Effingham Street		Assume Those with Unknown Workplaces All Worked at Nursery Street	
	Number per Category	Percentage	Number per Category	Percentage
<0.5m	10	10.00	10	21.28
<1m	6	6.00	10	21.28
<1.5m	23	23.00	8	17.02
>1.5m	61	61.00	19	40.43
Total	100		47	

Total Work Journeys for Known Places of Work

	No. per Category	Cumulative	Percentage of 127
<0.5 mile	12	12	9.45
<1 mile	14	26	11.02
<1.5 miles	28	54	22.05
>1.5 miles	73	127	57.48

Nine employees with unknown workplaces worked over 1.5 miles from either factory.

Table 8.11

Straight Line Distances from Residence to Workplace for Spear and Jackson Clerks and Managers, 1883-1906

	No. per Category	Cumulative	%
<0.5 mile	5	5	4.76
<1 mile	18	23	17.14
<1.5 miles	36	59	34.29
>1.5 miles	46	105	43.81

Table 8.12

Straight Line Distances from Residence to Workplace of Marsh Bros. Twist Drill Dept. Employees, 1900-6

	Number	%
<0.5 mile	2	8.33
<1 mile	9	37.50
<1.5 miles	6	25.00
>1.5 miles	7	29.16
Total	24	

Figure 8.1 (following page)

Sheffield Omnibus Routes in 1822

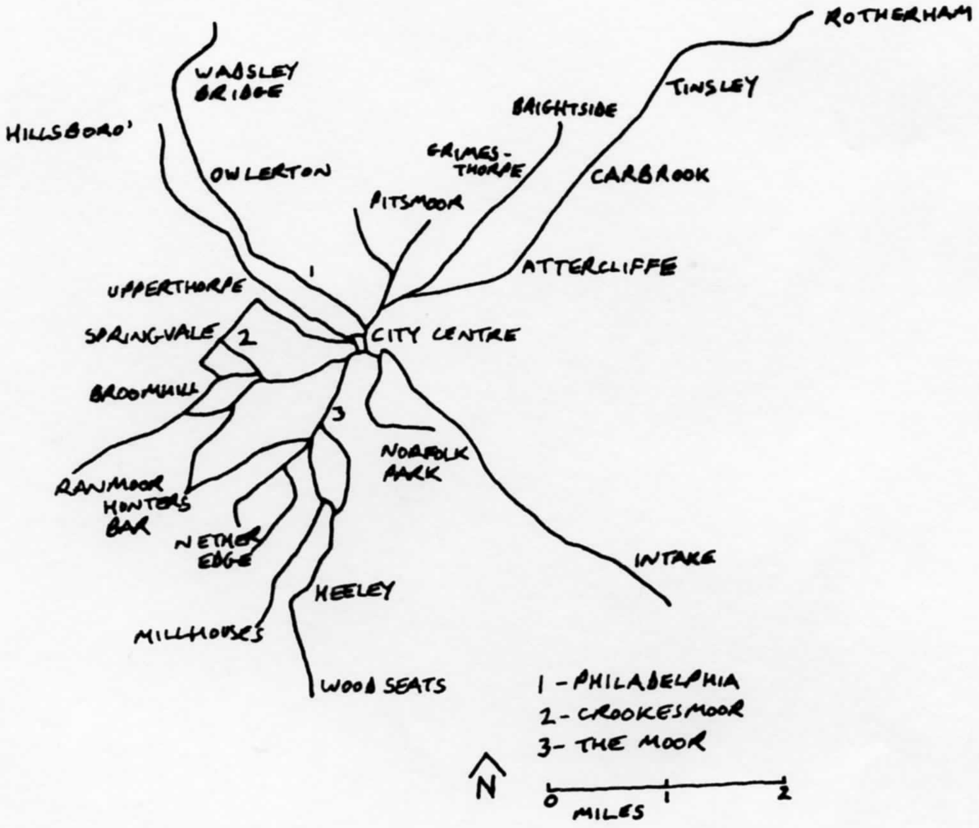

ROTHERHAM
WADSLEY BRIDGE
TINSLEY
BRIGHTSIDE
HILLSBORO'
GRIMES-THORPE
OWLERTON
CARBROOK
PITSMOOR
ATTERCLIFFE
1
UPPERTHORPE
SPRINGVALE
2
CITY CENTRE
BROOMHILL
3
NORFOLK PARK
RANMOOR
HUNTERS BAR
NETHER EDGE
INTAKE
HEELEY
MILLHOUSES
WOOD SEATS
1 - PHILADELPHIA
2 - CROOKESMOOR
3 - THE MOOR
N
0
1
2
MILES

Figure 8.2 (following page)

Sheffield's Tramway System, 1913

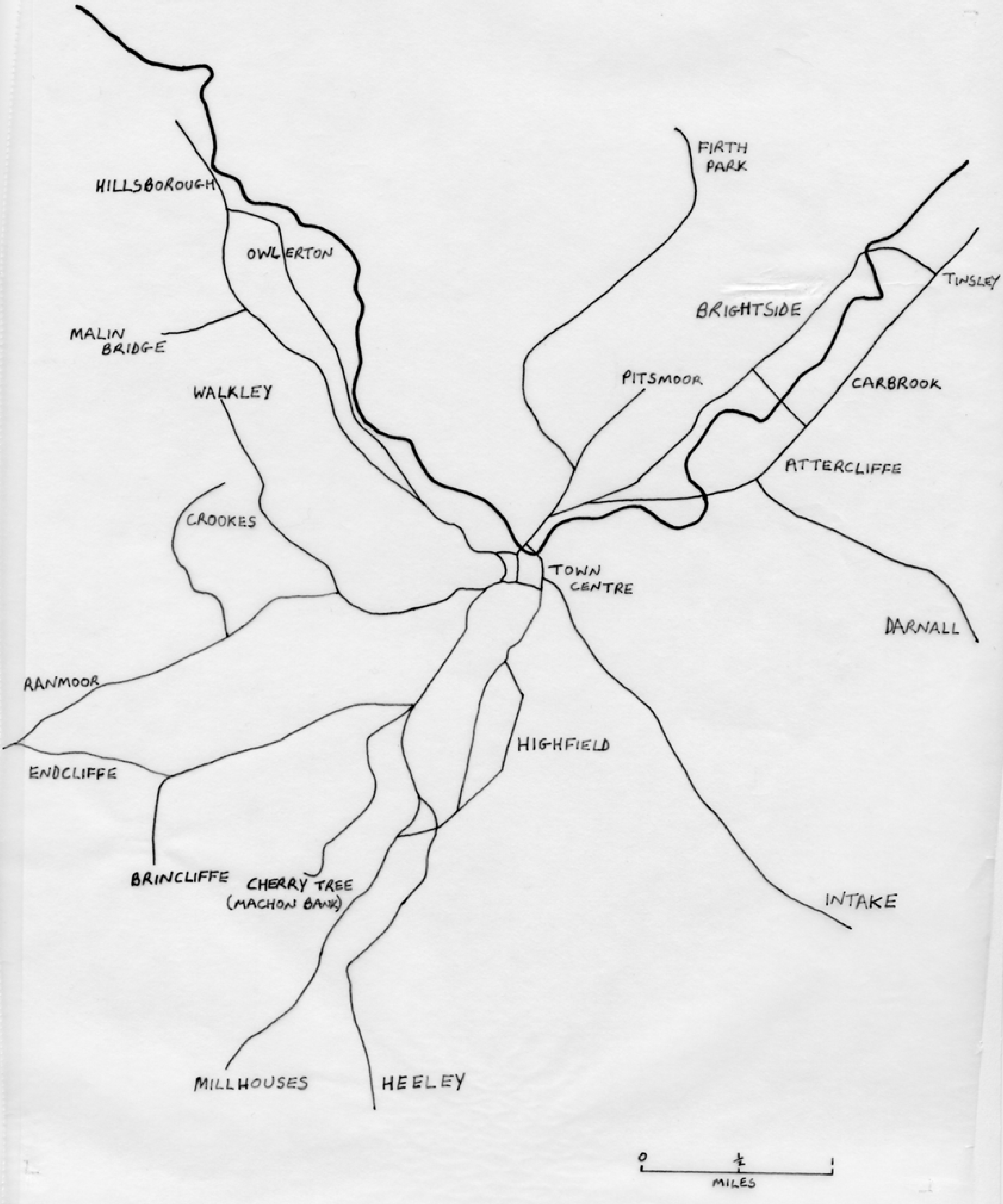

HILLSBOROUGH
OWLERTON
MALIN BRIDGE
WALKLEY
CROOKES
RANMOOR
ENDCLIFFE
BRINCLIFFE
CHERRY TREE
(MACHON BANK)
MILLHOUSES
HEELEY
HIGHFIELD
TOWN CENTRE
FIRTH PARK
PITSMOOR
BRIGHTSIDE
TINSLEY
CARBROOK
ATTERCLIFFE
DARNALL
INTAKE
0
½
1
MILES

Figure 8.3 (following page)

Locations of First Motor Vehicle Registrations in Sheffield, November 1903

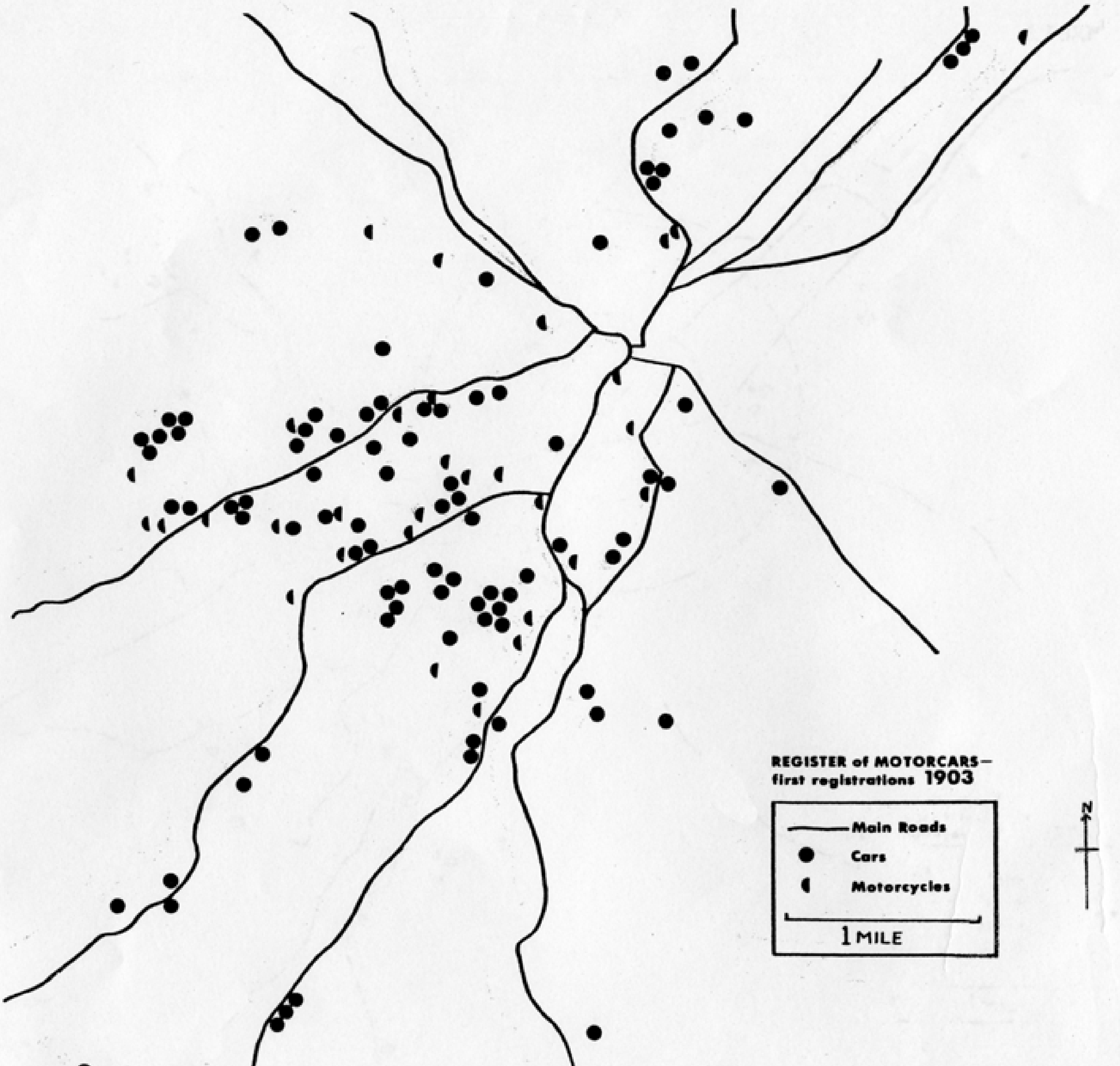

REGISTER of MOTORCARS—
first registrations 1903
Main Roads
Cars
Motorcycles
1 MILE
N

Figure 8.4 (following page)

Locations of Places of Residence of Cocker Bros. Employees (see Table 8.10)

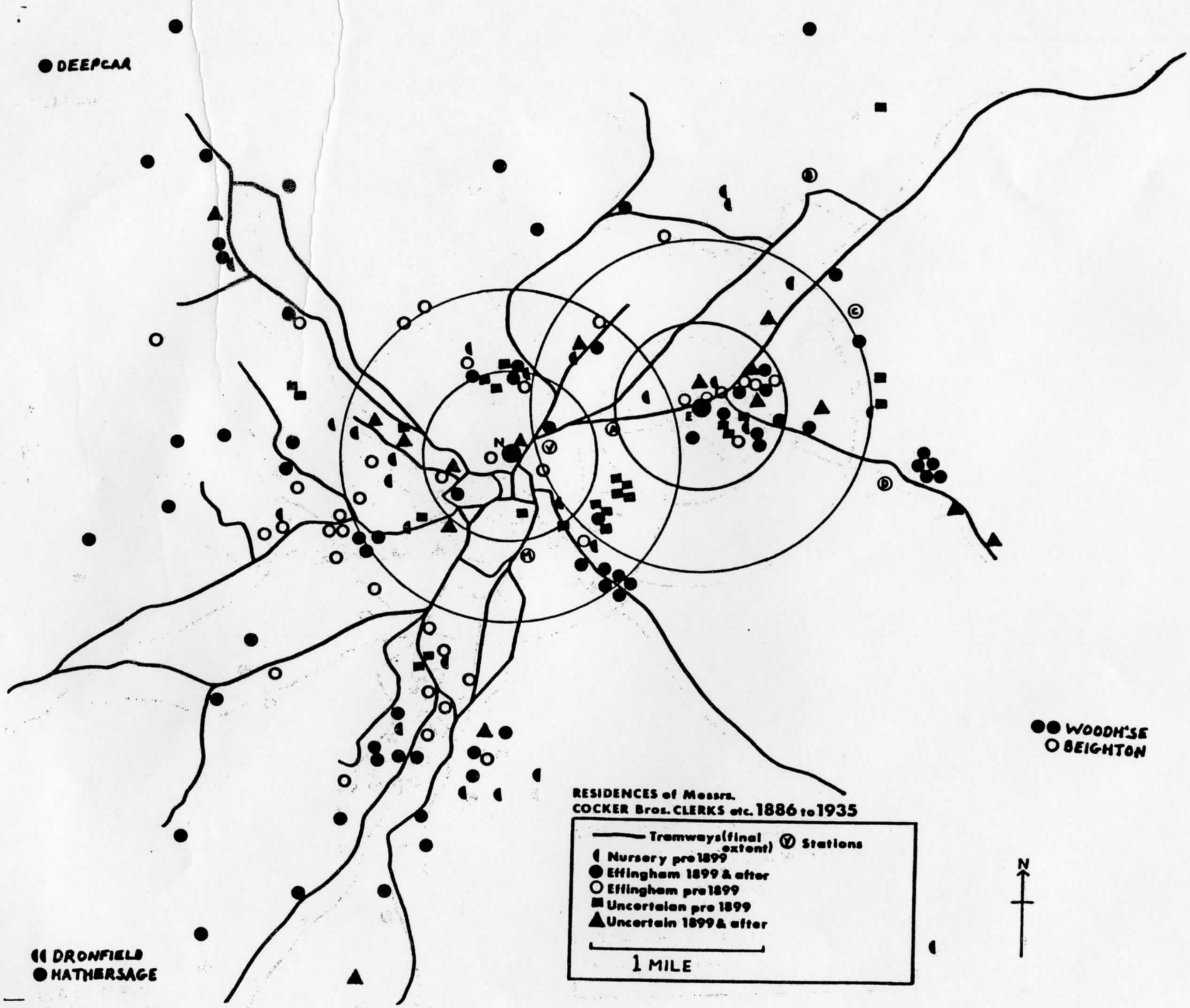

DEEPCAR
WOODH'SE
BEIGHTON
DRONFIELD
HATHERSAGE
RESIDENCES of Messrs.
COCKER Bros. CLERKS etc. 1886 to 1935
Tramways (final extent)
Stations
Nursery pre 1899
Effingham 1899 & after
Effingham pre 1899
Uncertaian pre 1899
Uncertain 1899 & after
1 MILE
N

Figure 8.5 (following page)

Locations of Places of Residence of
Spear & Jackson Employees (see Table 8.11)

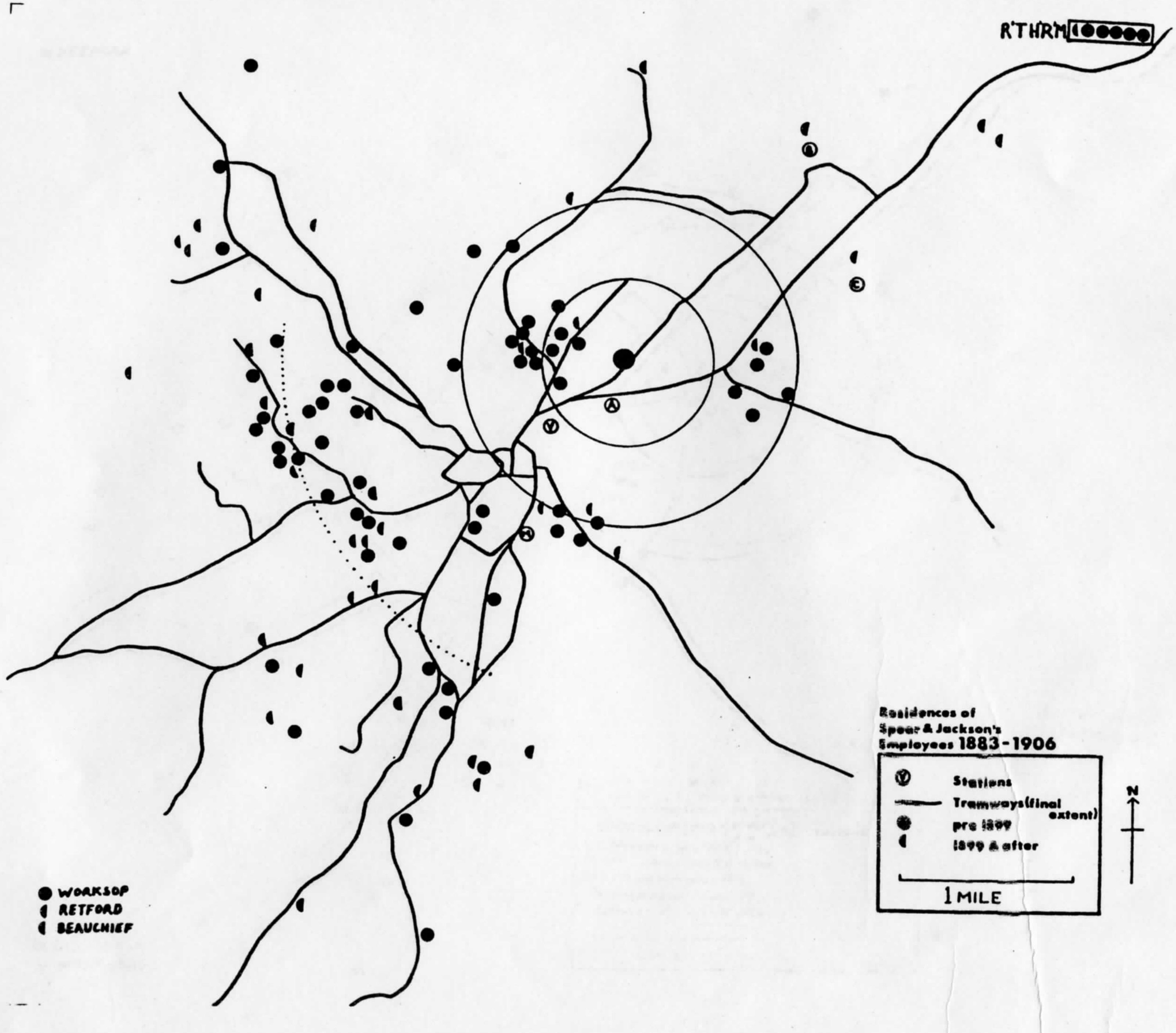
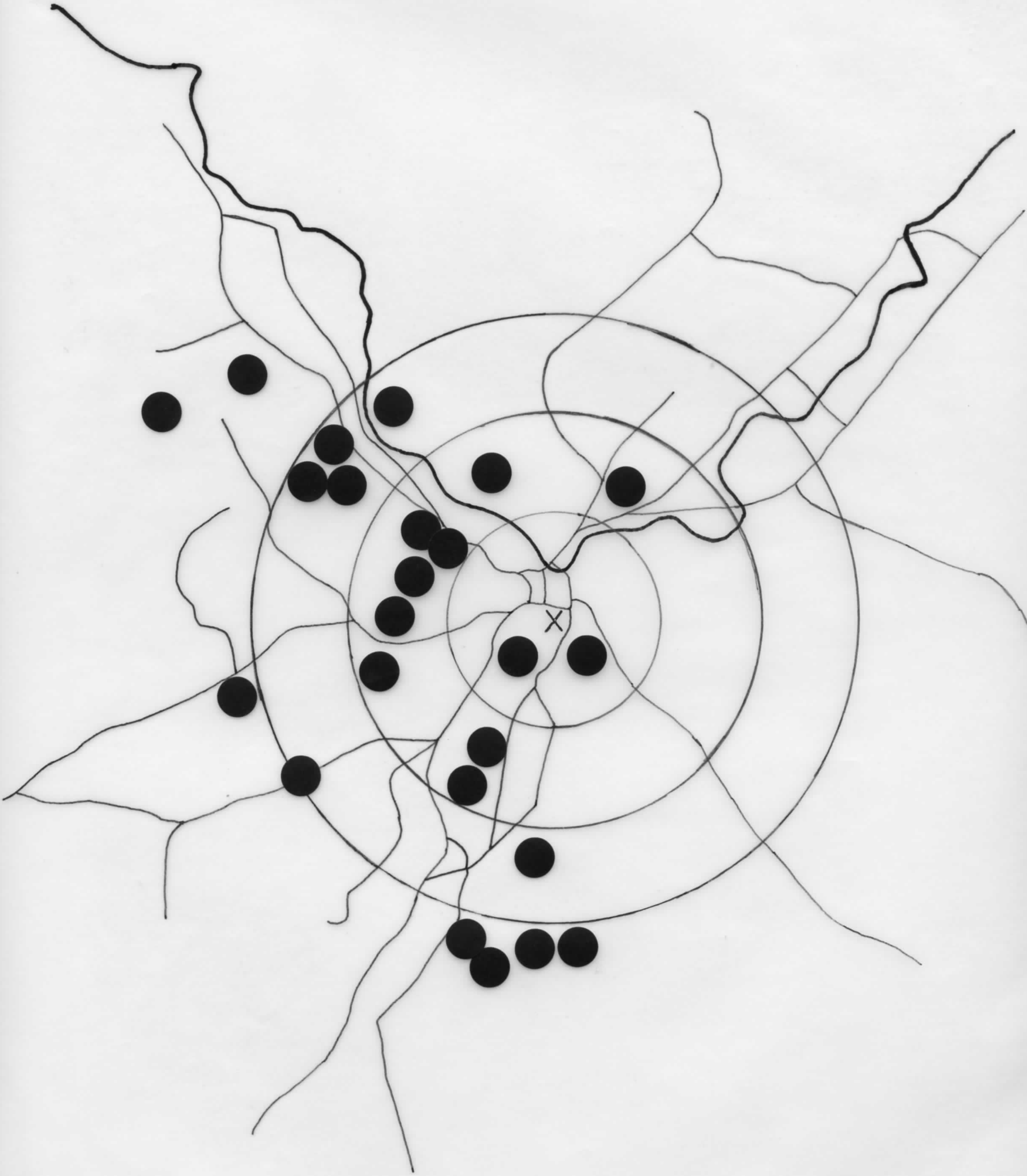

RTHRM
Residences of
Spear & Jackson's
Employees 1883-1906
Stations
Tramways (final extent)
pre 1899
1899 & after
1 MILE
N
WORKSOP
RETFORD
BEAUCHIEF

Figure 8.6 (following page)

Locations of Places of Residence of Marsh Bros. Employees (see Table 8.12)


X
0
½
1
1½
MILES

CHAPTER 9

LAND OWNERSHIP AND INDUSTRIAL LOCATION (1) - TENURE AND INDUSTRIAL DEVELOPMENT

As the scale of manufacturing grew, availability of large sites became more important as a factor in industrial location (see Chapter 6). This makes an understanding of the structure of land ownership and the land market essential. If there were factors restricting the supply of land, limiting its use or distorting its price structure, these could have had a bearing on where industry would locate.

Important questions include:

- on what terms and tenures was industrial land available?
- how did land availability and values vary over time and between different parts of Sheffield?
- did landowners discriminate between land uses when selling or leasing land, or favour particular scales of development?
- how did the rights of existing occupiers and neighbours affect availability of land for industry?
- was land reserved speculatively for particular classes of user, such as large steel companies?
- was there planning for future industrial uses in certain parts of the town?
- were purchasers able to speculate in land rather than erect buildings?
- how were the costs of common services and street works dealt with, and did they all fall on the purchaser, thus raising the initial capital cost of establishing new premises?
- did estate management practices restrict the freedom of operation of industrial premises?
- how were restrictions defined and imposed?

1. Sources of Information on the Sheffield Industrial Land Market

Assembling information about land ownership and dealing, including the extent of estates and the pattern of ownership is difficult because land deals were confidential private business transactions.[1] The West Riding Registry of Deeds, used by Caulton as a source of data, contained no information on land values or rentals. While it might have been possible laboriously to assemble a partial picture of Sheffield land ownership from data in the Registry, this would be of little help in understanding location decision making without knowing how much was paid for sites and whether land was sold for specific uses. The Register did not include plans before 1884, leases under 21 years were not registered, and plots were generally defined by reference to adjoining ownerships not by street. The availability of records from the Duke of Norfolk's Estate made a case study a more appropriate method of dealing with the topic.

2. How Works Were Used as Security to Help Raise Capital

By the mid nineteenth century, industrial property in Sheffield was an important element in the process of capitalisation and investment. In 1853, for example, the lease of the Park Iron Works was secured to one of the Patriotic Building Societies.[2] From the 1850s, Indentures of Leases to Building Societies are relatively common in the Duke of Norfolk's Agents' Letter Books. Although the Indentures are not usually specific as to use, most appear to relate to plots suitable for housing or small businesses.[3] Michael Joseph Ellison told the SCTH that many leasehold properties (presumably mostly houses) on the Norfolk Estate were mortgaged to Building Societies,[4] usually through the agency of local solicitors.[5] In Chapter 12, reference will be found to the importance of bank borrowing to an industrial relocation later in the century.

Even relatively small works could be used in a complex way as security for purchase of the property itself, or to raise funds for the business. A list of legal documents relating to Cocker Bros.' Nursery Street and Fitzalan Works was compiled when the documents were passed to their solicitors in 1908. The Nursery Street Works was held under two separate leases. The list records a succession of mortgages by assignment by a series of lessees. Although an

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[1]Kellett, 1969, 126
[2]ACM/LB/C/442
[3]E.g. Indenture dated 31 August 1855 for land in St. Mary's Road to the Sixth Patriotic Benefit Building Society; Indenture dated 15 June 1855 to the South Yorkshire Benefit Building Society ACM/LB/D/5 and 91
[4]SCTH, M. of E., PP1888XXII, Q.7806
[5]Aspinall, 1977, 18

equitable mortgage granted by Cocker Bros. in 1864 when they converted their under-lease into a head lease was clearly related to acquisition of the property, most of the mortgages were given at times which suggest the use of the property as security for loans to finance business. On the second Nursery Street estate and the Fitzalan Works, similar complicated mortgage histories demonstrate the importance of real property as security for business finance.[6]

Other evidence exists of the use of industrial properties as security. The bundles of title deeds deposited with Sheffield Archives by Aurora Holdings include assignments for mortgage security from the 1780s onwards, including substantial properties such as the Toledo Works.[7] The Dukes of Norfolk used commercial property as security in this way. In July 1864, the Duke discharged mortgages of £6,000 and £3,800 secured on the Sheffield Markets by payments to the mortgagees.[8]

Aspinall argues convincingly that in Sheffield, '... the supply of capital for house-building came from highly specific sources ... and was not diverted from other commercial enterprises or capital sent abroad'.[9] This is confirmed by Newton. When funds were raised through the banks, land and property were key forms of security. The Union Bank specialised in industrial and commercial lending.[10] The largest single group of companies borrowing from this bank between 1855-85 was steel and/or iron manufacturers (234 out of 595 firms, or 43.6% of the total; 148 or 24.9% were steel makers).[11] Of £1,074,710 lent to these 595 firms, £496,130 (46.2%) was secured using property or land, either by the direct deposit of deeds with the bank (29.2%) or by mortgage (17%). A futher £73,150 (6.8%) was secured by a combination of deposited deeds or mortgage with another form of collateral.[12] Mortgages were offered particularly to protect larger loans - around half of the applicants for sums between £8,000 and £65,000 proposed this form of security.[13] Given that the majority of the directors of the Union Bank were local manufacturers,[14] it is apparent that industrialists were knitted into a complex set of relationships between growth, the supply of land and the availability of capital to develop it and their businesses.

[6]List of Deeds and other legal documents supplied to the author by Cocker Bros, dated 29 May 1908 not catalogued separately by SYRO; copy in author's pssession
[7]SC Aurora 490-508
[8]ACM/LB/G/619-20
[9]Ibid., 17-9
[10]Ibid., 50
[11]Ibid., 88
[12]Ibid., 91
[13]Ibid., 96
[14]Ibid., 57

3. Who Owned Land in Sheffield?

The industrialist, then, was an important player in the markets for property and development capital. In competing for sites the entrepreneur faced complexities of land availability, ownership and tenure which would have acted to moderate freedom of choice of sites. In Sheffield, a number of estates controlled much of the land with possibilities for development. The Dukes of Norfolk's Sheffield Estate held large parts of the town centre and substantial areas to the north east and south east. The Dukes tended to grant 99 year leases.[15] The Earls Fitzwilliam also owned land in the area. Their Wentworth Woodhouse Estate included land east of the Norfolk Estate in Grimesthorpe and Tinsley[16] which became important for industrial expansion in the last 40 years of the nineteenth century - see Figure 9.1. The Earls' estates extended at least as far as the land on which were built Tinsley Locks on the Sheffield Canal.[17] Vickers built the River Don Works on Fitzwilliam land in Brightside in 1863[18]. The Earls owned Tinsley Road[19] and most of the parish of Tinsley itself.[20] The Fitzwilliams generally granted 200 year leases, but also sold freeholds.[21] Other major landowners included Lord Effingham (leases only),[22] and Sheldon's and Spooner's Trustees (500 year leases), Birley's Charity (land in Walkley let on 99 year leases) and the Shrewsbury Hospital Trustees (99 year leases).[23] Other important landowners granting 99 year leases included the cutler George Wostenholm, the Town Trustees and the Church Burgesses.[24] Earl Wharncliffe owned estates to the west of Sheffield.[25]

Freeholds were available in parts of the town. A solicitor gave evidence to the SCTH that around 25% of all land in the town was freehold, and the Corporation and others were prepared to sell freeholds. Nevertheless, freeholds were difficult to obtain.[26] This opinion was confirmed by the Mayor, who said that roughly a quarter of Sheffield was freehold, though all the 'old town' was leasehold.[27] Much of the freehold land lay in mainly residential areas such as Walkley and

[15]SCTH, M. of E., PP1886XII, Q.7707
[16]Ward, 1960
[17]PRO/RAIL 867/1
[18]Scott, 1962, 11
[19]ACM/LB/V/279
[20]White's Directory of Sheffield, 1902
[21]SCTH, MofE, PP1886XII, Q.1023
[22]Ibid.
[23]Ibid., QQ.3543-57
[24]SCTH, M. of E., 1888XXII, QQ.686-98
[25]Pawson and Brailsford, 1879, 315
[26]Ibid.
[27]Ibid., QQ.3668-70

Park Wood Springs where freehold land societies were active[28]. However, freehold land was to be had for industry in other parts of the town even late in the century. Particulars of Sale described 'The Albion Works Estate' as 'valuable Freehold Building Land' on Savile Street 'Near the Midland Railway Goods Station...'. T.W. Ward and Co. purchased the freehold at auction in 1897. The site area was 2,854 square yards - a reasonably substantial property.[29]

4. The Fitzwilliam Estate

Little evidence was found about the relationship between land ownership, the land market and industrial development except in relation to the Dukes of Norfolk's Estate, though the Fitzwilliams also sought to generate income from sources other than their traditional agricultural and coal mining activities. That they succeeded is shown by the increase in revenues from the 19,164 acres of their Wentworth Woodhouse Estate from £26,000 p.a. in 1801 through £73,794 in 1873 to £130,000 p.a. in 1901. Minerals still remained an important part of this latter figure at £74,000 p.a.,[30] but the Earls also exploited their land in Brightside and Tinsley for urban and industrial development from the 1860s.

The Fitzwilliam Estate was, however, considered by the solicitor referred to above to be far less active in developing its urban interests in the period up to 1888 than the Norfolk Estate. He had never seen a Fitzwilliam lease and told the SCTH that the Dukes of Norfolk let hundreds of leases for every one granted in Wentworth Woodhouse property.[31] This seems predictable. In the main, urban development proceeded outwards from the Wicker along the Lower Don Valley towards Tinsley. Fitzwilliam land stood furthest from the town centre and was still being developed as the 1890s drew to a close. Unfortunately no information on the policy or detail of the development of the urban estate was found in the Wentworth Woodhouse Muniments in Sheffield Archives.

5. The Norfolk Estate

i. Data on the Development of the Norfolk Estate - Letter Books, Ledgers and Database

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[28]SCTH, M. of E., PP1886XII, Q.3527 & see Chapter 5
[29]Particulars of Sale by Auction, 1 June, 1897, copy supplied by Ward's and in possession of author
[30]Ward, 1960
[31]SCTH, M. of E., PP1888 XXII, QQ.1185-91

A substantial body of correspondence does exist for the Norfolk Estate in copy letter books kept by the Dukes' Agents from 3 December 1841 until the end of the study period around 1900. Although one sided (incoming correspondence has not survived), much knowledge of estate management practice and the terms and prices of lettings and offers to let can be gained from the outgoing letters.

The Norfolk Agents' Letter Books contain information about the terms on which leases were offered and granted, and about some sales of freeholds. Before 1861 there is no consistent listing of transactions in the Letter Books. However, from the commencement of the books on 3rd December 1841, a number of letters give details of rents due, propose the terms for leases to be granted, or record the grant of leases. In addition, the Sheffield Archives contain three ledgers covering the years 1825-50 (Book A[32]), 1857-60 (Book B[33]) and 1861-71 (Book C[34]). They contain records of applications for building land. 1,975 applications are recorded. Unfortunately not all are legible or complete. From 1825 to April 1861, records which included the year of the transaction, a reasonably detailed location,[35] the price charged for the lease and (where possible) the site area, were incorporated by the author into a computerised database. The database is listed as Appendix 11. The lists of applications do not seem to be a complete catalogue of land transactions. Although a small number of ledger applications duplicate cases in the Letter Books, there were many of the latter which were not reflected in the ledgers. Where there was no duplication, data from the Letter Books from 1841-61 were also computerised. It was decided to include applications which did not proceed as well as those whch were completed by the granting of a lease. This was done because the books record the price at which the Estate was willing to strike deals. The evidence suggests that there was little negotiation of prices once the Agents had noted the agreed sum, though there were probably unrecorded oral negotiations. A case in point is a lease to Firth's in Savile Street East in 1885. This was offered at 6d per yard on 24th March 1885.[36] On 27th March the Duke's Agent wrote (no doubt in response to a complaint from Firth's) to say the price was reasonable and would not be reduced as they could let to several others at that rent.[37]

Register A contains many incomplete and illegible entries - it appears to be a series of pocket notebooks rebound into a single volume. Books B and C are

[32]ACM/S384
[33]ACM/S612
[34]ACM/S613
[35]In Book A the street name was often not given
[36]ACM/LB/R/359
[37]ACM/LB/R/364

more systematic and include a plan showing the site of each lease,[38] though they too contain some pages which give only the name and address of the applicant and no other details. The data from these ledgers were only used up to the end of April, 1861. From that date a more convenient and consistent source was available from the Letter Books.

On 3 May, 1861, the Agents began to list bundles of leases which were being sent to London solicitors Few and Co. 'to be executed by the Trustees of the Duke of Norfolk's Sheffield Estates'.[39] Duke Henry Fitzalan was a minor, which would explain the commencement of this practice at that time. The list sent on 3 May 1861 is given as 'List No.1'. Although subsequent lists are not numbered, the practice of sending off bundles in this way continued until Letter Book AE, when the lists cease. The final list found was dated 11 September 1899. From 1861-99, other letters also record transactions, though far fewer than in earlier years. Where these were not reflected in the lists of leases (for example freehold sales to railway companies, or some short leases) they were also recorded.

152 records from the Letter Books predate 5 May 1861 (of which duplication of the Applications Registers accounts for around ten records), with 867 thereafter. The post-1861 lists of leases usually include the date, the name of the lessee, the township where the property is situated, the name of the street,[40] the area of land leased,[41] the ground rent per annum,[42] and the length of lease. One or two do not contain all these data.[43] There is a small number of lists of leases which do not contain enough information to be useful (probably no more than 10-20 leases). There are no lists of leases before 1861 and the applications, letters of offer and confirmation of transactions cannot be taken as a complete record - we know that, at least for some residential leases, building agreements were no more than a verbal arrangement.[44] There are also some tantalising letters which indicate that deals were being done but do not give enough data.[45] In addition, there are three missing Letter Books covering all or part of the years 1872-74, 1879-80 and 1883-84 and Letter Book M (1875-76) is largely illegible due to deterioration of the copy letters. The only choice was to note and analyse all suitable data, while bearing these shortcomings in mind when interpreting the

[38] Though frequently with insufficient reference points to fix the location in the street
[39] ACM/LB/F/135
[40] But not the precise location of the property in the street except in a few cases of corner properties where the lists identify both streets fronted
[41] Generally in square yards but sometimes in acres, roods and perches for larger properties
[42] Either per square yard or for the whole property
[43] E.g. ACM/LB/F/139
[44] Offer, 1973, 342
[45] E.g.: ACM/LB/P/518; V/298

results. Entries to the database were only accepted when there was sufficient information to identify the street, together with a sale price or ground rent and a date for the transaction or offer. Where available, the site area was also noted. Altogether 1,019 separate offers and transactions which met the criteria for inclusion in the database were found in the Letter Books. The criteria used for selection of records for the database were designed to allow analyses to be carried out on levels of ground rents in different parts of Sheffield over time, and the distribution of plot sizes to assess, for example, whether industrial lessees such as Firth's and Brown's were leasing plots larger than average or whether large plots were commonly leased by most builders.

From 5 May, 1861, 803 records are taken from the lists of leases and thus represent definite transactions. That is 92.6% of the post 1861 data. The proportion of offers to transactions in the remaining records is much more difficult to determine but the overall database of 2,146 records is sufficiently representative to inform a discussion about ground rental values. Given the scarcity of such data, it must be considered a significant set of records. The letters also contain useful information on estate management practices, terms and conditions of leases and estate planning which inform this and the next two chapters.

ii. The Dukes

To set this information in context, some background knowledge of the estate, its owners and managers is required.

The Dukes of Norfolk were the highest ranking non-Royal peers, and hereditary Earls Marshal of England. There were five during the study period:[46]

- Charles Howard, 11th Duke (1746-1815)

  Duke 31 August 1786 - 16 December 1815.
  A Protestant Whig (conforming to enable him to hold public office) noted for his conviviality. Lived in splendour, expending vast sums on restoring the family's principal seat, Arundel Castle, and extending his collection of paintings. Frequently drunk (his nickname was 'the drunken Duke'), of dubious personal habits and sometime intimate companion of the Prince Regent.

[46] Dictionary of National Biography, Vols.10 and 23, Oxford, 1908 and 1927; Foss, 1986, Ch. 1

- Bernard Edward Howard, 12th Duke (1765-1842)

  Duke 16 December 1815 - 16 March 1842.
  Nephew of the above and a Catholic. Devoted his energies to repeal of the penal laws, and after the 1829 Emancipation Act to promoting the interests of Catholics and improving Arundel town.

- Henry Charles Fitzalan Howard, 13th Duke (1791-1856)

  Duke 16 March 1842 - 18 February 1856.
  An MP, and Treasurer to the Queen's Household 1837-1841. Married the daughter of the 1st Duke of Sutherland, the richest man in England. Pompous and unsympathetic to the poor, advising them to eat curry if they could not afford bread, because of its power to warm the stomach.

- Henry Glanville Fitzalan Howard, 14th Duke (1815-1860)

  Duke 18 February 1856 - 25 November 1860.
  An MP, noted for his charitable activities. Regarded as a saintly man; devoted most of his income to building Catholic almshouses, hospitals, schools, convents and Brompton Little Oratory. A friend of cardinal Newman. Created Lord Howard of Glossop by Gladstone as a reward for political services.

- Henry Fitzalan Howard, 15th Duke (1847-1917)

  Duke 25 November 1860 - 11 February 1917.
  Aged 13 on succeeding to the title. Sent abroad to travel at the age of 17. Improved Arundel Castle and Derwent Hall, Derbys. Very active in public affairs in later life, using his position to strengthen the interests of Catholicism. Main link between Government and Vatican, especially on the Ireland Question. Postmaster General 1895. Mayor of Sheffield 1895 and first Lord Mayor 1896. First Lord Mayor of Westminster. Donated 160 acres of land to the City of Sheffield as pleasure grounds. Co-founder and first Chancellor of Sheffield University 1904. Remembered as 'a generous and far sighted landlord'.

iii. The Land Agents

For the first years of the nineteenth century, the Dukes' Sheffield estates were managed by Vincent Eyre,[47] who was involved until at least December 1812 as a Trustee of the Duke.[48] A Mr. Houseman was land agent in 1819. On his death that year, four years after the succession of Duke Bernard Edward, Michael Ellison was brought from another of the Norfolk estates to take over the position. Ellison continued as land agent for 41 years until 1860 when he retired due to ill health.[49] From 1834 he was assisted by his son, Michael Joseph.[50] Olsen suggests that Michael Ellison left superintendence of leasehold development to his clerk and steward Marcus Smith.[51] Smith was certainly responsible for most of the correspondence in the Land Agents' Letter Books until 1872, although this does not necessarily mean that his superior was not involved in running the estate, at least where more important matters were involved. A letter in June 1848 shows that Ellison not Smith decided the rent for a lease to Chas. Cammell and Co.[52] and other examples of his involvement exist.[53]

After Ellison Senior's retirement, his son took on his post.[54] Thus, although the chief land agent and the Duke were both succeeded in the same year, continuity of management was ensured through two experienced agents - Ellison Junior and Smith. An Income Tax Return for 1863-4 shows the employees in the office to have been:

Edmund Winder	Surveying Clerk
Alfred Scargill	Surveying Clerk
E. Saville Foster	Cashier
H. Turner Simpson	Clerk
Joseph Bedford	Clerk
Joseph Oates Jr.	Clerk of the Market

The Return was signed by Marcus Smith.[55]

For the eleven years to 1872, Ellison and Smith were joint agents. Thereafter Ellison was sole agent.[56] He was assisted by Edmund Winder, who saw out the century in the Estate Office. Winder was the signatory of most letters from 1875 until the end of the study period. Ellison Junior retained an active role, however.

[47] Ward, 1971, 71
[48] List of Deeds supplied to the author by Cocker Bros., copy in the author's possession
[49] Anon, 1861
[50] SCTH, M. of E., PP1888 XXII, Q.7695
[51] Olsen, 1973, 338
[52] ACM/LB/B/91
[53] E.g. ACM/LB/D/206; ACM/LB/D/964
[54] Ibid.
[55] ACM/LB/G/214
[56] Ibid., Q.7696

Correspondence about railway proposals often involved him[57] and other letters confirm he was consulted about leases and breaches of covenant.[58]

Most of the Dukes took little interest in the management of their Sheffield estates. Ellison Senior's obituary recorded that Duke Charles 'appears to have cared nothing for improving the ducal property', and Ellison set about reforming the management of the estate 'with the concurrence of his noble employer [the new Duke Bernard] who contented himself with sanctioning general rules of policy, leaving his agent to work them out'.[59] From what little correspondence exists between the agents and the Dukes in the Letter Books, this situation does not seem to have changed much after the death of Duke Bernard.

The majority of letters to the Dukes simply cover requests for execution of leases.[60] There are reports on the operation of the estate's collieries, showing that coal remained an important source of money even after the growth in income from urban development. Other letters are generally about the town's Volunteers or charities. Certain key policy decisions obviously did require ducal involvement. For example, rebuilding of the Sheffield markets was being planned in the 1860s but could not be put into effect until Duke Henry Fitzalan reached his majority.[61] He was more interested in the operation of the estate than his predecessors - for example Edmund Winder wrote to him about rights of way to be granted in a lease.[62] Detailed instructions were sought from the Duke about widening a bridge in 1871.[63] However, estate management policy was usually discussed at meetings, as when Smith asked to explain something to the Duke personally in January 1869,[64] or when he sought an opportunity to obtain orders for 'the extension of the Silkstone Bed of Coal and other matters' before the Duke's departure for the Continent in July 1871.[65] The only matter of policy raised in correspondence with the Dukes uncovered in a thorough search was in a letter dated 14 October 1871 about the Artisans, Labourers and General Dwellings Company, which had requested land to build houses for working people. Smith commented that it was advantageous for noblemen to support schemes for cheap housing in country places but that:

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[57]E.g. ACM/LB/P/328
[58]E.g. ACM/LB/P/734; ACM/LB/P/21; ACM/LB/R/89
[59]Anon, 1861
[60]For one example of many see ACM/LB/E/9 - 27 Feb. 1858
[61]Pawson and Brailsford, 1879, 142
[62]ACM/LB/J/329
[63]ACM/LB/K/200
[64]ACM/LB/J/176
[65]ACM/LB/K/181

> I cannot conceive it will be to your Grace's pecuniary interest to give encouragement to such a Society ... in Sheffield ... where your Grace is possessor of so large an Estate on which the dwellings of Artisans and others have been and will be erected. I regard the project as one of those schemes (so rife at the present time) for serving the few under the pretence of benefiting the many.[66]

It was the Agent's duty to advise on the protection of his master's pecuniary interests but the letter also reflects a consistency of policy which was expressed publicly by Ellison Junior before the SCTH, when he condemned freehold land societies because so many investors had lost money when societies collapsed.[67] He maintained that 'artisans and members of the working classes' could and did take leases of small parcels of land from the Duke and that Building Societies would take mortgages of leases to assist them. The majority of leases of cottage property were held by such people.[68] Unfortunately there is no similar explicit discussion of industrial development policy but if this example is anything to go by, the agent's advice does seem to have been heeded on matters of policy.

All this suggests that although there were five different Dukes during the study period, most of whom had considerable interests outside Sheffield, the organisation and relationship of the Dukes' stewards led to the development and implementation of consistent policies and practices for the management of the Sheffield estates from 1819 until 1900. There does appear to be a common approach to development throughout this period, with changes in practice and policy taking place incrementally, often in reaction to external stimuli such as the growth of the railways, or legislative and political pressures.

iv. <u>The Estate</u>

The Howard family inherited its lands around Sheffield from the 7th Earl of Shrewsbury, whose heir married the Earl of Arundel and Surrey in 1606. The estates were important because they restored the wealth lost when the 4th Duke of Norfolk was executed by Elizabeth I and the dukedom was temporarily attainted. According to the 1873 Commissioners on Land Holdings the Norfolks owned 19,440 acres in the West Riding,[69] of which about 12,000 lay in and around Sheffield.[70] There was, however, lack of knowledge or misunderstanding among even informed contemporaries about the precise amount and location of

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[66]ACM/LB/K/352
[67]SCTH, M. of E., PP1888XXII, QQ.7799 et. seq.
[68]Ibid., QQ.7706 & 7806
[69]Ward, 1960
[70]Marshall, 1993, 18

land owned by the Estate. A local lawyer was asked by the SCTH to estimate the proportion of the town covered by the Norfolk Estate. He replied that he 'should hardly like to hazard an opinion ... but the bulk of two districts is certainly covered by the Norfolk estate, that is the east and north end'.[71] Alderman Clegg, a solicitor who was then Mayor of Sheffield, and a critic of Norfolk estate management[72] also ventured an opinion:

> I am informed, and I believe it to be true, that on both sides it extends to something like five miles on that and the other railway ...
>
> Q. Taking both sides together? - Taking both sides; two and a half on each ... [73]

Michael Joseph Ellison had to correct this:

> ...the Duke of Norfolk's land does not and did not extend to and along past Brightside but only so far as Grimesthorpe Lane, nearly half a mile short of Brightside. The frontage of this railway belonging to the Duke extends to about one mile and one eighth on each side, of which about one sixth is under lease to the railway company.[74]

The distribution of holdings is shown on an undated estate plan.[75] Figure 9.2 is a copy coloured by the author and photo reduced. The plan does not bear a scale. Overlaying it on other maps suggests it is close to 2.5" to the mile. The plan shows the line of the 'intended Canal' south of the River Don and refers to the 'Late' Duke Charles. This suggests a date between 1816[76] and 1819 when the canal opened. Perhaps it was drawn to assist Ellison on his appointment in 1819.

From the plan, and other evidence, the Norfolk Estate fell into four broad categories at this time:

i. Urban land developed by 1820. Although the plan does not show the extent of the estate within the existing town, we know that the Dukes were active in estate development in the town centre and Alsop Fields.[77] The Duke granted leases on land in Nursery Street, north west of the Wicker next to the River Don in 1801 and 1802, later to become Cocker Bros.

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[71] SCTH, M. of E., PP1888XXII, Q.850
[72] Cannadine, 1980, 50
[73] Ibid., QQ.3490-92
[74] Ibid., Q.7708
[75] ACM She 156
[76] Duke Charles having died in December 1815
[77] See Chapter 5 and ACM/LB/A/215

works.[78] Leases are also listed in Lambert Street, Scotland Street, Pea Croft and White Croft to the west of the town centre.[79] The town centre estate also included premises.[80] Examples also occur of the assignment of leases for existing buildings in the built up area of the Park, where development began in the 1790s. Figure 9.3 shows the extent of the development of Alsop Fields and the Park by 1823[81]; unfortunately it is much more difficult to piece together the extent of the town centre freeholds.

ii. Land in the Don Valley to the north; the Lower Park (near the canal basin); and west of the River Sheaf south of the town. This land would become the focus for urban development during the nineteenth century.

iii. The remainder of the Park and Manor to the east of the Sheaf and south east of the town. This remained largely agricultural. In 1881 Ellison Junior told the SCTH that only 200 out of 2,461 acres in the Park were under leases, with 50 or 60 acres reserved as public pleasure grounds, 12-14 acres for land around the Duke's own residence and the majority of the land farmed on yearly tenancies.[82]

iv. Outlying rural land in places such as Ecclesfield, Treeton and Handsworth. Some of this land was exploited for minerals and building but never achieved the status of more expensive and densely developed urban land.

The plan is consistent with the location of leases and other disposals recorded in the Agents' Letter Books, and may be taken to be an accurate representation of the estate in the early part of the century. There is little evidence from the Letter Books of any serious attempt to extend the Dukes' holdings between the 1840s and 1900. A marginal note to a letter detailing ground rents payable by the MSLR in Effingham Street and on the canal bank indicates that some of the land in question was purchased from the Shuttleworth family in 1850.[83] In 1850, eight acres of land and a grinding wheel were purchased freehold at Wadsley Forge and a 63 year lease was then granted on the property.[84] In the same year

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[78]List of Deeds and other legal documents supplied to the author by Cocker Bros., dated 29th May 1908
[79]ACM/LB/A/225 and 231
[80]ACM/LB/P/737 & P/607
[81]Based on Leather's plan of Sheffield, 1823
[82]SCTH, M.ofE., PP1886XII, QQ.7716-18
[83]ACM/LB/B/642
[84]ACM/LB/B/329

the freehold of Rivelin Bridge Wheel was also bought for £220-00.[85] In 1863 the Agents offered to buy land to allow a main road in Brightside to be extended.[86] Some time between 1878 and 1882, land was purchased from the Gas Company in central Sheffield to allow the markets to be enlarged.[87] As there are no other signs of purchases it seems safe to assume that the Dukes concentrated mainly on the development of their estate rather than its extension.

The Norfolk Estate had, then, a monopoly of land ownership adjacent to the canal and the S&R close to the town centre. The Dukes also owned most of the land in central Sheffield and Brightside over which the Chesterfield Extension of the MR passed. Their holdings on the line of the MSLR, though less extensive, were strategically placed. They owned a large proportion of the level river valleys of the Lower Don and Sheaf, though Norfolk land above Lady's Bridge in the Upper Don Valley was scarcer. It was to the Duke of Norfolk or the Earl Fitzwilliam that anyone wanting a large, relatively level site with canal or rail access would have to go. Those seeking land close to the main goods stations, or (before the advent of working mens' trams) with easy access to a large workforce and the central business district would be compelled to do business with the Duke.

The evidence of the land law reformers before the SCTH confirms this. Alderman Clegg, while conceding that industrial lessees had entered into their leases with their eyes open,[88] pointed out that:

> They practically had no alternative. They must go there because there was nowhere else except at a very enormous cost for carriage and carting and so forth, which could not have been done in the case of, say, Messrs. Brown and Co. the large armour plate makers and so forth. They could not possibly go anywhere else.[89]

Another solicitor, talking of the extent of the great works on Norfolk land, described the Duke's position as monopolistic.[90]

So, although the Dukes of Norfolk did not enjoy a monopoly of the whole Sheffield land market as some of their contemporaries believed, they certainly controlled most of the areas of greatest interest to this study. If the Norfolk

[85]ACM/LB/B/497
[86]ACM/LB/G/10
[87]SCTH, M.ofE., PP1886XII, QQ.7703-4
[88]Ibid., Q.3487
[89]Ibid., Q.3488
[90]Ibid., Q.992

Estate was in such a strong position to be the major supplier of industrial land at least in the middle years of the nineteenth century, how was this position exploited?

In the succeeding sections of this and the next two chapters we will examine:

- the tenures on which land was made available for development;
- the degree of landlord's control exercised by the Estate;
- the process by which large steel companies came to occupy and then own substantial production sites;
- the release of land to the market;
- the extent to which the Estate planned for industrial development;
- how obstacles to development were removed and whether the Estate actively promoted development;
- the relationship between the Estate and the railway companies insofar as it affected development;
- land values over time for those parts of the Estate which were disposed of during the study period.

6. Farmland into Townland

Most of the land in the Lower Don Valley developed for urban land uses from the third decade of the nineteenth century was productive agricultural land when it began to be taken for development. The same applies to land in the Highfield area, Neepsend and much of the Park. We know this from the Agent's evidence to the SCTH,[91] from the fact that industrial developers had to pay compensation for loss of crops they disturbed during building operations, and from other sources.[92]

A landlord seeking to redevelop an agricultural estate would have been severely hampered if it were necessary to obtain possession of farmland held under lease.

[91] Ibid., Q.7708
[92] E.g. Blackman, 1963

This problem did not arise on the Norfolk Estate in Sheffield, because its agricultural tenancies seem to have been capable of almost instant termination. They presented little or no obstacle to the transfer of land to new lessees who wanted to carry out development.

Usually it was the Estate which gave the tenant notice to relinquish land for building. A letter would be sent requiring the tenant to surrender their land 'as speedily as possible' and advising them that they would be paid a 'Tenant Right' in compensation.[93]

In many cases, the loss of land would have been a serious blow to the holding. A farm at Hall Carr Place was almost halved in size when 1,860 sq.yds. were taken for development.[94] Often, whole farms and smallholdings disappeared. Of course, the effects were not always so drastic. Even after Firth's had removed over four acres from his farm adjoining the S&R Railway in 1854,[95] Joseph Ibbotson was still paying agricultural rents on 39 acres,[96] though this land too was redeveloped over the next twenty years.
The fact that land had been allocated for development did not mean that eviction of the farming tenant always followed immediately. Land might be reserved by industrialists at agricultural rents until needed for factory space. It might then go on being cultivated until its new owner called for it.[97]

Paying the Tenant Right was an obligation of the new lessee. All recorded draft leases and terms included the requirement to pay the Tenant Right direct to the former tenant. So, although there was no legal obstruction to removing agricultural tenants, and the Estate procured their removal, there was a capital cost which would have added to the initial outlay of setting up a works. The valuation of Tenant Right could be quite variable. It depended to a degree on the state of the crops on the land affected.[98] The first of Firth's leases to appear in the Letter Books in February 1850 involved a payment of £8.0s.0d. for a site of 1a 3r 0p - about 0.2d per sq.yd. The next lease, in July 1851, included a total

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[93]E.g. ACM/LB/B/370, 374 & 648; other examples of such correspondence include ACM/LB/B/381, 30-5-1850; ACM/LB/D/62, 1 Aug. 1855; and letters in Letter Book A securing land for the Gas Company and the ill fated Cotton Mill
[94]ACM/LB/C/528
[95]ACM/LB/B/308 & 671
[96]ACM/LB/D/19
[97] In July 1854 John Brown was asked to explain why Brown's were preventing a tenant from cultivating land when the company had yet to begin developing it - ACM/LB/C/22 Mar. 1854 & 679
[98]E.g. ACM/LB/C/209

Tenant Right of £42.7s.9d for a site of 2a 2r 18p, which comes out at around 0.8d per sq.yd.[99]

The additional valuation for disturbance of crops could therefore bump up the total Tenant Right quite considerably. In this instance, the Tenant Right represented about 19% of fixed expenses of £222.16s.9d. demanded of the tenant by the Estate, and approximately 15.5% of the total initial outlay including the first instalment of the ground rent.[100] As such, it was an important consideration in land costs, even though it was probably a relatively small part of the overall cost of building and equipping a works. Similar proportions were paid by other lessees, with slightly higher figures for summer valuations suggesting seasonal variations in the value of crops.[101]

Compensation would also be given for loss of other property. Messrs. Brookes had to pay a tenant £25.0s.0d. to compensate for the loss of a house.[102] Stephenson Blake had to give £20.0s.0d. because they took the site of a kiln. The Estate may have been sanguine about the displacement of its agricultural tenants, but it did offer them limited protection in certain circumstances. When Messrs. Brookes were granted their lease on land next to Cammell's factory, they were obliged to allow the previous inhabitants to occupy their house on the site for a further two years. Aid was also at hand from Marcus Smith for the erstwhile tenant of the site of Firth's Norfolk Works. In August 1851, Smith wrote to Firth's[103] to reprimand them for not paying the Tenant Right following the grant of the lease.[104] Payment was delayed and a further debt to a sub-tenant was discovered.[105] Smith pursued the matter with dogged determination until he achieved full and final settlement for the tenants in July 1852.[106]

The Tenant Right, then, was taken as seriously as financial obligations to the Estate itself, but the Estate had first call on any monies paid by lessees. It

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[99]This sum was broken down as:

- Land 2a 2r 18p @ £8 =	£20.18s.0d.
- Land affected by works 10 yds wide x 36	£ 1.16s.0d.
- Field used for brickmaking 0.2.0 @ £8 say	£ 4. 0s.0d.
- Land taken for extension of common sewer through vegetables 0.0.30	£12.17s.6d.
- Ditto through agricultural land	£ 2.16s.3d.

ACM/LB/B/671

[100]Ibid.

[101]E.g. ACM/LB/C/668 & 490-1

[102]ACM/LB/B/439-40

[103]ACM/LB/B/677

[104]ACM/LB/B/671

[105]ACM/LB/B/688

[106]ACM/LB/B/970

increased the amount of initial outlay for industrialists setting up their own plant by an amount which was more than purely nominal as a percentage of total land costs. For the Estate the Tenant Right was similar to the system of lessees paying for infrastructure. It was a way of shifting the immediate cost of developing the Estate onto industrial and urban capitalists. However, since the consequence of this would be to depress the amount of residual ground rent which a site could sustain economically, it can be argued that this was more of a cash flow effect than a way of avoiding paying for urban capital.

7. Tenure on the Norfolk Estate

Tenure is important for a number of reasons:

i. If the Norfolk Estate did not permit a form of tenure acceptable to developers or end users, the supply of land would have been limited;

ii. We have noted that some forms of tenure such as short tenancies might be more attractive to industrialists. If this were the case, and say only long leases were available, the market for land would be restricted. Alternatively, it might need to be modified by the intervention of intermediaries such as tenurial capitalists who could take a long lease and sublet, underlet or licence the property for shorter periods. On the other hand, industrialists preferring long term interests in land would be deterred if only short leases were on offer;

iii. The forms of tenure available would affect the value of the property as security for loans;

iv. Some investment in plant and machinery might only be worthwhile if a return could be gained over a relatively long period. If the length of lease available were too short, sites might be unattractive for investment. Similarly, the developer would need to be sure of a return on buildings and infrastructure works. This would require an interest long enough to generate sufficient income to cover costs and profit, either from the developer's own business or from letting or selling-on the property.

As one would expect of an aristocratic estate of the period, the Sheffield Estate was settled land. The Settlement limited how each Duke, as Tenant for Life, could deal with the Estate. Much Norfolk land was settled as part of the Arundel Estate. From 1628, when that estate was settled, until an Estate Act of 1846, leases with a term longer than 21 years could not be granted on this land. The

Sheffield Estate did not form part of the Arundel Estate, and was settled separately.[107] This was a source of some confusion to the SCTH until it was cleared up by Michael Joseph Ellison and may therefore have added to uncertainty about the estate for potential developers.

There were four main forms of tenure on the Sheffield Estate:

i. Agricultural Tenancies
ii. Yearly Tenancies
iii. Leases
iv. Freeholds

i. <u>Agricultural Tenancies</u>

These were described in the section of this chapter entitled Farmland into Townland. Essentially they were annual tenancies which were easily terminated and did not give the tenant an estate in land.

[107] SCTH, M.of E., PP1888XXII, Q.7707

ii. Yearly Tenancies

Short holdings were used extensively in the early residential development of the Park. Land was held on yearly tenancies from the Duke. It was sub-let to middlemen, often in groups of 11-12 houses, on six months notice. The occupiers had weekly tenancies. This led to poor maintenance and insanitary conditions, but the Estate preferred to retain the flexibility to get its land back for redevelopment - though Michael Joseph Ellison could not say in 1888 whether this would take place in five, ten, fifteen or even twenty five years.[108]

iii. Leases

Four types of lease were used on the Estate:

i. 99 year Leases
ii. Shorter Leases
iii. Sub-Leases, Under-Leases and Tenancies
iv. 200 year Leases

a. 99 Year Leases

99 year leases were authorised by a settlement of 11 June 1767 and used continuously thereafter.[109] This was the main way land was released for development. Of 1,022 offers of land and transactions found in the Norfolk Letter Books, 913 involved 99 year leases.

b. Shorter Leases

Leases shorter than 99 years (109, or 10.67% of 1,022) were used for three main purposes:

- To procure coterminous reversion of adjacent properties. This might be by granting a lease of 90-98 years next to a site let a few years earlier, as in the case of Messrs. Brookes, who took the site next to Cammell's works in Brightside five years later than Cammell's lease, and with a commensurately shorter term.[110] Sometimes it occurred at the tail end of a lease when:

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[108]Ibid., QQ.7719 et seq; 7733-4; 7812
[109]Ibid., Q.7707
[110]ACM/LB/A/394 & B/439-40

> ... it would not be desireable to grant renewals except for short terms just to allow ... the old buildings to wear out.[111]
>
> [and]
>
> in some cases I [Ellison Junior] renew the leases for seven, ten or fifteen years ... my object being ... to get the whole block of property to come out of lease at the same time ... [112]

- To allow temporary use of land required for later development. One example was a seven year lease to Cammell's of 12,500 sq. yds.[113]

- To give shorter terms to some commercial and industrial occupiers. 63 and 21 year leases were the most common terms.[114]

c. Sub-Leases, Under-Leases and Tenancies

Not all property was occupied by the head lessee. The normal chain of ownership in Sheffield was Landlord-Lessee-Tenant.[115] In 1880, 56.6% of small firms in Sheffield rented work space, as opposed to leasing land. This proportion had only fallen by 3.8% in 1901.[116] Under-letting was allowed on the Norfolk Estate on a nominal payment of one guinea to the Duke.[117] The Letter Books show that there was under and sub-letting on the Estate.[118] The intervention of the 'land jobbers' who were regarded as such a problem in the Sheffield housing market[119] could have influenced the price and availability of industrial land if they had sought to speculate in this area of the market. In fact Appendices 4 and 5 show that all the larger firms leased land direct from the Estate. A random selection of smaller company and trade leases was also compared with White's Directories to see if lessees appeared later as occupiers. Sixteen sampled commercial and industrial sites all appeared to be occupied at least in part by the head lessee for their business - see Appendix 6. The most significant form of lease for the main commercial and industrial premises on the Norfolk Estate in Sheffield was the head lease.

d. 200 Year Leases

[111] ACM/LB/AC/724
[112] SCTH, M. of E., PP1888XXII, Q.7901
[113] ACM/LB/B/65, 91 & 114
[114] E.g. ACM/LB/A/297; B/329, 402, 442, 486; V/137
[115] SCTH, M. of E., PP1888XXII, Q.1215
[116] Lloyd-Jones & Lewis, 1993, 216
[117] SCTH, M. of E., PP1888XXII, Q.730
[118] E.g. ACM/LB/D/19; H/110; G/968
[119] SCTH, M. of E., PP1888XXII, QQ.96-150

Ellison Junior told the SCTH that he would not offer longer terms while 99 year leases were proving satisfactory for achieving the development of the Estate.[120] By 1899, Edmund Winder was in correspondence with his solicitors about the use of longer leases, concluding that 200 years provided the best balance between retaining the prospect of a reversion and giving greater security to the tenant.[121] Presumably this option could be considered because the Settled Land Act, 1882 permitted Tenants for Life to apply to the Court for a general consent to grant leases longer than the standard 99 year term included in the Act.[122] Only two such leases appear in the Letter Books before this date, permitted under a clause of the 1767 settlement allowing longer leases for single owner occupied homes on sites up to two acres.[123] After Winder's letter a further seven were granted before the cessation of the Letter Books eight months later.[124] The decision to introduce longer leases was tied to the need to generate more demand for development land and to counter '... the steady downward tendency in the value of money ...'.[125] Whether it achieved this we cannot tell. 200 year leases introduced at this late stage can have made no significant difference to industrial development in the study period.

iv. Freeholds

Settlements normally forbad the sale of freeholds.[126] In Sheffield, sales were relatively rare on the Norfolk Estate after the series of Estate Acts in 1802 which led to the breaking up of the Alsop Fields freeholds and some in the Park. According to the Agent these disposals were to pay for extensions to the Arundel Estate in Surrey and Sussex.[127] Local opinion, however, had it that pressure from manufacturers and merchants for 'a more general diffusion of real property' had persuaded the Duke to part with plots where development had occurred.[128]

Thereafter, sales were 'chiefly for public purposes'.[129] The Letter Books record freeholds going to the railways,[130] the tramway company[131] and the Council;[132]

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[120]Ibid., Q.7979
[121]ACM/LB/AC/926
[122]45 & 46 Vict., Ch.38, IV, Cl.6
[123]ACM/LB/P/535; V/137; SCTH, M. of E., PP1888XXII, Q.7775
[124]ACM/LB/AD/256 & 723
[125]ACM/LB/AC/926
[126]McMahon, 1985, 93
[127]SCTH, M. of E., PP1888XXII, QQ.7767 & 8073
[128]Baines, 1822, 294
[129]SCTH, M. of E., PP1888XXII, Q.7742
[130]E.g. ACM/LB/K/60

to charities such as a church school in Ecclesfield;[133] and to other aristocrats such as Lady Burgoyne.[134] Elsewhere in the East Midlands the Norfolks kept up a steady sale of freeholds around Worksop, many to the Duke of Newcastle.[135] In Sheffield the policy on freeholds remained restrictive until the 1890s. On 31 March 1893 the Agent wrote to the largest industrial lessees on Norfolk land to offer them the opportunity to purchase their freeholds.[136] The firms were:

Charles Cammell & Co.
John Brown & Co.
Henry Bessemer & Co. Ltd.
Thomas Firth & Sons Ltd.
Spear and Jackson
Moses Eadon & Sons
Kayser Ellison & Co.

Subsequent correspondence confirms that other firms were added to the list. By 1900 the firms listed in Table 9.1 had decided to purchase or been offered the fee simple of their property. All but one[137] leased more than 1,300 square yards. Most were much bigger. Although there were few land deals with the big steel companies in the 1890s, this policy seems to have been applied subsequently to new purchases, as when Cammell's were sold 17,190 square feet of virgin land freehold in 1900.[138]

There is no explanation for this change of policy in the letter books themselves. It is all the more surprising given Michael Joseph Ellison's strong defence of the leasehold system before the SCTH.[139] Ellison said that where property was held in large blocks, landlords should grant either freeholds or leaseholds, but not a mixture, which would lead to 'what one may call a magpie estate'.[140] It would seem that the desire to keep the Estate intact had to be balanced increasingly against the threat of radical reform and changes in the state of the property market. In this light, three possible reasons (alone or in combination) for the sale of industrial freeholds suggest themselves:

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131 E.g. ACM/LB/AC/802
132 E.g. ACM/LB/Y/182
133 ACM/LB/K/60
134 ACM/LB/A/173
135 ACM/LB/D/277
136 ACM/LB/V/35
137 The Worksop and Retford Brewery with a site of 345 sq. yds.
138 ACM/LB/AE/476
139 SCTH, M. of E., PP1888XXII, QQ.7749 et seq.
140 Ibid., QQ.7981 et. seq.

a. As we shall see later, most suitable sites on the Estate for large scale industrial undertakings had been let by the 1890s. The firms concerned were mostly prosperous; perhaps more so than when the value of thier ground rents had been calculated, so that their rents may have under-represented the value of their sites in the long term. The sale of freeholds would have given the opportunity to wring further value out of the Estate without having to wait for reversions due in another 40 or 50 years time.

b. In the years before the mid 1890s, 'there was a substantial shift of incomes to wage earners and against the incomes from property'.[141] Micael Joseph Ellison told the SCTH in 1888 that 'the value of property has very much diminished of late years' and pointed to the fact that the Council was unable to sell surplus land after street improvements were finished.[142] The decline was a trend which seems to have affected the policy of the Fitzwilliams soon afterwards. In the third quarter of the 19th century they developed their Ecclesfield estate 'on the traditional leasehold pattern, laying out roads and letting plots to speculative builders...'. By 1900 this policy was regarded as anachronistic and freeholds began to be sold.[143] Given the declining real value of fixed ground rents over time, especially compared with other forms of investment, it would be logical to capitalise the value of freeholds which could be sold to large, rich tenants and invest the capital elsewhere.

c. These reasons may have been reinforced by the political pressure placed on the large landed estates in the last quarter of the century. The first Norfolk industrial freeholds were offered for sale only two years after the Report of the SCTH. At the Committee's hearings in 1888, the Duke of Norfolk had come in for strong criticism over the management of his Sheffield Estates. One of the main criticisms had been the anticipated effects of the reversion of leases on capitalists who had invested in plant and equipment on leasehold land. The Duke may have wished to placate political opposition, or may have feared that the value of industrial reversions would soon be 'stolen' by legislation and should therefore be cashed in.

There seems every probability that it was the combination of these factors which led to the decision to sell freeholds. As with 200 year leases, the timing of the

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141 Pollard and Crossley, 1968, 235
142 Ibid., Q.7924
143 Cannadine, 1980, 422

decision can have done nothing to influence industrial location decisions on the Norfolk Estate by the giant steel producers.

v. The Impact of Reversion

The 99 year lease seems to have been sufficiently long to enable investment decisions to be taken by industrialists during the initial rapid growth of the steel industry. The question of reversions does, however, raise the possibility that the threat of loss of property on reversion could have deterred re-investment in established plants.

The fate of a works at reversion was an issue for the land reformers. Leases granted before reforms proposed by the Law Society in 1877[144] allowed the Estate to claim plant and equipment as well as land and buildings.[145] It was alleged that the Dukes of Norfolk did not renew leases on favourable terms. It was forecast that within 50 or 60 years from 1888 'the whole of those magnificent works upon which millions of money have been spent will fall into the hands of the Duke of Norfolk'.[146] Manufacturers were instrumental in setting up a Sheffield Leasehold Enfranchisement Society.[147]

Yet Ellison was able to produce examples to show that each renewal was considered on its merits. The Letter Books support him. Sometimes rents rose,[148] sometimes they were unchanged.[149] Sometimes the Estate neglected to pursue renewal at all and even failed to collect unpaid rent.[150] Ellison presented a convincing case that the Estate did allow manufacturers to remove plant on the expiry of leases.[151] There were '... no usual terms of renewal at all, each case (was) taken on its own footing'.[152] Above all, the critics were unable to state that manufacturers felt themselves insecure in putting down expensive plant.[153] The empirical evidence of development proves this. Although the Estate might have found it uncomfortable to try to recover the reversions of giant steel plants if the matter had ever been put to the test, it seems that those making the initial investment decisions in plants felt they could turn enough profit over 99 years to leave the problem of reversion to a later generation.

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[144]Ibid., QQ.3661-2
[145]Ibid., Q.3479
[146]SCTH, M. of E., PP1886XXII, QQ.741, 743 & 814
[147]Ibid., QQ.976-7
[148]E.g. ACM/S384
[149]E.g. ACM/LB/R/507; Y/6
[150]E.g. the case of Attercliffe Forge Works in 1883 - ACM/LB/V/299
[151]SCTH, M. of E., PP1886XXII, Q.7712
[152]Ibid., Q.7901
[153]Ibid., QQ.976-7

Table 9.1

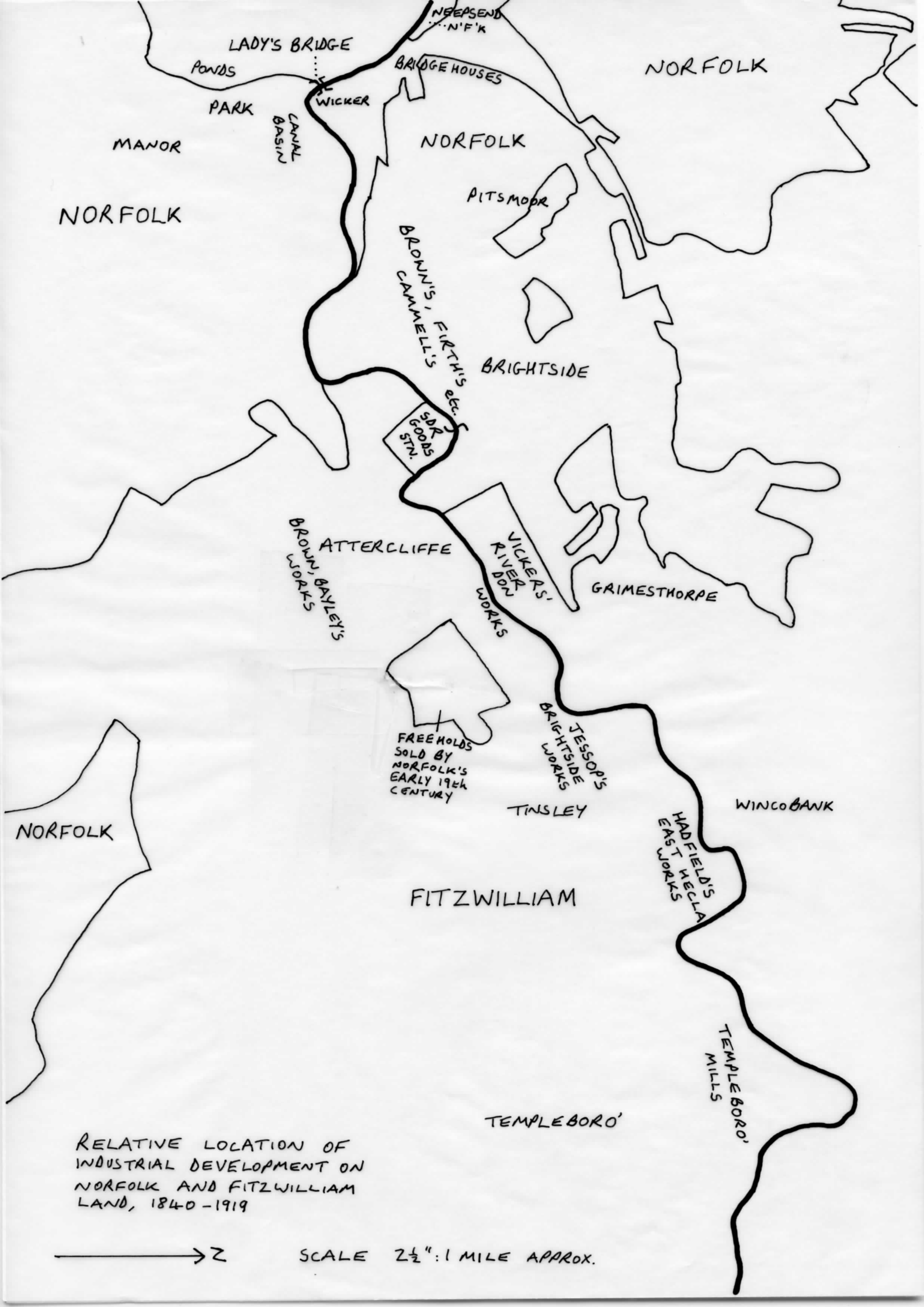
Sales of Industrial Freeholds on the Norfolk Estate 1891-8[154]

Company/Location	Date ofPurchase or Offer
Firth and Sons, Attercliffe	April 1891 (Purchase)
Davy Bros., Park Iron Works	September 1891 (Offer)
John Brown & Co., Attercliffe	October 1891 (Purchase)
Spear and Jackson, Attercliffe	January 1892 (Purchase)
Cammell and Co., Attercliffe	July 1892 (Purchase)
Wm. Turner and Sons, Mowbray St.	October 1898 (Offer)
Worksop & Retford Brewery Co., Mowbray St.	October 1898 (Offer)
John Bedford & Sons Ltd., Mowbray St.	October 1898 (Offer)
W.H. Thackray, Mowbray St.	October 1898 (Offer)
Oxley Bros. Ltd., Mowbray St.	October 1898 (Offer)
Thomas Wm Sorby Esq., Mowbray St.	October 1898 (Offer); February 1899 (Purchase)
Midland Works and Siding, Attercliffe	November 1898 (Offer)
Royd's Mill Silver Refinery, Sheffield Smelting Co., Attercliffe	November 1898 (Purchase)

[154]ACM/LB/V/365; W/167; W/231; W/336; X/95; AC/534 ; AC/557; AC/557; AC/557; AC/557; AC/557; AC/557; AC/654; AC/712; AC/749

Figure 9.1 (following page)

Relative Locations of Fitzwilliam and Norfolk Estates in Eastern Sheffield/Rotherham (diagramatic)



RELATIVE LOCATION OF INDUSTRIAL DEVELOPMENT ON NORFOLK AND FITZWILLIAM LAND, 1840-1919

SCALE 2½":1 MILE APPROX.

Figure 9.2 (following page)

The Estate of His Grace the Duke of Norfolk and
the Trustees of the Late Charles Duke of Norfolk (c.1819)

Sheffield urban area (including developed Norfolk land) coloured dark grey

Undeveloped Norfolk land coloured pink (woodlands coloured green), outlined red

Commons where the Estate owned mineral rights shown dotted red; other commons hatched red

Trustees' land coloured light grey, outlined dashed red

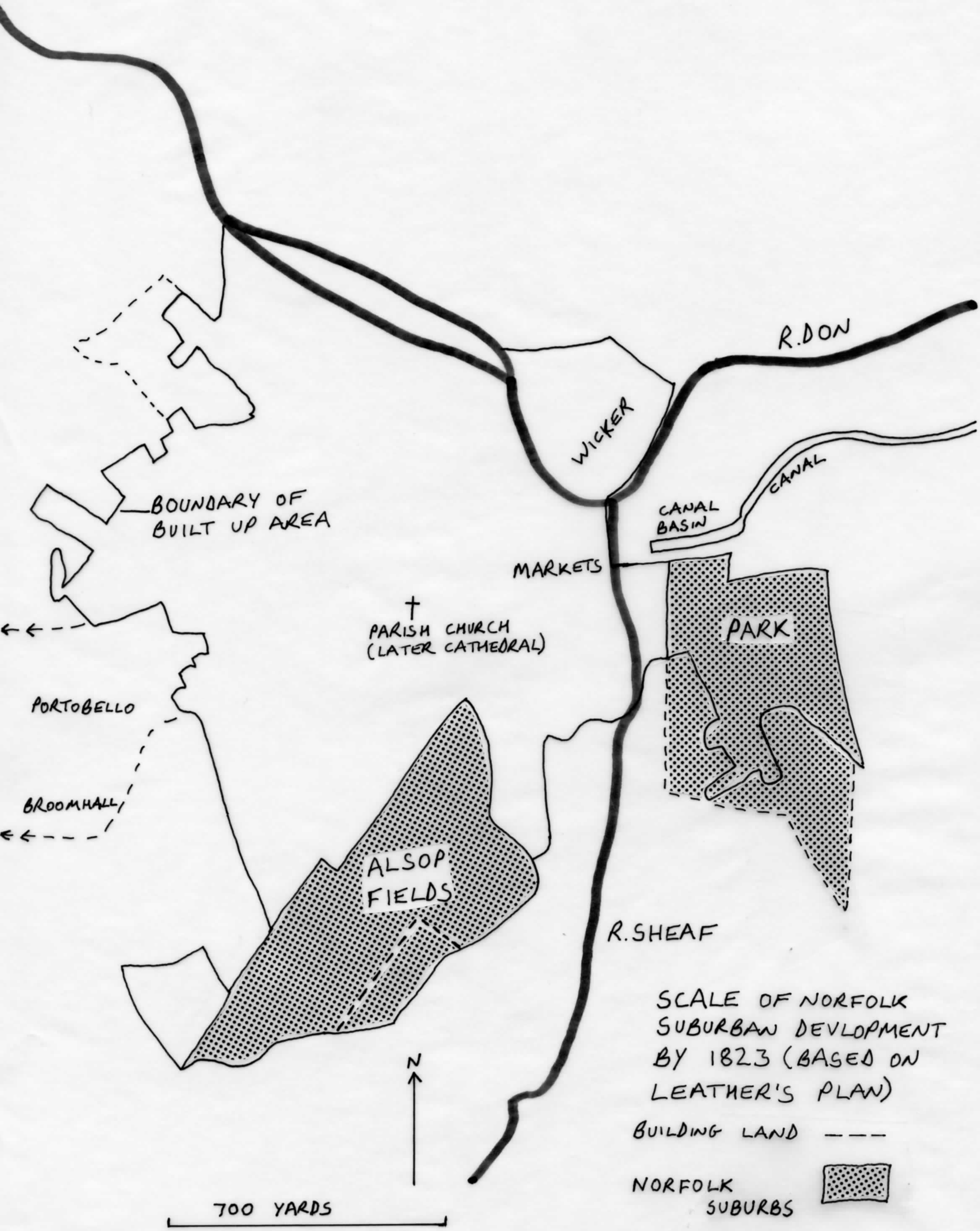
Land sold or saleable freehold marked 'S' where sold

BRADFIELD
ECCLESFIELD
E C C L E S F I E L D
Wadsley
ROTHERHAM
WHISTON
HANDSWORTH
S H E F F I E L D
T O W N S H I P
D E R B Y
REFERENCES
The Estate of His Grace the Duke of Norfolk
of the Trustees of the Late Charles Duke of Norfolk
Lands Saleable under different Estate Acts
Lands Sold marked S
Commons where the Minerals are reserved under the

ACM. She 156

Figure 9.3 (following page)

Extent of Development of Alsop Fields and the Park, Norfolk Estate, 1823



R.DON
WICKER
CANAL
CANAL BASIN
BOUNDARY OF BUILT UP AREA
MARKETS
PARISH CHURCH (LATER CATHEDRAL)
PARK
PORTOBELLO
BROOMHALL
ALSOP FIELDS
R.SHEAF
N
700 YARDS
SCALE OF NORFOLK SUBURBAN DEVLOPMENT BY 1823 (BASED ON LEATHER'S PLAN)
BUILDING LAND
NORFOLK SUBURBS

CHAPTER 10

LAND OWNERSHIP AND INDUSTRIAL LOCATION (2) - THE PLANNING AND MANAGEMENT OF INDUSTRIAL DEVELOPMENT ON THE NORFOLK ESTATE

The planning and management of the Norfolk Estate has not won the admiration of historians. Olsen comments that 'it is the unremarkable quality of the management and the indifferent nature of its results that give the estates[1] their particular interest'.[2] Cannadine talks of 'mismanagement and ducal indifference' coinciding with 'absence of planning and controls over building'.[3] Caulton considers that 'the Norfolk Estate's contribution to planning was slim',[4] though apart from the district of Sharrow, where town planning principles learned in America were applied by the landowner 'no such discipline (i.e. planning) existed for the rest of Sheffield, although if the Dukes of Norfolk were content to let their estates go to speculative builders, they imposed a street pattern quite different from that elsewhere in the town of the same period'.[5]

Although there was contemporary opposition to the way the Estate was developed,[6] this was not universal. Michael Ellison Senior's obituary commented favourably on his promotion of new development and improvements which benefited the town as well as the Duke.[7] Support for Sheffield railway projects and encouragement of a better water supply through the new Water Company set up in 1830 were also praised. The growth of the great works in the East End on Norfolk land was seen as a positive feature for the town. The redevelopment of parts of the Park to produce a less haphazard urban form was also emphasised, as was the laying out of Norfolk Park and its dedication to the public.[8] The author of these articles was not necessarily wholly objective, perhaps because of the prestigious position of the Duke's men of business in Sheffield. However, the sentiment probably represents a strand of thinking which measured progress and planning on a realistic contemporary scale, appreciated that the prosperity of the town had improved, that this improvement depended on the prosperity of industry and commerce, and that they could only thrive in a sympathetic estate management context.

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[1]The Norfolk Estate, Sheffield and Chalcots Estate, Hampstead
[2]Olsen, 1973, 335
[3]Cannadine, 1980, 405
[4]Caulton, 1980, 526
[5]Ibid., 526
[6]Cannadine, 1980, 50
[7]The new Corn Exchange, Haymarket, Market Hall, relocated Shrewsbury Hospital, Blonk Bridge and new roads in the town centre
[8]Anon, 1861

1. The Broad Pattern of Development

To assess which areas of the Estate received the most attention from developers, the records in the database were categorised between the main locally perceived districts of the town. Identification of streets with particular locally perceived districts is arbitrary. Such districts do not have the formally defined boundaries of local government areas.[9] Nevertheless, the finer grain of analysis permitted by assignment of data to such districts is more useful than the division of properties between the nineteenth century Townships.

In Sheffield, some longer streets link more than one district. Without precise addresses, it was necessary to assign these streets to composite areas (described in the table as Crookes/Walkley or Pitsmoor/Attercliffe, for example). Even so, definition is precise enough to underline the importance of the Park, Attercliffe, Pitsmoor, Brightside and Grimesthorpe in the development of the Dukes' estates in the nineteenth century. This focus on the East End is, of course, of great importance for this study. The ability to contrast the growth of Attercliffe and Pitsmoor with other areas of the town is also useful. The locations of the perceived districts are shown in Figure 10.11.

Table 10.1 shows the breakdown of the data by locally perceived district. For each district the number of leases is split between 1825-50, 1851-75 and 1876-99. This sub-division shows an emphasis on the development of the Park and Manor in the earliest period. The next twenty five years were characterised by the rapid growth of Brightside and Pitsmoor in the East End. The North End around Bridgehouses also saw increased development. The Park, which was less favourably placed for communications after the railways opened, saw a fall at this time. In the final period, while the North and East Ends remained dominant, the Highfield/Lowfield area was an increasingly popular location - perhaps related to the opening of the new Midland Station on the Chesterfield Extension of the MR. These data add to the evidence which shows that improving communications were a material factor affecting demand for land and the Estate's willingness to supply it.

2. The Street Pattern

Caulton's observation that the Norfolk Estate street plan is characteristic, and at

[9]For example, local newspapers and guidebooks were sometimes cavalier about the distinction between Attercliffe and Brightside when describing industrial Sheffield, even though both names were associated with villages before industrialisation, and with local government Townships

variance with the rest of the town is undoubtedly correct. This difference is particularly marked in Brightside, though it is also found in Pitsmoor, Highfield/Lowfield and (to a lesser extent) in the redevelopment of the Park. Its most notable feature is the use of a rectilinear grid, with strong intersecting diagonals. The grid had been used before as the basis for planning on the Estate. The Alsop Fields area, developed in the late eighteenth century, was formed on a square grid, with the main thoroughfares of Eyre Street and Arundel Street and smaller parallel streets on a south west-north east axis crossed by Earl Street, Furnival Street, Charles Street and so on following a north west-south east alignment. Smaller streets and alleys subdivided the basic blocks created by the grid with site depths from back of footway to back of footway of about 135' 6"[10] - see Figure 10.1.

The nineteenth century grid used in Pitsmoor (Figure 10.2) and Highfield/Lowfield (Figure 10.3) was more open lengthwise, characterised by long parallel roads such as Petre Street and Earsham Street (Pitsmoor) or Shoreham Street and Edmund Road (Highfield). Depths between streets were 120-130'[11] or, in Pitsmoor as little as 86'.[12] Intersecting streets were fewer and were commonly angled.[13] This pattern lent itself to a linear form of development. On Pitsmoor, one of Sheffield's steeper hills, use of diagonal streets probably derived at least in part from the need to achieve acceptable gradients on roads intersecting those which were parallel to the contour lines. The reason for this approach in the comparatively more level area of Highfield is less easy to guess. Perhaps it was an attempt to create easy routes for through traffic. After 1864 the introduction of building bye-laws would help to account for the laying out of streets to produce the characteristic linear residential terrace. This may explain the grid used on the Fitzwilliam Estate in Attercliffe east of the Norfolk enclave. The Ellisons and their predecessors were, however, using the grid long before the bye-laws made it an obvious choice - it is not clear if the Highways Boards influenced the street plans.

Of greatest interest is the street pattern laid out in Brightside surrounding the Sheffield and Rotherham Railway. Here, the grid was of remarkable size, straddling the railway (Figure 10.4). Forking from the Wicker, the long parallel routes of Carlisle Street/Carlisle Street East and Savile Street/Savile Street East/Brightside Lane ran north eastwards towards Brightside, crossed only by

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[10]E.G. Eyre Street - Eyre La. - OS 1:2500, 1903, Sheet CCXCIV.12

[11]E.g. St. Mary's Rd. - Mary St. = 121' 3"; Shoreham St. - Lancing St. = 128' - OS 1:2500, 1903, Sheets CCXCIV.12 & CCXCIV.4

[12]E.g. Bramber St. - Shoreham St. - ibid.

[13]E.g. Lyon Street, Harleston Street and Sutherland Road, Pitsmoor; Charlotte Road, Highfield & Alderson Road, Lowfield, ibid.

Sutherland Road, Carr Wood Road and New Hall Road. Between the two main thoroughfares lay the third parallel in the grid - the railway. The presence of the railway accounts for the small number of intersections, but not for the dimensions of the plots between road and rail, which were considerably deeper than the norm - 357' from Carlisle St. East to the railway for example.[14] Sufficient, in fact, to accommodate an additional parallel street either side of the tracks if the usual grid found in Pitsmoor, Highfield or even other parts of Brightside such as Greystock Street/Corby Street (where street to street depths were about 116'[15]) had been adopted. One might have speculated that this depth of site arose from the reservation of land under the railway's Limits of Deviation, except that these were tightly drawn in Sheffield. Intuitively, the most probable explanation is that the Estate was planning these streets for larger scale development than was expected on the surrounding roads - probably industry linked to the new transport corridor. The evidence contained in the Letter Books bears this out.

i. <u>How Streets Were Planned</u>

The Norfolk Estate street pattern was planned and laid out by the Duke's Agents in the manner common for leasehold development at the time, with edge stones to mark the carriageway and post and rail fencing to identify sites.[16] Until the early 1870s it was common for the Letter Books to include copies of sketch site plans sent to those who had applied for land.[17] These plans usually show the course of streets as they were proposed or actually laid out by the Agents. Proposed roads were generally shown by dotted lines. Substantial sites created by the juxtaposition of roads and railway were already established by the courses of Carlisle Street/Carlisle Street East and Savile Street/Savile Street East by the mid 1840s, with Spear and Jackson's Aetna Works following soon after the Sheffield and Rotherham Railway, Cammell's Cyclops Works developing on land leased in Savile Street between 1844 and 1847;[18] and Firth's beginning to build in Savile Street East in 1849.

A letter about land availability on 7 June 1849[19] was accompanied by a plan showing sites available by the railway from the Midland Station to Savile Street East and Carlisle Street East. A sketch tracing is included as Figure 10.5. From

[14]OS 1:2500, 1905, Sheet CCXIV.4
[15]Ibid.
[16]Marshall and Newbould, 1925, 10
[17]The first Letter Book to contain no such plans is M, beginning in early 1875 - though Letter Book L is missing - so the practice probably ended when Marcus Smith left office in 1872
[18]ACM/LB/A/394
[19]ACM/LB/B/9

this plan it is clear that it was intended that the full depth of sites should be sold, with no question of further subdivision or insertion of secondary streets. The Agent advised that if the enquirer would 'have the goodness to inform me for what the land is wanted I will then state whether you can have it', showing that control was being exercised over land use. The subsequent paragraph explaining the facility for connecting sidings to works tells us that the land was designated for industry or commerce.[20]

Although the Estate generally built or procured the building of streets according to its plans, it did not always succeed in executing them to their full extent. The laying out in 1854 of Lumley Street and its associated network of roads between the Sheffield Canal, the MSLR and the Duke's colliery railway[21] - see Figure 10.6a & b - resulted in a street pattern with only a passing resemblance to the Agent's sketch plan. Similarly, a plan of land to be leased to the MR in 1860 shows the straightening out of Brightside Lane where it ran alongside the Head Goit of the Attercliffe Forge Works.[22] This would have involved construction of at least two new bridges, or diversion or culverting of the Goit. As later maps show, this improvement was never carried out. The construction of the viaduct for the MR's Chesterfield Extension over the historical alignment of Brightside Lane prevented the plan from being resurrected.

The same plan shows the proposed route of Carlisle Street East and New Hall Road, with another proposed road (Kenninghall Street) south of Carlisle Street East (Figure 10.7). This is interesting because of the anticipated return to the shallower depth of site between the proposed road[23] and the railway, when compared with those prevailing to the west of Carwood Road. This shallow depth proved shortlived. The road does not appear on any published maps and seems never to have been completed. The process by which this came about shows how influential the imperatives of industrial development were on urban form. The railway contractor Joseph Sales took a lease south of the road in 1860.[24] This was taken over and extended by John Brown and Co. in 1865.[25] The Midland Railway had also leased land south of Kenninghall Street in July 1860 for sidings. In May 1870, Brown's took the remaining site between their holding and the Railway land, and the area north of the sidings and south of Carlisle Street East. The plan accompanying this transaction in the Letter Books identifies the

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[20]ACM/LB/B/192
[21]ACM/LB/C/474
[22]ACM/LB/E/667
[23]Called Kenninghall Street - ACM/LB/G/130
[24]ACM/LB/E/685
[25]ACM/LB/H/110

rest of the land north of Kenninghall Street as 'Sundry Leaseholds' and even includes a short road linking it with Carlisle Street East.[26] Yet by the 1890s, Kenninghall Road and the land to the north had been absorbed into Brown's Atlas Works.[27]

The future improvement of existing roads was also protected, even at a loss of short term income to the Estate. A case in point was the lease of land at the corner of Duke Street and High Street Lane, Park in March 1848. Most of the land was leased for 99 years, but 139 sq.yds. needed for future highway widening was let on a yearly tenancy.[28] The Duke's own infrastructure might also be affected by improvement schemes. In July 1856, the Agents proposed a change in the route of the tramway from the Estate's Park Collieries to allow for the laying out of further streets.[29]

Sometimes third parties had to be involved in street improvements. Their involvement might be as simple as the need to purchase a plot of land from the Licensed Victuallers' Association for the construction of Carlisle Street East and New Hall Road in April 1863.[30] The Estate purchased the freehold of a substantial piece of land - 6,312 sq.yds. The purchase was linked to opening up land for development, for the Duke's offer was subject to confirmation that a third party would take a lease from the Norfolk Estate of the Duke's land and the residual area not required for road construction.[31]

It might be necessary to work with an adjoining owner, as when the Agents wrote to the Midland Railway (which owned half the land involved) to suggest arching over the River Sheaf from Commercial Road to Broad Street Bridge.[32] Some improvements were carried out entirely by others. The Midland Railway was obliged under the terms of a lease to construct all but the northernmost section of New Hall Road. John Brown and Co. and Cammell's built or widened bridges to ease communications between the branches of their works north and south of the railway.[33]

ii. Providing Urban Capital - Building the Roads Needed to Serve Development Areas

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[26]ACM/LB/J/474-8
[27]PRO/MPS/5/274
[28]ACM/LB/B/15
[29]ACM/LB/D/472
[30]ACM/LB/G/10
[31]ACM/LB/G/33
[32]ACM/LB/P/208
[33]Barraclough, 1976, 60

Constructing properly paved streets adequate for industrial traffic would have been an important part of developing a manufacturing area. In Chapter 6 the marshy nature of the lower Sheaf and Don Valleys and the difficulties this created for pioneer firms such as Firth's is described. Michael Joseph Ellison told the SCTH that the Duke paid for street construction. Tenants paid for sewers and kerbing opposite their property pro rata to their frontage. Surfacing and footpaths were carried out to standards required by the Borough Surveyor and the cost was passed back to the tenants through their ground rents.[34] In fact, this was not quite the case for large industrialists. They had to pay directly not only for edge stones and sewers, but also for setting and industrial water conduits. The tenant was also responsible for providing a footway in front of the property.

Tenants may have borne the cost of infrastructure either directly or through rents, but the Estate carried out most of the works to lay conduits and make the road, though edge stones, surfacing and footways seem to have been the province of the lessees at least in some cases. In the 1840s the Estate's work was often done using the unemployed, paid for through the Poor Law Union. In March 1843, they were engaged in building a new street linking the old and new turnpikes in Pitsmoor[35] and the approaches to a new bridge at Hall Carr Grange, Brightside.[36] Exactly a year later they were being used to level spoil banks by the railway and to carry out other highway works.[37] The Duke's own workmen laid conduits and a new street in June 1851.[38]

Having constructed the roads, the Estate was keen that they should not remain a maintenance burden. A good deal of energy was put into procuring outstanding payments and completion of works, so that highways could be dedicated. In August 1855 twenty streets were dedicated, after letters to lessees urged them to put edge stones in place to complete the roadways. This group of dedications included streets in Highfield, but most were in eastern Sheffield.[39]

Even after these streets were off the Estate's hands there was much to do on the many roads still being developed. Tenants had to be cajoled into meeting their

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[34]SCTH, M. of E., PP1888XXII, QQ.8120 and 8122
[35]ACM/LB/A/78
[36]ACM/LB/A/79
[37]ACM/LB/A/128
[38]ACM/LB/B/622
[39]ACM/LB/D/56

obligations.[40] Achieving adoption was not always easy. In March 1863, the Estate informed Brown's that Savile Street and Savile Street East were not yet dedicated due to the 'rigid' attitude of the Board of Highways for Brightside Township.[41] In 1872, Ellison Jr. wrote to tenants in New Hall Road to tell them it would not be adopted by the local Board until it was flagged and asphalted. The Estate had 'made the road' but it was up to the lessees to surface it.[42] Some roads took many years to complete to the authorities' satisfaction. It was not until June 1875, 25 years or so after it was begun, that Carlisle Street East was completed.[43] The piecemeal approach to highway construction may have reduced capital outlay for the Estate, which was probably a necessity when leasing land on ground rents, but it must have added considerably to estate maintenance costs and the burden of administration. It would seem to have frustrated Brown's at least, since they took the trouble to complain of slow progress on the adoption of Savile Street and Savile Street East. It would also have imposed a not inconsiderable initial financial burden, which would have meant that any firm seeking a new site on the Norfolk Estate would have had to have sufficient funds to cover the cost of the urban capital needed to sustain its new site as well as the industrial capital required for plant and machinery.

3. Railways and the Planning and Development of the Norfolk Estate

The Agents were keen to promote and protect the advantages given to their industrial development land by direct connection to the railway. In writing to a potential purchaser looking at land in Carlisle Street and Savile Street in June 1849, it was pointed out that:

> The Midland Railway Co. have afforded to the owners of works alongside this Railway the facilities of sidings, and as there is a material benefit from the privileges to the Compy. and to the parties themselves there is no probability of such privileges being withheld. The Duke of Norfolk has a right to make them but the Company must approve of the means. The parties bear the expenses of the work.[44]

The Estate had had the foresight to protect its right to make sidings. This was not a new departure. A letter in December 1860 explained that landowners adjoining the canal had the right to build basins and wharves onto the waterway.[45] In August 1850, the Estate included in the terms of a lease a right

[40]E.g. letter to Arthur Lawley and Co., Atlas Works, requiring completion of footpaths in front of their property in June 1856 - ACM/LB/D/432
[41]ACM/LB/F/958
[42]ACM/LB/K/709
[43]ACM/LB/M/261
[44]ACM/LB/B/192
[45]ACM/LB/E/832

to connect to the railway. By July 1853 permission had become obligation and, as described later in the section on covenants and development obligations, lessees had to set aside a strip of land for sidings. Nine draft leases or offers of terms were found containing this obligation.[46]

By the 1880s, the advantages to the Estate of railway connections were well appreciated by its Agent. Michael Joseph Ellison told the SCTH (admittedly with half an eye to deflecting charges of land speculation) that land on the Estate had risen in value from £3 to £40 per acre (over what timescale is not clear) 'consequent upon the railways, not upon anything which the Duke has done'.[47] Yet the Estate's attitude to transport improvements had not always been so positive. Opposition by the Duke delayed plans for a Sheffield Canal in 1792 and 1803.[48] The Duke also opposed the proposal to build the S&R Railway[49] which connected Earl Fitzwilliam's collieries to Sheffield. However, Michael Ellison 'used strenuous efforts' to have the NMR run via Sheffield rather than Masboro', and was one of the promoters of the SAMR.

So long as railway development benefited the Estate, it had the support of the Agents. The Estate was able to profit from improvements in suburban land values arising from accessibility by rail. It could also gain directly by selling or leasing land to the railway companies. In some cases, the Estate promoted its own railway improvements to add value to parts not served by rail.

The railway companies found that Sheffield was no exception to the rule that it was simpler and quicker to deal with and through the great proprietors when buying land.[50] The Norfolk Estate's Agents were involved at a very early stage in helping the MSLR in particular to acquire land. At least one 99 year lease required the tenant to give up land to the MSLR when it was needed by the railway, with a provision for compensation.[51] The Estate also assisted the MSLR to buy land in central Sheffield for its station. In June 1849, Ellison Snr. wrote:

> In 1847 I received instructions to purchase sundry properties at and near Effingham Street to enlarge the site of the intended Station. I succeeded that year and subsequently in obtaining (properties) at fair prices ... [52]

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[46]ACM/LB/C/294, E/364-6, 367-9, 685, 742, 799-801, F/28-30, F/148, J/474-8
[47]SCTH, M. of E., PP1888XXII, QQ.3646-9
[48]Hadfield, 1973, 266-9
[49]Batty, 1984, 15
[50]Kellett, 1969, 333
[51]ACM/LB/A/43
[52]ACM/LB/B/195

This was the site of Sheffield Victoria Station, which eventually opened in 1851.[53] Later in the century, the Estate helped to expedite the construction of the MR's Chesterfield Extension. In July 1863, the Agent wrote to the railway company to say he had an application:

> ... for a large plot adjoining the Sheffield and Rotherham Railway. It may happen that you may require part of this plot - you stated some time ago your scheme for the Chesterfield Line would leave the Rotherham Railway near New Hall.[54]

While there would have been little sense in trying to let land which might be taken under Parliamentary powers, it does seem the Estate was trying to assist the planning of the railway. Later, the Estate worked on behalf of the Midland Railway by buying in leaseholds on the route.[55]

The price of landlord co-operation for the railways was a restriction on their Limits of Deviation which left them short of land for widening and building sidings in later years. They were forced to lease land from the estate for those facilities.[56]

The Estate was not always supportive of railway proposals. The criterion deciding its attitude was the benefit which would accrue to the Estate. The Agents sought to negotiate to modify projects to improve their effects on Norfolk land, or where such improvements could not be achieved, to secure better compensation. Outright opposition was unusual, presumably because the Estate would always lose against Parliamentary powers. An early instance was the intended link between the MSLR at Bridgehouses and the S&R at The Wicker. The Estate dissented from the plan because it took a valuable piece of its land. It was, however, prepared to negotiate a better financial deal in return for removing its opposition.[57] In April 1848 the Duke refused to pay for a road bridge to give access to the proposed MSLR Victoria Station, on the grounds that the only bridge site which would bring advantage to his estate would be near Royd's Mill Weir, not in the place proposed by the railway company.[58] In July 1863, when the route of the Chesterfield Extension was being planned, the Estate was worried that its interests might be affected adversely. The Midland Company were reminded that they were:

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[53]Proctor, 1975
[54]ACM/LB/G/129
[55]ACM/LB/H/928-88
[56]E.g. ACM/LB/E/534 and 664-7
[57]ACM/LB/A/175, 11 Jan. 1845
[58]ACM/LB/B/37

> ... under the Lease from the Trustees of the Duke of Norfolk, required to make provision for a Roadway over the Railway ... It will be quite impossible to make that Roadway if your Chesterfield line shall leave the Rotherham Railway to the east of that roadway. Allow me to suggest that you divert the present line of Railway slightly to the North so that you may keep that diversion for the goods traffic to the present Sheffield Station ... [59]

The Agent's advice seems to have been taken. A later Ordnance Survey map shows railway junction and road arrangements for the Chesterfield Extension more or less as the Estate desired.[60] In February 1864, the railway company was informed that the Estate wished to see a diversion of the proposed Extension to avoid land to be let to Cammell's and that there was an objection to the diversion of Princess Street which was planned to be 'a great thoroughfare'. It was suggested that this might be avoided by building the railway on a brick arch instead of an embankment.[61] The latter suggestion at least was adopted.

This policy of protecting the immediate interest of the Estate, but otherwise not opposing railway extension was continued in February 1867, when the LNWR had a Bill before Parliament which affected Norfolk farm and colliery land. Few and Co. were instructed as follows:

> I am aware of the diverse interests of the petitioners against this Bill while I am of the opinion our course is a very straightforward one and which we may pursue if we do not tack ourselves to any other parties. We must endeavour to protect the Duke of Norfolk's Estate and obtain compensation for the injury the Farm will sustain. Mr. Huntsman [the Collieries manager] must restrain the Co. from taking too much of the space appropriated for his Coal Depot and from interfering with the line of his colliery railway. Beyond this he [presumably the Duke] has no wish to go ... [62]

This correspondence probably relates to abortive proposals by the LNWR in 1867-8 to obtain access to Sheffield.[63]

The attempt by the NER to gain a foothold in Sheffield in the 1890s was more difficult for the Estate, involving a substantial land take in the East End, not all of which was seen to be compatible with the Estate's best interests. In particular the site of Attercliffe Goods Yard had been earmarked for industrial development by the Agents. There was obviously a good deal of correspondence on the subject

[59]ACM/LB/G/129-30
[60]PRO/MPS/5/274
[61]ACM/LB/G/418-9
[62]ACM/LB/H/982
[63]Batty, 1984, 34 & 45

of the SDR, since the National Archives Register records two Norfolk Estate Letter Books[64] devoted to the subject. In fact there must have been a lot of additional correspondence on railways, for another book[65] is identified as dealing with this subject more generally. Unfortunately none of these books was available for study when the author was conducting his researches. There is sufficient information in the general Letter Books to tell us that Winder could see no reason for the Duke of Norfolk to petition the SDR Bill 'except if you should petition a Bill because it contains obnoxious clauses'.[66] His solicitors obviously counselled in favour of petitioning. Winder responded that it would not be prudent to petition the Bill, given its favourable reception within Sheffield.[67] He suggested that the Duke should instead oppose the unacceptable aspects of the Bill in the House of Lords. Some negotiation with the promoters ensued, because the Letter Books contain (unusually) the original of a letter from the SDR Company asking for the opportunity to lay their plans before the Duke, as the scheme had taken a different position since the Council gave its support. The promoters added that they knew the Duke had the good of Sheffield at heart.[68]

The Duke found his personal and public interests in conflict. Having taken Few and Co's advice to petition the Bill, he appeared before the 1896 Select Committee in his public capacity as Mayor of Sheffield, and privately as a large landowner along the route of the railway.[69] On behalf of the Council he supported the scheme.[70] His private petition had pointed to the proximity of the competing MSLR and said that 'no public advantage would be gained by [the SDR's] construction at all commensurate with the inconvenience and injury which would be caused thereby to your petitioner and his tenants'. The Duke told the Committee that his private concerns had been met (presumably by compensation), that he could now 'allow the public interest to prevail', and that his petition had been withdrawn 'wisely' and 'very properly'. Nevertheless, the barristers opposing the SDR gave him an embarrassing time.[71]

Initially the Duke said that the Estate and its tenants would be injured by the SDR, even though Firth's (until recently his tenants), and other substantial companies including T.W. Ward, Jessop's and the South Yorkshire Engine Co.

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[64]P19, 332 and 333
[65]P19, 336
[66]ACM/LB/Z/55, 19 Feb. 1894
[67]ACM/LB/Z/56
[68]ACM/LB/Z/98
[69]SCSDR, M.ofE., HL1896, Q.381
[70]Not very effectively - he does not seem to have been well briefed on its specific benefits
[71]Ibid., QQ.425-30

were amongst the Bill's promoters,[72] and Brown's (another former tenant), Hadfield's and Vickers sent witnesses to support the Bill in Committee.[73] His narrow interests relating to land taken and compensation must have weighed more heavily than the wider political implications, but the Duke cannot have been comfortable in this position, as his demeanour before the Committee suggests.

i. Railways Proposed by the Estate

The Agents did try to give rail access to land they wished to open up for industrial development. In October 1871, Marcus Smith sent to the MR Company a plan 'showing the scheme referred to by me of a branch line of Railway from lands on which extensive Works will be erected' (Figure 10.8). To carry out the project, the Midland Company would need to build arches over the Head Goit of the Attercliffe Forge Works and under the new Chesterfield Extension. Smith told the Company that 'in making provision for schemes of this kind on the Duke of Norfolk's Estate it is needful to look ahead to what may be required'. Had the Railway Company been interested in the branch line, the Estate would have reserved land for it.[74] The plan shows the branch running from the Midland main line, south eastwards over the Don to serve land around the projected Stevenson Road in Attercliffe, which was later occupied by the SDR's Attercliffe Goods Station.

The railway company assumed the Estate was offering to pay for the branch line. Smith explained that this was not what he had in mind:

> This line will, I have no doubt, be a feeder to the M.R. and although it will be made to give accommodation to lands belonging to the Duke of Norfolk I did not intend that his Grace should do more than give the land and afford facilities for making the railway. If the manufacturers on this land be not connected with the Midland Line they will endeavour to be taken up by the M.S. & L. It will be too late to scheme a line when the land is occupied with Buildings and therefore I wish to look ahead ... [75]

With the Chesterfield Extension open since February 1870 it was too late to scheme a line on this route, since it would have involved closure of the main line to install bridgeworks over the local branch. The branch was never built and a factory was developed on the site from which the line would have started.[76] Even

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[72]Barnett, 1984, 33-6
[73]SCSDR, M.ofE., HL1896
[74]ACM/LB/K/329-31
[75]ACM/LB/K/354
[76]PRO/MPS/5/274

so, the attempt to plan this line shows that the Estate had accepted that '... districts divided and confined by the railways tended to be cast finally and irretrievably into the now familiar mould of coal and timber yards, warehousing, mixed light and heavy industrial users, and fourth rate housing'[77] and was exploiting it to the full.

Another case where there were perceived benefits to the Estate from railway improvements arose in February 1881, when the Duke's Trust was asking the MSLR to put up a passenger station at Neepsend 'for the accommodation of the inhabitants of Nether Hallam' - the initiative came from the Estate, not the railway company.[78] Once more we see the imperative of perceived benefits to the Estate driving decision making. In this instance it is doubtful whether the Estate benefited in practice. Certainly the small group of streets immediately to the south of the station are shown as largely developed on the O.S. base used by the SDR[79] and the 1906 OS map, but this was a cramped area close to the river and a Gas Works where most of the housing was built specially for railway workers from the 1860s.[80] The Old Park Wood remained undeveloped and Bacon's Plan of Sheffield (1910) shows smallholdings still unbuilt on by the riverside next to the Toledo Works in Neepsend Lane.

ii. Acquisition of Land by the Railway Companies

The railway companies were major land users. Much of their activity took place on Norfolk land. The unit size of many land purchases by the railway companies was greater than those of the steel manufacturers on the Norfolk Estate. Unfortunately the Letter Books to which the author had access did not contain a complete record of all transactions with the railway companies - those with the S&R pre-date the books, as do the majority needed to allow the SAMR to get underway in 1838. Those which do occur show the railways were important both as outright purchasers and tenants. Examples are shown in Table 10.2.

These purchases and leases represent only the tip of the iceberg of railway acquisition of Norfolk land. Apart from the permanent way itself, the Park, City, Nunnery, Queens Road and Attercliffe Goods Stations and Depots were also built on the Estate, as was the Wicker Goods Station, the original site of the S&R terminus. Together with the Attercliffe and Brightside Sidings and the canal basin, the Estate provided the land for most of the terminal facilities in Sheffield

[77]Kellett, 1969, 293
[78]ACM/LB/P/881
[79]Ibid.
[80]Lodge 294.03, 1988

which were not exclusive to particular manufacturers. Thus it was not only an important supplier of land to production facilities, but also to the distribution networks which enabled them to trade. In addition to the main line railways, there were also the Duke's own railways serving the Sheffield and Nunnery collieries - yet another contribution to the land take of the distribution sector.

The development of the railway system was, then, interwoven with the development of the Norfolk Estate. The benefits which could be reaped from exploitation of the new transport technology were appreciated quickly. The financial interests of the Estate were pursued single mindedly to gain full advantage from the railways. Where railways did not enable industrial development, they were themselves a source of direct income. Projects such as the SDR might be seen to have disadvantages. Yet the strength of the Duke's position as a landowner and peer ensured that he would receive adequate compensation in return for withdrawal of his opposition. This power was subject to far more external influence by the end of the century, as pressure grew on the landed aristocracy to take a more civic view of their responsibilities. In many ways, though, it was the railways which transformed a rather unprepossessing, marshy district with minimal value to the Estate into urban development land with the potential to become an economic powerhouse for the Duke and the town. Viewed in this light, the symbiosis between the traditional aristocratic landowner and the brash new railway companies is easy to understand. Much credit must go to Michael Ellison for grasping the possibility that disbenefits brought by the railways through greater competition for the Duke's coal could be counterbalanced by using the same vehicle to create a market for urban land where none existed before. Although his son told the SCTH that the Estate was dealing with building land in Attercliffe before the S&R opened[81] we saw at the beginning of this section how willing he was to acknowledge the role of the railways in improving suburban land values. Even if the railways kept down central rents as Offer suggests,[82] (and Kellett's view is that the effect on the central property market was more complex[83]) this would have mattered less to an estate where ground rents were already fixed in the central area by long leases than the opportunity to receive increased grounds rents from new leases in suburbs where the railways had created development potential. With no pretensions that the East End could be turned into a quarter of genteel residential squares or Arcadian suburbs, the railways allowed the Estate to reap the rewards of industrial development with its associated transport infrastructure and working class housing.

[81]SCTH, M. of E., PP1888XXII, Q.7708
[82]Offer, 1981, 105
[83]Ibid., 323

4. Did the Estate Hoard Land for Industry?

Laying out streets is a relatively neutral planning activity and many street forms can accommodate a range of land uses. Even though the size of the street grid in Brightside and the fact that the Estate controlled how sites were used is suggestive, it was felt worthwhile to see if there was further evidence to show that this part of the Estate was being developed deliberately for industry.

In Chapter 6, forward planning of water supply specifically to serve industrial development was reported. In the sections of this chapter on street layout and railways the Estate is shown planning to enable land to come into industrial use. It must be beyond doubt, then, that from an early date there was a specific intention to plan the Estate in the East End to attract industry.

The Estate reserved land for larger industrial undertakings in two ways - reservation by companies of plots of land for later expansion; and holding back sites from the market speculatively for big companies. The first crops up in a letter in June 1849, where the Agent tells an enquirer that:

> I could not give you a satisfactory answer without first seeing the parties who had the refusal of a large plot of land on the North West side of the railway and deemed it better to defer writing to you till I should have their decision. They have now decided to take the whole plot applied for.[84]

In May 1850, Beet and Sons agreed to take a lease of land which had been reserved for Spear and Jackson. Spear and Jackson were paying an agricultural rent to secure the right of first refusal on the land.[85] Beet's were allowed to occupy part of their new property at a farming rent until they wished to build, when the residue of the valuation was due.[86] In Princess Street in October 1853 the Estate agreed to keep back 600 sq.yds. until July 1856, but with rent payable during the reservation period.[87] In July 1863, the Estate sent a sketch of available sites near Brown's works.[88] In October the Agents wrote again asking Brown's to give a decision so they could 'attend to the applications of others',[89] suggesting that land was being retained speculatively for the larger industrial undertakings even when it was not formally reserved. Firth's had the benefit of

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[84]Ibid.
[85]ACM/LB/B/370, 410 and 648
[86]ACM/LB/B/374 and 388
[87]ACM/LB/D/462
[88]ACM/LB/G/27 July 1863
[89]ACM/LB/G/217

similar treatment in March 1885, when they were told that:

> In fixing the price of the 1,400 yards of land in Savile Street East for which you have applied at 6d per yard I had taken into consideration your present tenancies under the Duke of Norfolk. I think the price asked a reasonable one as the land could easily have been let at 6d to several applicants had we not thought it right to reserve it for the accommodation of some of the large firms in the neighbourhood ... [90]

Elsewhere we saw that land was set aside for the MR for their Chesterfield Extension, even though the project was still at a fairly tentative stage. An application for a site was refused in December 1898 because the navigation company was entitled to first preference.[91]

The Estate was, then, content to see land stand undeveloped to enable it to pursue its intention of achieving large scale industrial and infrastructure development in Brightside, though not all railwayside land was leased in large plots direct to manufacturers. 864 sq.yds. next to the Midland Railway was let to James Sykes, Railway Contractor, on the corner of Carlisle Street and Hall Carr Street in 1849 at a rent of 6d per sq.yd.[92] An adjoining piece of land went to a Mr. W. Fretwell Hoyle, Gentleman, of Rotherham for the same rent in 1857.[93] A mason took 356 sq.yds. in Carlisle Street next to Sybry, Searles and Co. on the railway in 1860[94]. These were, however, isolated incidences compared with the overwhelming tendency to grant railwayside leases to large scale industry.

i. <u>Choice of Sites</u>

a. <u>How the Estate Handled Applications for Land</u>

There was often correspondence about industrial land, but the Agents' practice when dealing with applicants was not consistent. When Firth's agreed to buy their freehold in April 1891, the terms were concluded at a meeting and the subsequent letter did not repeat them.[95] On the other hand, Cammell's dealt with the matter by letter.[96] The Agents generally prepared the lease for a property[97] and may therefore have felt that further correspondence was superfluous for simpler leases. For industrial properties until at least the mid

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[90] ACM/LB/R/364
[91] ACM/LB/AC/748
[92] ACM/S384
[93] ACM/S612
[94] ACM/S612
[95] ACM/LB/V/365
[96] ACM/LB/X/95
[97] ACM/LB/C/474

1860s it was the usual practice to set out the main (and sometimes all) terms of the proposed lease. In December 1880, an applicant for land was informed that all applications now had to be dealt with in writing and signed by the applicant, suggesting a formalisation of the process.[98] Around the same time, shops in the new Corn Exchange were being let by formal tender.[99] However, it is not clear how far this more structured approach was adhered to. In March 1894, Winder wrote to a Mr Bovill who had applied for land for an omnibus and cab business, inviting him to visit the Estate Office in the Corn Exchange because:

> ... it will be only waste of time to write letters in an enquiry of this kind - a good deal of information probably being necessary on both sides before any proposal can be made.[100]

b. <u>Freedom to Choose Plots of Land</u>

The evidence suggests the Estate hoped that demand from large firms would push up land values. Efforts to plan ahead for water supply and rail communications had similar objectives. This profit driven land use 'planning' was associated with a wide degree of market choice about the size of sites and the precise location of the plots which companies could take. To a degree the location of available sites was determined by the way in which the Estate progressed the laying out of roads. Once a road was projected, though, applicants for land were given every opportunity to specify what they wanted. Cammell's were sent a sketch of land on the north side of the railway opposite their works in June 1848, and were told the Agents would stake out whatever area they wanted.[101]

Jas. Sykes was offered the choice of several plots around the Wicker railway station '... provided such land be required and used for purposes not objectionable to his Grace'.[102] Mappin's were advised in September 1850 that 'The width of the plots adjoining Savile Street East is 42 yards and you may take any frontage you think proper',[103] making it clear that there was a minimum parcel size which the Estate considered it appropriate to lease but that beyond that, purchasers were left with freedom to pick the plots they thought best suited to their business. The Agent wrote to another applicant in October 1850:

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[98]ACM/LB/P/202
[99]ACM/LB/P/607, 1 July 1881
[100]ACM/LB/Z/88
[101]ACM/LB/B/65
[102]ACM/LB/B/192, 7 June 1849
[103]ACM/LB/B/459

> Before the plot of land you wish to take in Savile Street East be set out, I should wish you to point out the precise situation in which you will take it. When I saw you on the subject you had several sites under consideration.[104]

Again in January 1854 the Agents communicated with a Mr. E. Hadfield:

> The Duke of Norfolk's Estate lying between the Sheffield Canal (near the Park Iron Works) and the Manchester, Sheffield and Lincolnshire Railway I have laid out for building upon and I send you a sketch showing the arrangement for such purpose. On this sketch Mr. Hewett can mark out what land his Client will require.[105]

Housing sites were also sold in minimum plot sizes in some areas, such as Norwood Road where the smallest available measured 1,200 sq.yds. in December 1881.[106]

5. <u>The Control of Industrial Development on the Norfolk Estate</u>

The Estate's attitude to planning was minimalist and pragmatic. The objectives were to open up land for development in the most efficient manner and to ensure that some basic but not very demanding environmental standards were observed.

i. <u>Control of Development and After-Use - Terms of Building Agreements and Leases</u>

On any estate which is developed under the leasehold system the potential exists for the landlord (or indeed subsidiary lessees) to attempt to control the way their land is developed and used through covenants. There are limitations on how effective covenants can be. The attitude of the Courts to the reasonableness of covenants, and the willingness of the landlord to try to enforce obligations both affect their efficacy. Covenants only bite once the lease is granted. Stronger control is available if the landlord witholds the lease until the development is finished. The Estate appears to have done this in some instances.

In the few examples from the Letter Books where written terms for housing development are stated, these do not seem to go much beyond confirmation of the term, the rent and site area, and an obligation to use the land to build houses.[107] For larger industrial properties, however, a more formal system was

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[104]ACM/LB/B/480
[105]ACM/LB/C/474
[106]ACM/LB/P/811
[107]E.g. ACM/LB/A/278 - land in Shoreham Street, 13 Feb. 1848; various correspondence in subsequent letter books, notably LB/D

used, with a letter from the Estate setting out the terms on which a lease would be granted, often accompanied during Marcus Smith's tenure by a plan identifying the land to be leased. From these letters we can ascertain the usual covenants imposed by the Norfolk Estate on industrial property in the East End.

The first such letter is addressed to Firth's, dated 7 February 1850[108] and refers to the site of the Norfolk Works next to the railway and Spear and Jackson in Savile Street East. The terms were:

- a 99 year term, commencing from Lady Day 1850;

- the lessee to pay:
  . rent of £65.0.0d per annum;
  . 1/6d per lineal yard of frontage for edge stones and setting;
  . 4/- per lineal yard towards the cost of the common sewer;
  . not exceeding £8 per acre to the present tenant of the land;
  . £70 towards the cost of a conduit serving the works;
  . a contribution towards the cost of maintaining the conduit;
  . 3/- per horse power per annum for the use of water;

- Unused water to be returned in pipes to the Don above Royd's weir;

- iron pipes to be laid in the street by the tenant to return water;

- the tenant to pave a 10 foot wide footway in Savile Street East for the length of the frontage.

Similar conditions occur in all subsequent letters stating the terms for industrial leases. A letter to an applicant for land in Brightside in January 1854 refers to 'the Covenants and Conditions usually inserted in the Duke of Norfolk's Leases granted of plots for manufacturing purposes',[109] showing that conditions were indeed standardised. Another letter to an applicant in February 1854 enclosed '... a draft lease adopted in ordinary Leases granted by the Duke of Norfolk - but of course where special provisions are needed these are introduced',[110] confirming the point.

In July 1853, the first example of a new covenant appears in the terms of a lease to be granted to Wilson Hawksworth and Co. in Carlisle Street East, requiring them:

> To set aside apart along the side of the Railway a space 20 feet wide for the purpose of a siding such space to be used by the lessees and others for such purposes only.[111]

[108]ACM/LB/B/308
[109]ACM/LB/C/474
[110]ACM/LB/C/497
[111]ACM/LB/C/294

The Estate continued to protect the potential for railway access in this way in subsequent draft leases on railwayside land, demonstrating conclusively that there was a strong perception that direct connection to the railway was a valuable asset. In later leases, the width of the reservation was reduced to 18 feet and the covenant reworded so that the space was 'to be used by the Duke of Norfolk and his lessees for such purpose only and no compensation to be claimed by the lessee'.[112] The inference is that in the limited area between the works on either side of the Midland Railway, the Estate was trying to secure space for sidings which would be available for common use by all its tenants.

The same draft lists other terms which do not appear in previous correspondence, but which were certainly applied generally. These are:

- An obligation to spend £1,500 on buildings within 5 years. This was a covenant often applied on leasehold estates and helps to answer the question of whether lessees of Norfolk land could speculate by purchasing it and selling it on without building on it. Clearly, the Estate's intention was to avoid this by requiring building works to take place. Specifying a minimum value for the works would help to ensure that the long term value of the wider estate was maintained and establish a potentially attractive reversionary value. A similar clause was required of Benjamin Huntsman in April 1859 for a site by the canal in Effingham Road. Interestingly, Huntsman had the choice of a 99 year lease and the obligation to build £1,500 worth of buildings or a 21 year lease with £400 worth of (presumably) less permanent structures,[113] demonstrating that the potential reversionary value was a key element in the motivation for imposing this covenant. Later draft leases also include this requirement - for example a proposal to Brown's in Effingham Road in November 1867, where buildings worth £2,000 were demanded.[114] A similar provision was made in residential leases. An applicant for land in Norwood Road was told in December 1881 that 'houses of not less value than £1,200 will be required to be built'.[115]

- An obligation to fence and wall the land with brick and stone walls 8 feet high.

[112] ACM/LB/E/685 - terms of draft lease to J.H. Sales, Coal Merchant, Carwood Lane, 20 July 1860
[113] ACM/LB/E/281
[114] ACM/LB/I/328
[115] ACM/LB/P/811

- An obligation to keep buildings repaired.
- A requirement to allow the landlord to enter and inspect the property.
- An obligation to quit the property at the end of the term.
- A covenant not to carry on offensive trades.

It is improbable that the lease to Joseph Sales represents a turning point in the terms of leases. It is more likely that this and subsequent letters simply document proposed terms more completely. 1860 was the year of Michael Ellison's retirement. It seems consistent with later practice that his son would include more detail in correspondence on such matters. A set of Heads of Terms sent to Brown's in September 1860 includes these covenants and adds provisos for re-entry at the end of the term and to prevent assignment of the lease.[116]

Thereafter, the standard clauses did not change much until January 1864, ten years after the introduction of the Smoke Bye-Laws, when a draft lease to Chas. Atkinson of the Fitzalan Works insisted that the tenant was 'to erect (Steam?) Engine Chimneys of not less height than 50 yds'.[117] Again, this seems to have become a standard obligation - in two draft leases of land in Carlisle Street East/New Hall Road and Kenninghall Road in May 1870, Brown's had to undertake:

> To erect Steam Engine Chimneys of not less height than forty yards and to convey the smoke from all the furnaces to be used on the ground into Chimney stacks to be built of a not less height than fifteen yards above the edge stones on Carlisle Street.[118]

There must have been negotiation about the height of these chimneys. The draft lease in the Letter Book originally required the Engine Chimneys to be 50 yards high and the Furnace Chimneys to be 17 yards, but both figures were struck out and lesser heights substituted. This covenant does not appear in earlier draft leases. Given the importance and size of the obligation it seems probable that this was a new covenant. One assumes that it was added to the standard list in a belated attempt to control the smoke nuisance being caused by the Duke's tenants.

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116 ACM/LB/E/741-2
117 ACM/LB/G/374
118 ACM/LB/J/474-8

It is surprising that there is no mention of covenants requiring properties to be used for a specific purpose. Nor is there a clause forbidding sub-letting. It seems probable, however, that these omissions are due to shortcomings in the correspondence. In two letters to Cammell's in February 1851, the Agent referred to a clause prohibiting sub-letting, and also said that the use to which the premises were to be put must be specified in the lease.[119]

There were, of course, occasions when the standard clauses were not sufficient or appropriate. To enable Brown's to connect two parts of their works separated by a public street the Estate laid down conditions about how a tramway might be laid out and operated across the road.[120]

Restrictions on industrial leaseholders were not onerous in the East End. Even when controls on smoke emissions were introduced they were not designed to limit production, only to ameliorate effects on surrounding property by discharging smoke higher in the atmosphere. Most covenants are those one would expect on an estate seeking to protect the value of reversions, secure the cost of laying out new streets and sewers and ensure its property was developed promptly, accruing value to the estate rather than speculators. The covenant preventing the carrying on of offensive trades does not seem to have restricted the steel industry in the East End unduly, though as we saw in Chapter 6, some industrialists were concerned that they might be impeded by this type of limitation. In the next section we will see that the covenant was enforced in Highfield, but normally the Estate seems to have put few obstacles in the way of industrial development and operations through its leases.

ii. Enforcement of Covenants and Controlling Nuisances

Covenants in leases are only important to the extent that they are enforced, or at least perceived by the tenant as likely to be enforced. This is significant for industrial tenants. As discussed in Chapter 6, the ability to carry on a business without controls over pollution and nuisance was regarded as a valuable asset. Where a freehold could not be obtained, land upon which covenants relating to nuisance and building obligations were minimal and/or not enforced vigorously would be attractive to industrialists. Tenacious application of such covenants would be a deterrent to industrial location.

By the time of the hearings before the SCTH, there appeared to be a strong

[119]ACM/LB/B/567 & 572
[120]ACM/LB/C/585

perception that the Duke's Agents were not doing enough to enforce repairing covenants. The example used was insanitary residential properties in the Park.[121] Ellison Junior told the Committee he had 'some of the surveyors going over the property continually' to check on its condition.[122] His policy was to enforce covenants when necessary, but he would not do so if somebody's home or livelihood might be put at risk.[123]

If the Estate was not especially punctilious about enforcing repairing covenants on residential properties, was it concerned about other types of covenant or other sorts of property? The Letter Books do not contain many letters dealing with enforcement. Those that appear suggest the Agents were prepared to step in where the value of the wider Estate was likely to be affected, or neighbours of a property in breach of covenant had complained. Where action was taken, the ultimate sanction of forfeiting a lease does not seem to have been used, probably because of the cost and uncertainty of achieving a judgement against a tenant, though leases on uncompleted developments might be withheld. Moderation of, or compensation for the nuisance, rather its removal seem to have been preferred solutions.

In a few cases a tough line was taken. A group of semi-detached houses in Burngreave was being erected in March 1857 without plans having been submitted to the Estate Office for approval. Michael Ellison wrote to the builder to say the Estate was withholding the lease until the houses were demolished and rebuilt at the distance from the road which Ellison had stipulated.[124] He was equally forceful in requiring that houses should not be used as beerhouses in breach of covenant.[125]

In general, however, a more relaxed approach was adopted. In May 1862, Marcus Smith noticed that building work had started on an extension to the Atlas Works and wrote to remind Brown's of covenants requiring them to do works to the sewer and roadway, which they were ignoring.[126] This principle of polite reminders seems to have been applied throughout the century. In August 1880, Edmund Winder wrote to a tenant that:

> Complaint has been made to Mr. Ellison of injury and annoyance caused by a low Engine-chimney on your premises in Sheaf Street

[121] SCTH, M. of E., PP1888XXII, QQ.3511 et. seq.
[122] Ibid., Q.7825
[123] Ibid., Q.7821
[124] ACM/LB/D/711
[125] ACM/LB/D/769; ACM/LB/N/926
[126] ACM/LB/F/589

[Highfield]. Such complaint having been made Mr. Ellison is obliged to take notice of it. He hopes however that it is only necessary to call your attention to the clause in your lease which provides that no damage nuisance or annoyance shall be caused by any thing done on your premises to any tenant of the Duke of Norfolk in order to have the cause of the complaint removed.[127]

Properties in Highfield seem to have been subject to stricter controls on smoke emission than those in Brightside. The use of steam engines in Highfield was forbidden by covenant, and the covenants were taken seriously by the Estate. In July 1863 the Agents wrote to a tenant to say that:

> When you called on me ... asking if the Trustees of the Duke of Norfolk will permit a small Steam Engine of 3 or 4 horse power, constructed to consume its own smoke, to be placed on the ... Columbia Works adjoining Suffolk Road I stated that although by the Lease ... no steam engine can be put down without the consent of the Landlord I saw no objection to ... giving consent to waive the operation of the covenant ... to the extent of an engine not exceeding 4 horses ... [128]

Clearly a small engine which consumed its own smoke was acceptable where a larger smoke generating machine would not have been. This policy of control through covenants continued at least until the 1880s. In 1882 Sebray Hall & Co. asked for an identical covenant forbidding the installation of a steam engine at their premises in St. Mary's Road, Highfield to be waived. The application was not entertained by the Agents.[129] In 1885 another tenant was told that:

> I have considered your application to be relieved from the (?) of the covenant of your Shoreham Street works which prevents your setting up of a Steam Engine, with (?) desire to meet your view (?) regret that I cannot see my way to do so. My view (expressed to you at our interview) that the failure of the 'Oto' gas engine you have (?) used was owing to the work required from it being beyond its power, and in the course of my enquiries have confirmed.[130]

Other forms of nuisance such as noise may have been seen as less offensive than smoke. In 1856 Marcus Smith wrote to a tenant in Princess Street to complain that:

> The person owning the property adjoining yours in Matilda Street has made a representation that his property is much injured by the working of the Machinery on your premises. I was surprised to learn from him that you have put down troughs for heavy Grinding and this contrary to the promise you made that you wished the Ground for the erection of a Silver plating establishment. Had I supposed the Land would have

[127]ACM/LB/P/21
[128]ACM/LB/G/173
[129]ACM/LB/P/849 & 853
[130]ACM/LB/R/31 Aug. 1885

> been thus applied you should not have had it for such purpose. It will be necessary to make an arrangement with the person who considers himself injured.[131]

Although the Estate was obviously trying to control the type of industrial use in Highfield to ensure that offensive trades were not carried on, there was no attempt to terminate the unsanctioned grinding. The compensation of the injured party was seen as adequate recompense for the breach. A similarly accommodating line was taken with Bessemer's in Brightside in December 1857:

> Some of the Lessees of the Duke of Norfolk possessing Cottage property opposite the works now erecting by you in Carlisle Street East have memorialised Mr. Ellison and asked his interference to prevent you creating what they think proper to designate a nuisance. These parties referred to contemplate an injury to their property by the placing of 'Tilts and Forges' near the same. It would seem to me that the objections may be overcome by your fixing these by the side of the Railway instead of adjoining the Street.[132]

There was no question of preventing the setting up of the tilts and forges; rather an attempt only to ameliorate their effects.

The East End must have been regarded as less sensitive to nuisance than Highfield. In 1881, for example, Brown's were allowed to deposit spoil on land adjoining Carlisle Street East, provided they would remove it when required by the Estate.[133] This is interesting not only because it shows that the Estate was prepared to tolerate what was probably a fairly unsightly land use in a main street, but also because it demonstrates that even in the last quarter of the century, pockets of land were available (albeit temporarily) in a relatively densely developed industrial area for secondary land uses. However, the Agents could be sensitive to the environmental effects of some forms of waste matter. In February 1870, they proposed to the Council a site for a night soil depot in Lumley Street between the canal and the MSLR This was put forward as an alternative to the Council's first choice in Acton Street because the latter would have caused too much nuisance to neighbouring properties.[134]

It seems, then, that some parts of the Estate were regarded as more suitable for trades producing heavy pollution than others. Smoke also seems to have been perceived as a more significant problem than other forms of nuisance such as noise or spoil heaps. Highfield to the south of the town centre was seen as a

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[131]ACM/LB/D/336
[132]ACM/LB/D/964
[133]ACM/LB/P/626
[134]ACM/LB/J/350

higher quality area where smoke generation was to be kept to a minimum and industrial processes limited to those which did not cause major disturbance. Limits on power generation were designed to ensure that industry in Highfield remained small in scale. The Estate's attitude to enforcing the covenant against large steam engines helps explain why no large scale steel manufactory was set up in Highfield after the railway arrived in 1870.

Although the Estate was sometimes lenient with industrial tenants, other parties could cause problems which the Agents could do nothing about. In March 1865 this led Marcus Smith to take a tough line with Messrs. Eadon for not paying for some conduits. He asked his lawyers to:

> ... recollect these are the parties who were so nasty with Messrs. Thos. Firth & Sons with regard to the placing of steel hammers on the premises of the latter - and from whom they received a large sum of money.[135]

The causus belli was the series of court cases brought by manufacturers claiming damage to their equipment from vibration caused by Firth's installation of two Nasmyth hammers in their West Gun Works in 1863.[136] These machines upset the neighbours but the Estate apparently took the side of its larger tenant.

Restrictions imposed by the Estate were, then, greater in the Sheaf Valley than the Lower Don Valley and this resulted in a different emphasis in the types and scale of industry which located in these places. However, the encouragement and forward planning by the Estate of the urban infrastructure needed to support manufacturing ensured that Norfolk land in Brightside offered a supportive environment for the extension of the steel industry up to the end of the 1860s.

6. Steel Works and the Development of Urban Land

i. Incremental Development

Figure 10.9 and the catalogue of leases and offers of leases to Firth's, Brown's and Cammell's in Appendix 4 show that development of the great manufactories on the Norfolk Estate was an incremental process. Works were built up on a series of leases over decades, as demand for production and storage space fuelled demand for land. As they expanded, they jostled for space alongside the railway

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[135] ACM/LB/G/994-6
[136] Tweedale, 1986, 33

and on streets surrounding their initial location. Although the Estate was reserving land for the large companies speculatively, it was left to the market to determine which of the big companies leased particular plots. This meant that the rational expansion of sites on land adjoining the original factory was not always possible. Moreover, except in the case of Kenninghall Street (see above) the street pattern laid out by the Estate looks to have imposed rigid boundaries on the land available for extension. Even though the original objectives of moving to Brightside for firms such as Brown's included the need to bring together production from a number of factories, companies found themselves operating again in fragmented works, intersected by public streets and a major railway corridor (which itself consumed land for sidings). Given the variety of different processes undertaken by the steel manufacturers this may not have been as inconvenient as it now appears, since different technologies or products could be associated with different parts of the plants. However, the companies which moved to the East End only slightly later in the century leapfrogged over the Norfolk Estate onto much larger sites on Fitzwilliam land - as in the case of Vickers' move to the River Don Works in 1863 (see Chapter 6). This process reached its logical conclusion with Hadfield's establishment of the East Hecla Works in the 1890s (see Chapter 6) and the building of Templeboro' Steel Mills during World War I.

ii. Industrial Land Values

The second feature of the evidence from the Letter Books is the changing value of industrial land over the years. More will be said of this in the next chapter.

iii. Scale of Steel Works

The third item of interest is the size of the plots which the steel companies were leasing. Of the total database of applications, offers, leases and sales, there were 1,853 occurrences which mentioned the plot area. 217 of these came from districts lying beyond Sheffield proper by the end of the nineteenth century.[137] The remaining 1,636 records from Sheffield were analysed to give a frequency distribution by size, set out in Table 10.3 along with the distribution of the 217 other occurrences and the total distribution of all the records which included a site area. Figure 10.10 shows the distribution graphically.

The figures show a strong bias towards smaller plots on Norfolk land in Sheffield.

[137] Bradfield, Chapeltown, Darnall, Ecclesfield, Greasboro', Grenoside, Handsworth, Malin Bridge, Oughtibridge, Ringinglow, Rivelin Valley, Shire Green, Stocksbridge (Mortomley), Treeton, Wadsley Bridge and Whiston

Just under half the sites (47.6%) measured 500 sq.yds. or less. 84.85% were 1,500 sq.yds. or less. Only 6.5% were bigger than 5,000 sq.yds. (1,522 sites were less than one acre, representing 93.0% of the data). This distribution looks rational when compared with Aspinall's analysis of building project sizes for the whole of Sheffield. He found that 50.1% of all projects (from a total of 9,295) consisted of only one or two houses, with a regular decline in numbers thereafter except for a small peak of projects comprising 20-29 houses.[138]

The contrast between the general scale of the Norfolk land market and the leasing activities of the steel manufacturers is very marked. Only six of the sites leased or considered by Firth's, Brown's and Cammell's (see Appendix 4) measured less than one acre. Only three measured less than 1,000 sq.yds. Two of the six small sites were not taken by the company to which they were offered. The leasing of large sites did not apply only to the biggest producers. Many other firms also leased, or investigated leasing big areas of land, especially alongside the railway. The main feature which distinguishes these undertakings from Firth's, Cammell's, Brown's, Hadfield's and Vickers is that they did not continue to expand and take further land in the Lower Don Valley on the same scale and at the same pace as these giant producers. Examples of such firms are given in Appendix 5. Of course, not all industrial sites, even on the railway, were large. However, most of the railwayside works set up in the 1840s and 1850s, and many of the other works in Brightside, Attercliffe, Neepsend and elsewhere were let in units far in excess of normal leaseholds on the Norfolk Estate of the period.

The fact that the steel companies were usually in a direct tenurial relationship with the Dukes tends to support the view that big manufacturers preferred to have the longest tenure they could obtain.[139] For the large steel companies, this relationship also meant that ground rents represented the initial market price they would have to consider when deciding whether to locate on the Norfolk Estate. This becomes important when considering the significance of land costs in the production function. For the manufacturer, it undoubtedly represented an economy, since it obviated the need to make a payment to an intermediate landlord or speculator. The position of firms taking over existing sites or premises would have been rather different. Though we saw above that Brown's thought they had obtained their first works at a knockdown price, due to a forced sale on the bankruptcy of Armitage, Frankish and Barker,[140] it is also conceivable (indeed probable) that in some cases it would have been necessary to

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[138]Aspinall, 1977, 9
[139]C.f. Kellett, 1969, 333-4
[140]Tweedale, 1986, 15

pay a premium to the existing lessee before a company could take the assignment of a lease. No evidence was found to confirm or deny this on Norfolk land,[141] but land hungry giant producers with the imperative to expand would probably have been prepared to pay such premiums. Most land, though, was taken in an undeveloped state from agriculture.

Whether economies of scale derived from this direct tenurial relationship is doubtful. Larger manufacturers were in a good position to bid for big sites direct from the Dukes, but there is no evidence that the Estate was prejudiced against smaller lessees. The Dukes were seeking large scale development by the railway to make the most out of the locational advantages of these sites for industry. Nevertheless, there was flexibility about the size of sites within the larger scale range which applied to development alongside the railway and on nearby streets. At the same time the Estate speculated in rising land values by reserving land by the railway for later development. This would have eaten into the price advantage of dealing direct with the Dukes and into any economies of scale.

[141]But see Chapter 12 for evidence from J. Edgar Allen's

Addendum: Additional information about the estate management practices and policies of the Dukes of Norfolk's Sheffield Estate

In 1997 the author was preparing an article based on this thesis (R.T. Simmons, "Planning and industrial development – the Norfolk Estate, Sheffield, 1800-1900", *Planning Perspectives*, Vol. 12 No. 4, October 1997, 403-32). Visiting Arundel Castle to check whether any additional light could be shed on the Dukes' estate management practices and policies, a letter from the Agent to one of the Dukes and some collateral information were found. This addendum contains the author's conclusions about this additional information. So far as possible the addendum is written to avoid repetition of what is already in the thesis, but some duplication has proved necessary to provide a coherent context for the additional information.

Richard Simmons
April 2013

The Dukes and their Land Agents

Five Howards held the Norfolk title during the nineteenth century - the eleventh to fifteenth Dukes. As Earls Marshall of England, essentially rural nobles and protagonists in national political or religious affairs, the Sheffield urban estates held little interest for the first four. In the late eighteenth century the ninth Duke had begun a 'grand but unrealistic plan' for a suburb of elegant streets and squares in Alsop Fields just south of the town centre [[1]]. Even under the vigorous Land Agent Vincent Eyre, progress had been patchy. The scheme was abandoned by the 11th Duke (who succeeded to the title in 1786), with the streets laid out on a characteristic grid, but developed for commercial and industrial uses and moderate quality housing rather than the emulations of fine Bath or Dublin terraces which Eyre had envisaged [[2]]. A series of Estate Acts allowed the properties to be sold. According to a later

Agent, these sales were to pay for improvements to estates in Surrey and Sussex [3], but Sheffield opinion held that it was pressure from manufacturers and merchants for 'a more general diffusion of real property' which persuaded the Duke to part with freeholds [4]. Certainly it seems that the sales were at especially low prices [5] and the tension between Sheffield's manufacturers and their landlord was to have resonances later in the century. With the abandonment of Alsop Fields the 11th Duke adopted a 'laissez-faire' attitude towards estate development which was perpetuated by his three successors [6].

Eyre was active until at least 1812. His successor John Housman does not seem to have possessed great foresight, writing to one of the Estate's lawyers in 1819 that 'It is possible, though I still think it is hardly within the range of probability, that the town under almost any circumstances can be expected to extend half a mile in twenty years' [7]. Housman died the same year.

The next Agent, Michael Ellison (hereafter Ellison Sr.), was the son of the Steward of the Howards' Glossop Estate. He learnt his profession there, then on the Petre Estate, Ferrybridge, Yorks., and on the Norfolk Estate at Worksop from 1816-19 [8], coming to Sheffield when he was 32. Ellison remained Agent at Sheffield until his retirement aged 74 in 1860 [9], taking on management also of the Glossop Estate when his brother became ill during the 1840s [10], handling the sale of the Worksop Estates to the Duke of Newcastle [11] and producing valuations and reports for the Dukes across their other estates [12]. From 1834, Ellison Sr. was assisted by his son, Michael Joseph Ellison (hereafter Ellison Jr.) who became Land Agent when his father retired. The Agents employed a number of staff [13]. The most senior, Marcus Smith, was made Joint Agent with Ellison Jr. from 1860 until the former's death in December 1871. Thereafter, Ellison Jr. acted as sole agent, supported by Surveying Clerk Edmund Winder, who had been with the Estate since at least 1863 and who saw out the century in the Duke's service. Thus, in spite of a succession of Dukes, most with consuming interests outside Sheffield, estate management remained in the hands of a small and homogeneous group from 1819 until 1900.

The Approach to Estate Management

The negative judgements which Olsen [14] and other modern historians have passed on the standard of Norfolk estate development and management are understandable, given the criticisms leveled by radicals during the land reform debates in the latter part of the nineteenth century, and the notoriously poor quality of some of the working-class housing on parts of the Estate such as the Park. Yet their judgements would not necessarily be recognised by contemporaries of the Ellisons. On Ellison Sr.'s death his obituary in a local newspaper praised his promotion of urban and industrial development, railway projects and other improvements which had benefited the town as well as the Duke. The obituarist, measuring progress by local and contemporary values, regarded Ellison Sr. as an important contributor to the prosperity of Sheffield [15].

The charge of ducal indifference to Sheffield's urban development is undoubtedly justified before the accession of the fifteenth Duke in 1860. His masters' heedlessness was not to Ellison Sr.'s liking. When the 14th Duke came into his title in 1856, Ellison wrote a report on the conduct of estate management, complaining that:

> ... the responsible situation which I have filled has been marked by peculiarities which in ordinary circumstances do not attach to the person or affect the duties of a local agent. In my case these duties have been neither simply administrative nor exclusively executive of the instructions or designs of those whom I have served and over whose interests I have presided. Your Lordship's father and grandfather have seldom visited this estate and when they have, the time dedicated to that object has been too limited for a minute examination of its advantages, its wants, or its capabilities. A general principle or policy was all that could be calculated upon and this was laid down with as

> little reserve or restriction as possible. The creating and perfecting of a system to be pursued in the management of this Estate based on such general principles has necessarily devolved on the Agent [[16]].

Ellison went on 'severely' to criticise the eleventh Duke's development policy [[17]].

The fifteenth Duke played a more active role in Sheffield life, living there for part of the year, and becoming Mayor, Lord Mayor and Chancellor of the University. He was, however, a minor in 1860, attaining his majority in 1868. Given the small number of letters concerning estate management policy in the Agents' correspondence, there can be little doubt that the Duke's men of business continued to play the leading role in determining how urban land should be developed, albeit with some key policy decisions taken at meetings with the Duke or the Trustees [[18]], a practice also followed with the 14th Duke [[19]].

Olsen's criticism that Ellison left leasehold development to a clerk, and that estate management was lax by default, can be reassessed in the light of the information in the Agents' letter books. It is true that Smith signed most of the letters in the earlier books; Edmund Winder did the same in later years. The correspondence shows, however, that both Ellisons had a grip not only on policy but on day-to-day matters such as the length of leases, rents of individual properties, enforcement of covenants, and complaints from tenants [[20]]. Both were closely involved in railway-related issues. The idea of Ellison Sr. as an aloof and disinterested steward does not fit with his own statements that he had '... taken an active part in the management of this [the Sheffield] estate for upwards of 35 years...' [[21]]; and, (when his brother became ill) that 'I have taken upon myself the responsible management of the [Glossop] estate and nothing is now done without my explicit sanction' [[22]]. Smith was sufficiently capable to be elevated to the role of joint agent, and could be relied upon to undertake responsible duties. There is no doubt that the Estate's management was under the detailed direction of its principal Agents.

Ellison Sr. was explicit about the aim of his stewardship:

> ... the management of this Estate ... has endeavoured to be so framed that it should inspire confidence and induce enterprise, leading to the outlay of additional capital upon the ducal estate without injuring the rights or property of an existing tenantry [[23]].

To this end he:

> ... participated in the carrying out of various public measures which have had a powerful influence in promoting and accomplishing its improved position ... [[24]].

Planning Industrial Suburbs - the Railways

The Estate faced a dilemma throughout the nineteenth century. Its virtual monopoly of coal supplies to the town before 1819 depended on the fact that Norfolk mines were close to the town centre, whereas competitors' coal faced difficult and expensive journeys into Sheffield. This advantage was eroded by each new canal and railway development. Generally, such schemes were supported by alliances of manufacturers. More than once, the Dukes were numbered among the objectors. Sometimes the Earls Fitzwilliam, who were keen to reduce the cost of getting coal from their outlying mines into Sheffield, joined the promoters against their fellow peers.

In 1792 and again in 1801 the Duke had obstructed attempts to promote a Sheffield Canal, at least in part to protect his tenants' mines from competition [[25]]. The

Sheffield District Railway was intended to open up a direct channel into Sheffield for the products of the Dukeries coalfield, and this undoubtedly increased the Estate's anxiety about the project. The concern about the effect of the canal and railways on the coal monopoly was justified. For example, the carting rate from Doncaster to Sheffield was 13/8d per ton mile before the canal opened. In 1831, the canal rate for coal was 2d per ton mile [26].

It would be a mistake, however, to assume that the Estate was always hostile to transport improvements. In his report to the new Duke in 1855, Ellison Sr. emphasised the advantages of the coalfield in the neighbourhood of Sheffield, but bemoaned the state of communications at the time of the eleventh Duke's death in 1815, particularly the lack of a direct route to Liverpool [27]. Although the Duke's opposition to the Sheffield & Rotherham Railway (S&RR) and a route proposed in 1835 through the Sheaf Valley past Dronfield's collieries has been ascribed to a desire to protect mining interests [28], Ellison's reasoning, expressed privately to the Duke, was that the S&RR as a branch line was not the railway Sheffield or the Estate needed. He wanted a main line and a Liverpool connection. He regarded the poor results produced by the S&RR (which lost money and was absorbed by the North Midland Railway (NMR) in 1845) as a vindication of his opinions [29]. His son told the Select Committee on Town Holdings that Ellison Sr. had sought to have the NMR main line routed through Sheffield rather than Rotherham [30].

It is, then, not surprising to find Ellison Sr. among the promoters of the Sheffield, Ashton-Under-Lyne & Manchester Railway (SA&MR) (later the Manchester, Sfeffield & Lincolnshire Railway (MSLR)) [31]. Not only did the Estate sell land to enable the railway to be built, it also purchased properties on behalf of the SA&MR to enable the site of the main station to be assembled [32]. Ellison Sr. considered that the MSLR '... has been productive of an amount of benefit to Sheffield and to the Ducal estate that cannot be too highly appreciated ...' [33]. In 1861, plans were formulated to extend the

Midland Railway main line through Sheffield. Again, the Estate worked with the railway company, buying property; offering to keep land needed for the railway free from development; and suggesting alterations to the route to reduce the line's consumption of building land and ensure that the S&RR could be retained as a goods branch serving the existing Midland freight depots and works on Norfolk land [[34]]. The estate's policy towards railway development can, then, be understood to be more internally consistent than might be apparent at first glance.

[1]. J. M. Robinson, *The Dukes of Norfolk: A Quincentennial History*, Oxford: Oxford University Press, 1982, p. 177.

[2]. D. J. Olsen, House Upon House: Estate Development in London and Sheffield, in H. J. Dyos and M. Wolff (eds.), *The Victorian City: Images and Realities* (2 Vols.), London: Routledge & Keegan Paul, 1973, p. 341.

[3]. SCTH, *Minutes*, PP1888XXII, QQ. 7767 & 8073.

[4]. E. Baines, *History, Directory and Gazetteer of the County of York etc.*, Leeds 1822, Repr. Newton Abbott: David & Charles, 1969, p. 294.

[5]. J. M. Robinson, *The Dukes of Norfolk: A Quincentennial History*, Oxford: Oxford University Press, 1982, p. 177.

[6]. Ibid., pp. 177, 194, 199.

[7]. AC/MD45, letter John Housman to Sir Arthur Piggott, 16 January 1819.

[8]. AC/Letter from Matthew Ellison of Glossop to his cousin William Ellison, 1815, included in a typescript copy of the Ellison family history deposited at AC; F. Steer, *Arundel Castle Archives - A Catalogue Vol. II*, Chichester: West Sussex County Council, 1972.

[9]. Anon., *The Retirement and Death of Michael Ellison Esq. Steward of the Sheffield Estate of the Duke of Norfolk*, Pamphlet reprinted from articles which

first appeared in the *Sheffield and Rotherham Independent*, 1861, in Sheffield City Libraries Local Studies Library.

[10]. AC/C438 letter Michael Ellison to the 12th Duke, April 1841.

[11]. ACM/LB/D/277, letter to Few & Co. (the Estate's London solicitors) 17 March 1856.

[12]. Evidenced by various authorisations for payments in Ducal correspondence at AC.

[13]. Two Surveying Clerks, a Cashier, two Clerks and a Clerk of the Market in 1863 [ACM/LB/G/214, Income Tax Return for the Sheffield Estate Office].

[14]. D. J. Olsen, House Upon House: Estate Development in London and Sheffield, in H. J. Dyos and M. Wolff (eds.), *The Victorian City: Images and Realities* (2 Vols.), London: Routledge & Keegan Paul, 1973, pp. 355-8.

[15]. Anon., *The Retirement and Death of Michael Ellison Esq. Steward of the Sheffield Estate of the Duke of Norfolk*, Pamphlet reprinted from articles which first appeared in the *Sheffield and Rotherham Independent*, 1861, Sheffield City Libraries Local Studies Library.

[16]. T. W. Ellison, Glossop Dale Reminiscences, in *Glossop Dale Chronicle*, 21 December 1934, from a typescript copy held at AC.

[17]. Ibid.

[18]. E.g. ACM/LB/K/181, letter from Marcus Smith to the fifteenth Duke, 13 July 1871.

[19]. ACM/S.479/Michael Ellison Sr.'s letters to the 14th Duke, 1854-7, 22 May 1856.

[20]. E.g. ACM/LB/B/91 letter to Chas. Cammell & Co. re short lease, August 1848; D/206, letter to Sir Isaac Morley re price of canalside land, 29 November 1855; D/964, letter to Messrs. Bessemer, Longsden & Co. re complaint from residential tenants about siting of tilts & forges, December 1857; P/734, letter to J. Moorwood re a football club, 5 October 1881; ACM/Letter Book 4 in the handlist of Estate Office records not listed in the National Archives Register - Michael Ellison's personal letters of business, 1855-7/E.g. 3 November 1855, 15 November 1855, 2 January 1856, 21 January 1856, 1 September 1856.

[21]. T. W. Ellison, Glossop Dale Reminiscences, in *Glossop Dale Chronicle*, 21 December 1934, from a typescript copy held at AC.

[22]. AC/C438, letter Michael Ellison to the Duke, April 1841.

[23]. T. W. Ellison, Glossop Dale Reminiscences, in *Glossop Dale Chronicle*, 28 December 1934, from a typescript copy held at AC.

[24]. Loc. cit.

[25]. C. Hadfield, *The Canals of Yorkshire and North East England* (2 Vols.), Newton Abbott: David & Charles, 1973, pp. 266-7.

[26]. J. Priestley, *Historical Account of the Navigable Rivers, Canals and Railways of Great Britain etc.*, London 1831, Repr. Newton Abbott: David & Charles, 1969,

p. 571.

[27]. T. W. Ellison, Glossop Dale Reminiscences, in *Glossop Dale Chronicle*, 28 December 1934, from a typescript copy held at AC.

[28]. J. Simmons, The Power of the Railway, in H. J. Dyos and M. Wolff (eds.), *The Victorian City: Images and Realities* (2 Vols.), London: Routledge & Keegan Paul, 1973, p. 287; S. R. Batty, *Rail Centres: Sheffield*, London: Ian Allen Ltd., 1984, p. 15.

[29]. T. W. Ellison, Glossop Dale Reminiscences, in *Glossop Dale Chronicle*, 28 December 1934, from a typescript copy held at AC.

[30]. SCTH, *Minutes*, PP1888XXII, Q. 7740.

[31]. Ibid.

[32]. ACM/LB/B/195, letter Ellison Sr. to R. L. Gainsford, June 1849.

[33]. T. W. Ellison, Glossop Dale Reminiscences, in *Glossop Dale Chronicle*, 28 December 1934, from a typescript copy held at AC.

[34]. ACM/LB/G/129-30, G/418-9, letters and plans to Midland Railway Co., 29 July 1863 and 12 February 1864; H/988-92, letter to Few & Co., 8 February 1877.

Table 10.1

Distribution of Applications for Leases, Offers of Leases, Leases and Sales on the Norfolk Estate, Sheffield, 1825-99

District	**1825 to 1850**	**1851 to 1875**	**1876 to 1899**	**Total**
Attercliffe	78	31	15	124
Alsop Fields	21	2	1	24
Alsop Fields/Town Centre	2	-	-	2
Brightside	53	215	53	321
Brightside/Grimesthorpe	-	2	23	25
Bridgehouses	20	21	2	43
Bridgehouses/Pitsmoor	18	20	13	51
Crookes/Walkley (?)	-	-	3	3
Town Centre	25	-	1	26
Town Centre/Attercliffe	1	-	-	1
East Bank (Park)	12	2	3	17
Grimesthorpe	6	8	3	17
Highfield	39	34	113	186
Highfield/Ponds	1	2	-	3
Lowfield	-	-	16	16
Manor Park (Park)	9	-	1	10
Neepsend	-	7	9*	16
Norfolk Park (Park)	1	1	19	21
Norwood (Pitsmoor/Burngreave)	-	-	7	7
Pitsmoor (including Burngreave)	75	123	89	287
Pitsmoor/Brightside	25	53	88	166
Pitsmoor/Woodside	-	1	-	1
Park	250	63	94	407
Park/Attercliffe	6	2	16	24
Park/Ponds	29	16	2	47
Ponds	19	-	12	31
Parkwood Springs/Neepsend	-	7*	3*	10
Sheffield Township (precise location of Boylands Street uncertain)	1	2	-	3
Total	691	612	586	1,889

* Mostly railway compulsory freehold purchases.

Table 10.2

Key Railway Land Purchases and Leases on the Norfolk Estate[142]

Year	Freehold or Lease	Location (and Use)	Site Area	Raillway Company
1845	F	Not known	1a-1r-4p	Sheffield & Huddersfield
1848	L	Not known (coal staithe)	0.5 acre	MSLR
1848	L	Effingham St (use uncertain)	Not known	MSLR
1853	F	Wicker Station (station extension)	5857 sq.yds.	MR
1858	F	Alongside canal towpath (running lines and station)	2a-3r-27p + 7 yard wide strip	SYR
1860	L	Savile Street (extension to Wicker Station)	2392 sq.yds.	MR
1860	L	New Hall Road (engine sheds and sidings)	13a-2r-28p	MR
1865	F	Neepsend and Park (line widening)	5.48 acres	MSLR
1871	F	Brightside Lane (Brightside Sidings)	17.28 acres	MR
1870	L	Sheaf Works (Freehold purchased 1891)	Not known	MSLR
1876	F	Park (probably extension of new Midland Station)	2.5 acres	MR

[142] ACM/LB/A/245; B/36; B/642; C/105; E/254-5; E/534; E/664-7; H/347-9; J/846; J/486; M/788; ACM/S612

Table 10.3

Frequency Distribution of Plot Sizes on Norfolk Land[143]

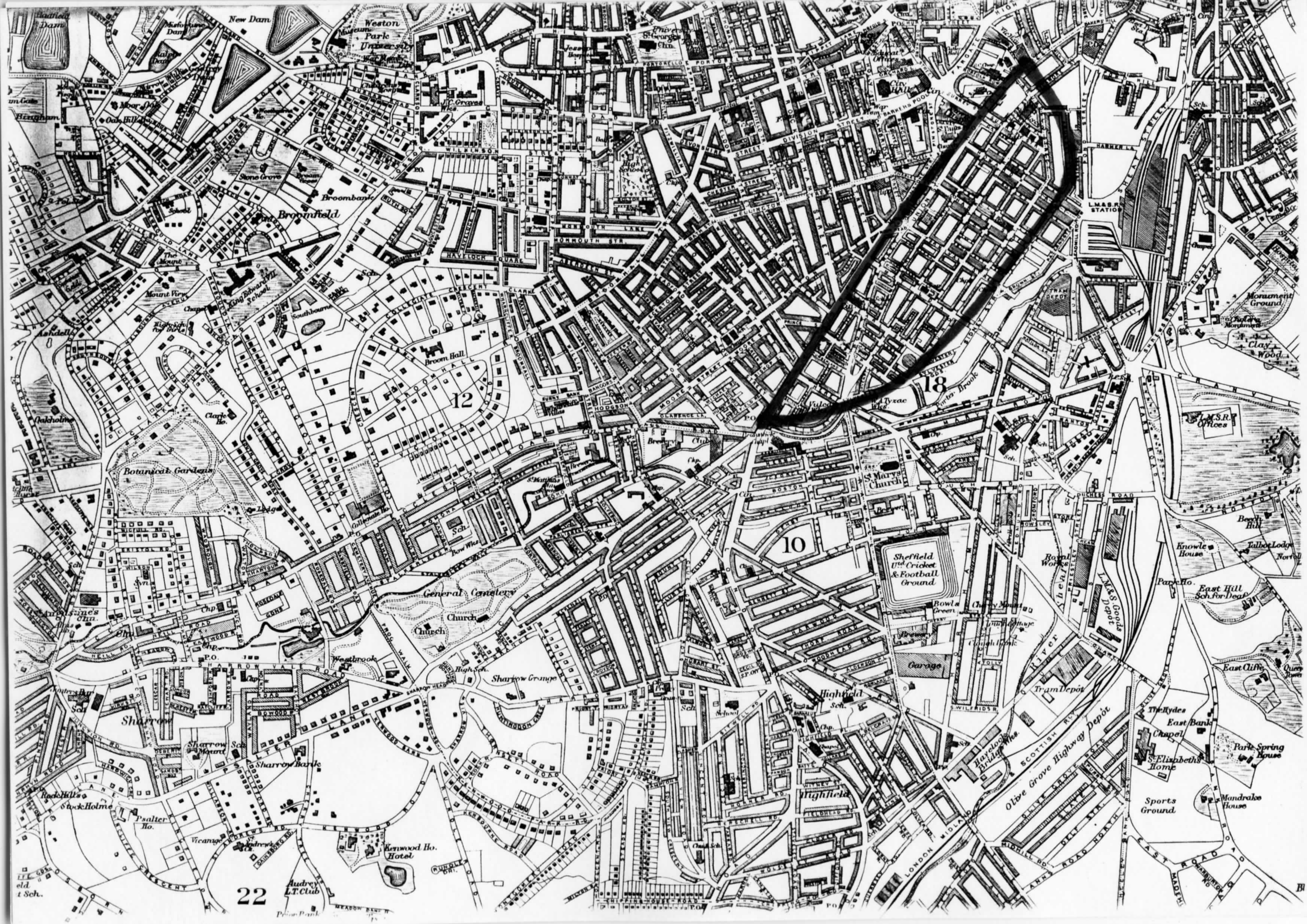
S = Sheffield (within what became the City boundary); O = Other areas (e.g. Handsworth);
T = Total of Sheffield and Others

	Absolute Frequency			**Absolute Cumulative**			**% Frequency**			**% Cumulative**		
Ranges (Sq. Yds.)	**S**	**O**	**T**	**S**	**O**	**T**	**S**	**O**	**T**	**S**	**O**	**T**
<=100	10	1	11	10	1	11	0.6	0.5	0.6	0.6	0.5	0.6
101-200	81	2	83	91	3	94	5.0	0.9	4.5	5.6	1.4	5.1
201-300	220	11	231	311	14	325	13.4	5.1	12.5	19.0	6.5	17.5
301-400	270	9	279	581	23	604	16.5	4.1	15.1	35.5	10.6	32.6
401-500	198	11	209	779	34	813	12.1	5.1	11.3	47.6	15.7	43.9
501-600	146	23	169	925	57	982	8.9	10.6	9.1	56.5	26.3	53.0
601-700	126	33	159	1051	90	1141	7.7	15.2	8.6	64.2	41.5	61.6
701-800	84	6	90	1135	96	1231	5.1	2.8	4.9	69.4	44.2	66.4
801-900	54	18	72	1189	114	1303	3.3	8.3	3.9	72.7	52.5	70.3
901-1000	60	14	74	1249	128	1377	3.7	6.5	4.0	76.3	59.0	74.3
1001-1250	83	28	111	1332	156	1488	5.1	12.9	6.0	81.4	71.9	80.3
1251-1500	56	23	79	1388	179	1567	3.4	10.6	4.3	84.8	82.5	84.6
1501-1750	32	6	38	1420	185	1605	2.0	2.8	2.1	86.8	85.3	86.6
1751-2000	32	5	37	1452	190	1642	2.0	2.3	2.0	88.8	87.6	88.6
2001-2500	32	5	37	1484	195	1679	2.0	2.3	2.0	90.7	89.9	90.6
2501-5000	46	9	55	1530	204	1734	2.8	4.1	3.0	93.5	94.0	93.6
5001-10000	45	4	49	1575	208	1783	2.8	1.8	2.6	96.3	95.9	96.2
10001-20000	37	2	39	1612	210	1822	2.3	0.9	2.1	98.5	96.8	98.3
20001-30000	9	2	11	1621	212	1833	0.6	0.9	0.6	99.1	97.7	98.9
30001-40000	2	1	3	1623	213	1836	0.1	0.5	0.2	99.2	98.2	99.1
40001-50000	2	1	3	1625	214	1839	0.1	0.5	0.2	99.3	98.6	99.2
50001-100000	7	1	8	1632	215	1847	0.4	0.5	0.4	99.8	99.1	99.7
100001-150000	3	1	4	1635	216	1851	0.2	0.5	0.2	99.9	99.5	99.9
150001-250000	0	1	1	1635	217	1852	0.0	0.5	0.1	99.9	100	99.9
250001-500000	1	0	1	1636	217	1853	0.1	0.0	0.1	100	100	100

[143]Based on records in database at Appendix 7 below

Figure 10.1 (following page)

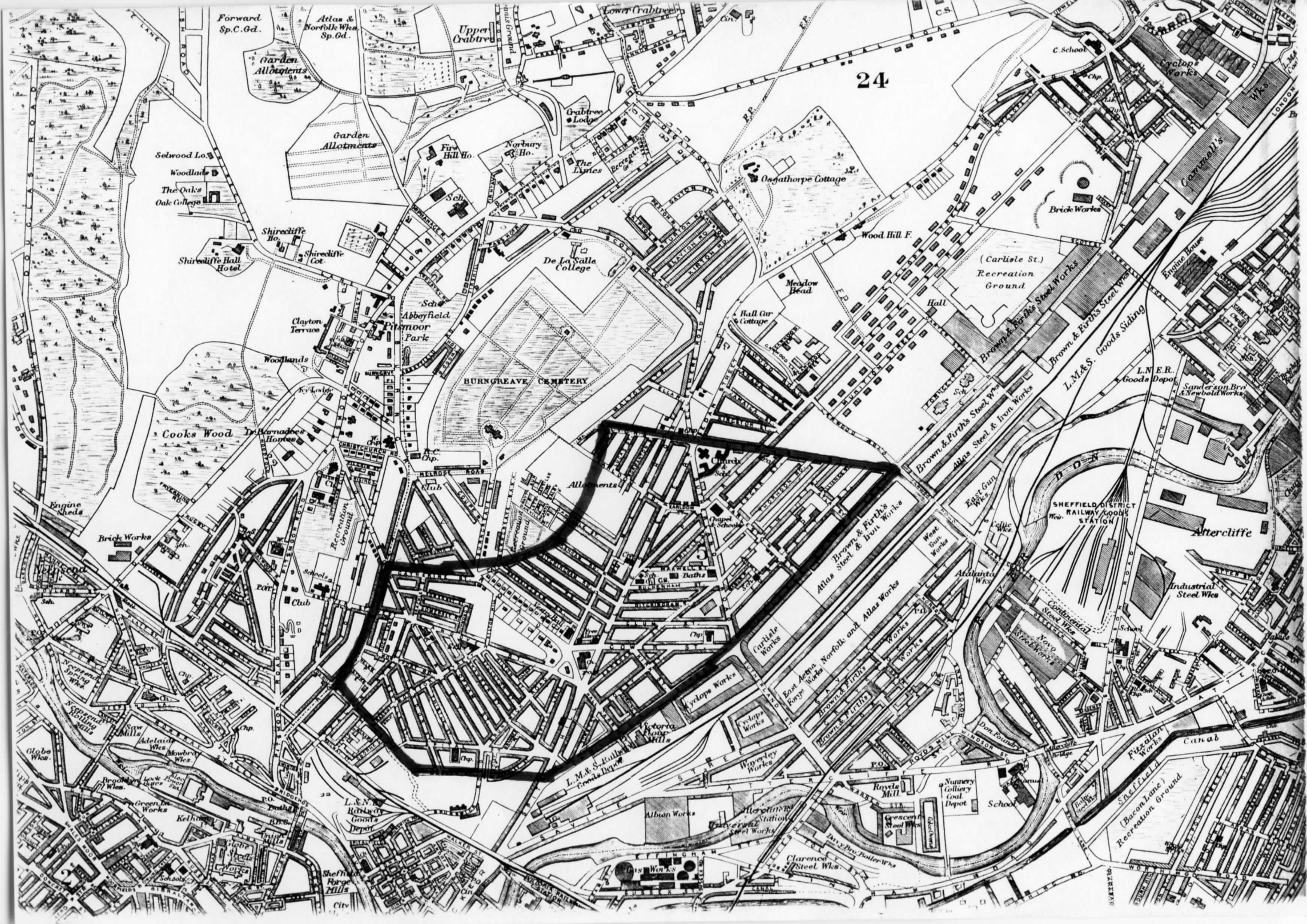
Development Pattern of the Alsop Fields Area, Norfolk Estate (as shown on inter-war Kelly's Directory Map)



New Dam
Weston Park
Museum
University
Broomfield
Broombank
Stone Grove
King Edward VII School
The Mount
Mount View
Southbourne
Broom Hall
12
Oakholme
Ashdell
Clarke Ho.
Botanical Gardens
Havelock Square
Monmouth Str
City Hall
Division Street
Clarence La
Hodgson
Moore Street
Brewery
Club
Tyzac Wks
Porter Brook
18
1
L.M.&S.R. Station
Tram Depot
Monument Ground
Clay Wood
L.M.S.R. Offices
St Marys Church
10
Sheffield Utd Cricket & Football Ground
Bowls Green
Garage
General Cemetery
Church
Westbrook
Sharrow Grange
High Sch.
Sharrow
Sharrow Sch.
Sharrow Bank
Psalter Ho.
Stock Holme
Vicarage
Kenwood Ho. Hotel
Audrey L.T. Club
22
Highfield
Highfield Sch.
Tram Depot
River
Scottish Rly
London Midland
Olive Grove Highway Depot
Knowle House
Talbot Lodge
Park Ho.
East Hill Sch. for Deaf
East Cliffe
The Hydes
East Bank Chapel
Park Spring House
St Elizabeths Home
Sports Ground
Mandrake House

Figure 10.2 (following page)

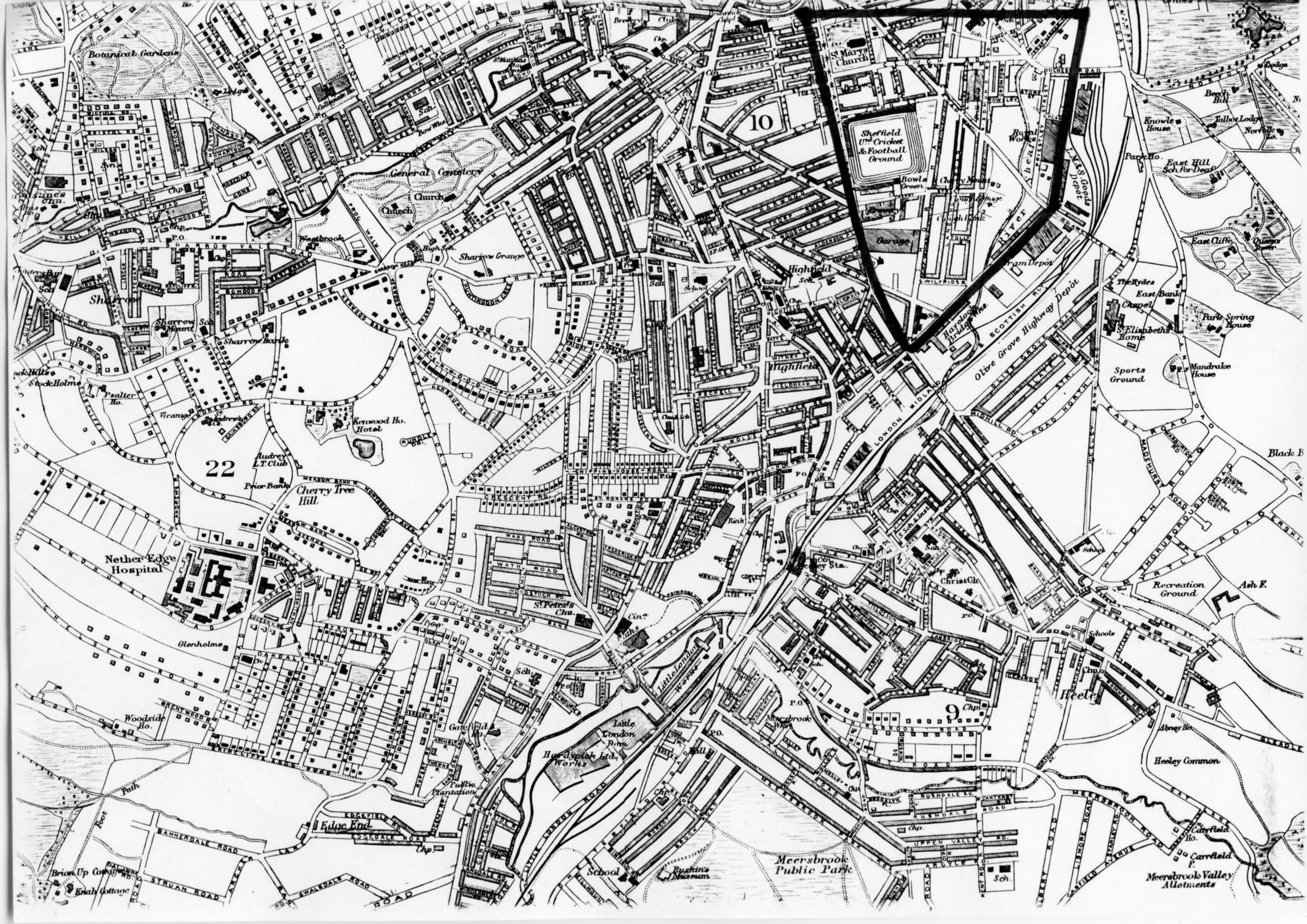
Development Pattern of the Pitsmoor Area, Norfolk Estate (as shown on inter-war Kelly's Directory Map)



24
Forward Sp.C.Gd.
Atlas & Norfolk Wks. Sp.Gd.
Upper Crabtree
Lower Crabtree
Garden Allotments
Crabtree Lodge
Fire Hill Ho.
Norbury Ho.
The Limes
Osgathorpe Cottage
Wood Hill F.
Selwood Lo.
Woodlands
The Oaks
Oak College
Shirecliffe Ho.
Shirecliffe Cot.
Shirecliffe Hall Hotel
De La Salle College
Abbeyfield
Pitsmoor
Park
Clayton Terrace
Burngreave Cemetery
Cooks Wood
Dr Barnado's Homes
Meadow Head
Hall Car Cottage
(Carlisle St.) Recreation Ground
Brick Works
Hall
Cyclops Works
Cammell's
Engine House
Brown & Firth's Steel Works
Brown & Firth's Steel Wks
Brown & Firth's Steel & Iron Works
Atlas Steel & Iron Works
Brown & Firth's Atlas Steel & Iron Works
Norfolk and Atlas Works
L.M.& S. Goods Siding
L.N.E.R. Goods Depot
Sanderson Bros & Newbold Works
Allotments
Church
Chapel & Schools
Baths
Recreation Ground
Engine Sheds
Brick Works
Neepsend
Club
Schools
East Gun Wks
West Gun Works
Celtic Wks
Sheffield District Railway Goods Station
Attercliffe
Industrial Steel Wks
Atalanta Wks
Continental Steel Wks
Novo Steel Works
Carlisle Works
East Aetna Forge Works
Brown & Firth's Works
Cyclops Works
Victoria Motor Mills
Neepsend Spring Wks.
Neepsend Rolling Mills
Saw Mills
Adelaide Wks.
Mowbray Wks.
Globe Wks
Brooklyn Wks.
Green Lane Works
Kelham
Globe Steel Works
L.M.& S. Railway Goods Depot
L.& N.E. Railway Goods Depot
Sheffield Forge Mills
City
Waverley Works
Royds Mill
Nunnery Colliery Coal Depot
Don Foundry
Windsor St.
School
Fitzalan Works
Sheffield Canal
(Bacon Lane) Recreation Ground
Albion Works
Attercliffe Rd. Station
Universal Steel Works
Crescent Steel Wks
Clarence Steel Wks.
Davy Bros Boiler Wks
Gas Works
Don
Weir

Figure 10.3 (following page)

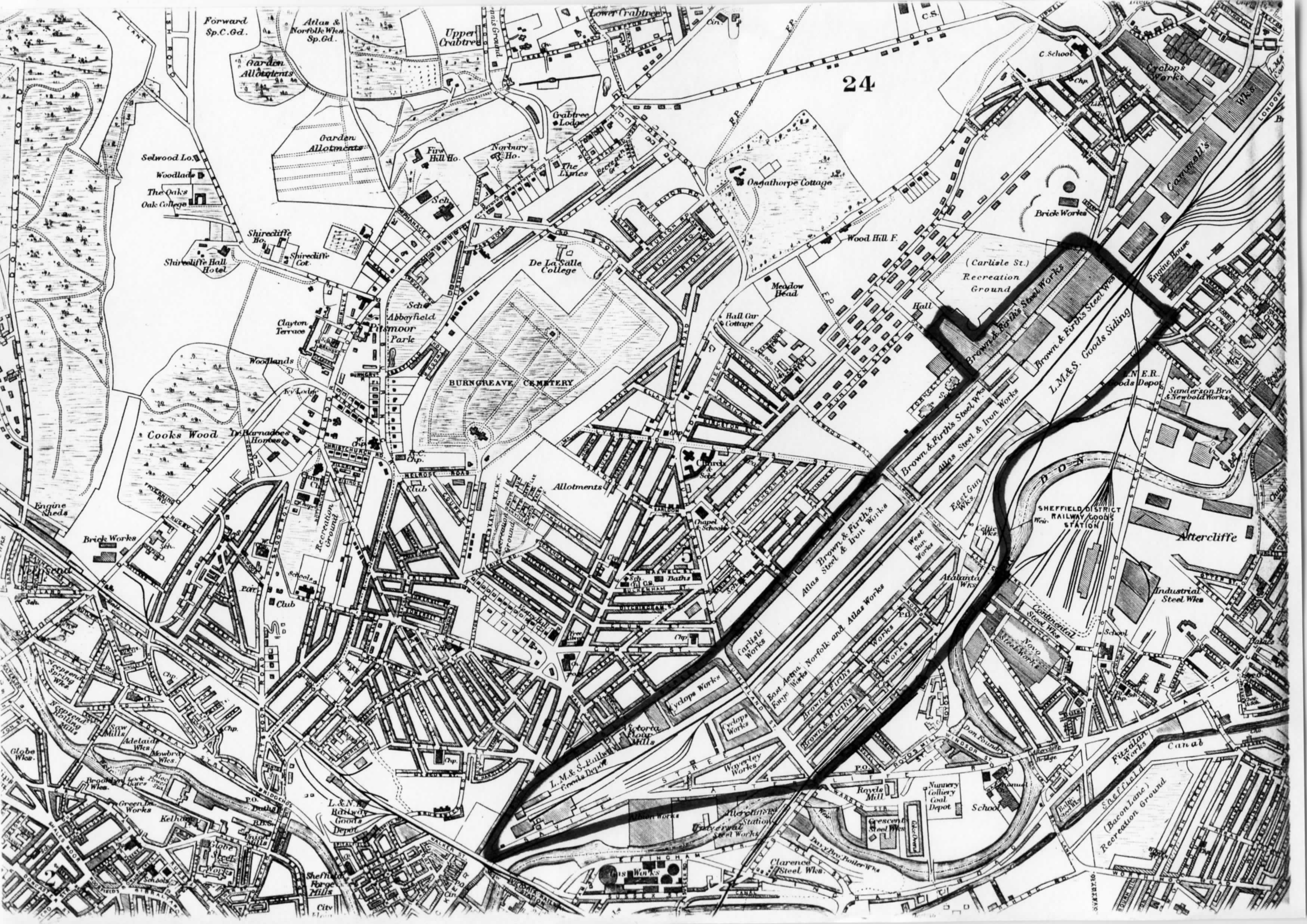
Development Pattern of the Highfield/Lowfield Areas, Norfolk Estate (as shown on inter-war Kelly's Directory Map)



Botanical Gardens
General Cemetery
Church
Sharrow
Sharrow Sch.
Sharrow Mount
Sharrow Bank
Sharrow Grange
Westbrook
High Sch.
Stockholme
Psalter Ho.
Vicarage
Kenwood Ho. Hotel
22
Audrey L.T. Club
Prior Bank
Cherry Tree Hill
Nether Edge Hospital
Glenholme
Woodside Ho.
Gatefield Ho.
Public Plantation
Edge End
Hardypick Ltd. Works
Little London Dam
Little London Works
St Peter's Chu.
Rink
Highfield
10
St Mary's Church
Sheffield Utd Cricket & Football Ground
Bowls Green
Garage
Royal Works
River Sheaf
L.M.&S. Goods Depot
Tram Depot
Scottish Rly
Olive Grove Highway Depot
London Midland
Knowle House
Beech Hill
Talbot Lodge
Norfolk Ho.
Park Ho.
East Hill Sch. for Deaf
East Cliffe
Queen's Tower
The Rydes
East Bank
Chapel
Park Spring House
St Elizabeth's Home
Sports Ground
Mandrake House
Recreation Ground
Ash F.
Christ Ch.
Schools
Heeley
9
Meersbrook Works
Heeley Common
Abbey Ho.
Carrfield Ho.
Carrfield
Meersbrook Valley Allotments
Meersbrook Public Park
Ruskin's Museum
School

Figure 10.4 (following page)

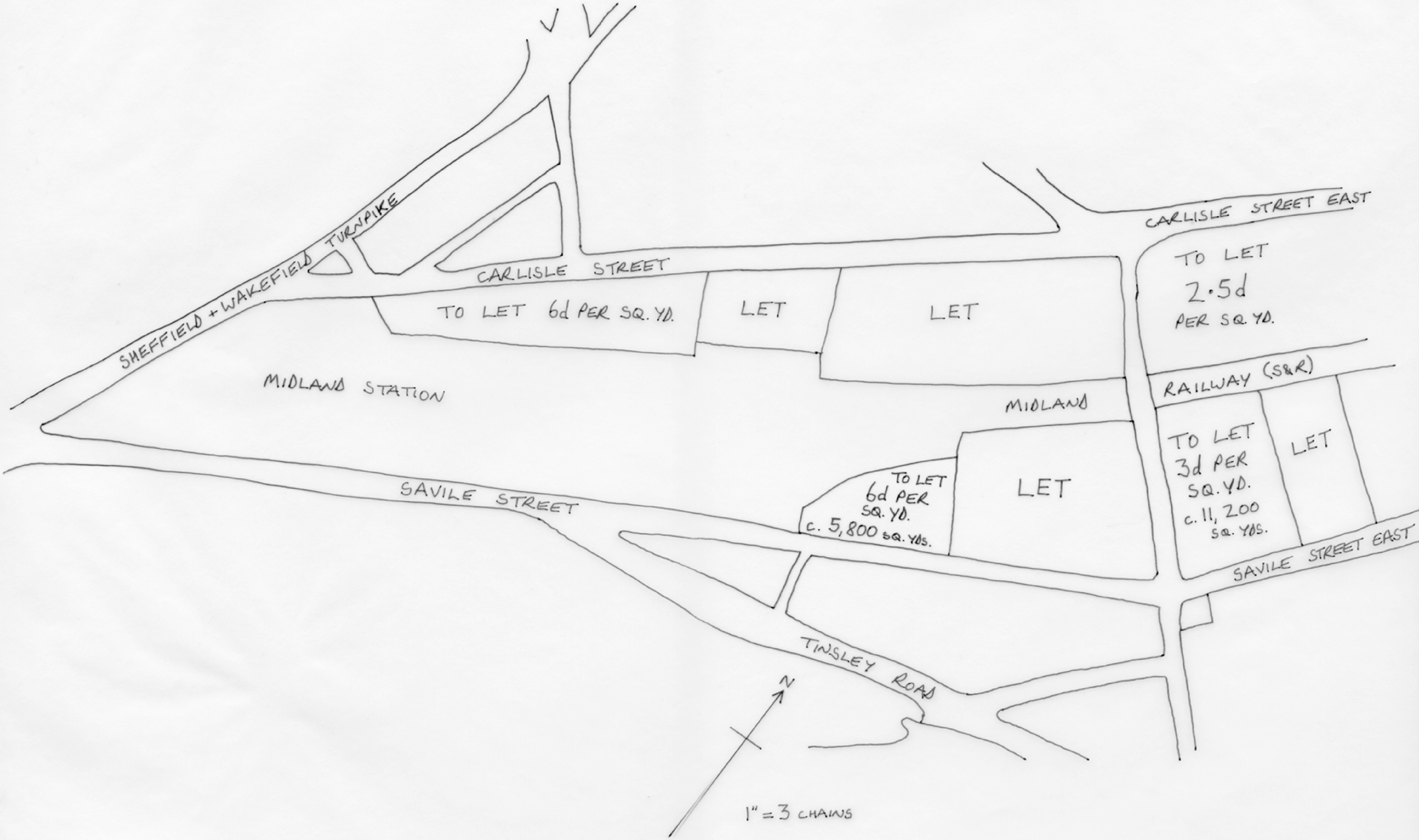
Development Pattern of the Brightside Area, Norfolk Estate (as shown on inter-war Kelly's Directory Map)



24
Forward Sp. C. Gd.
Atlas & Norfolk Wks. Sp. Gd.
Upper Crabtree
Lower Crabtree
Garden Allotments
C. School
Cyclops Works
Cammell's Wks.
Crabtree Lodge
Fir Hill Ho.
Norbury Ho.
The Limes
Selwood Lo.
Woodlade
The Oaks
Oak College
Osgathorpe Cottage
Brick Works
Wood Hill F.
Shirecliffe Ho.
Shirecliffe Cot.
Shirecliffe Hall Hotel
De La Salle College
(Carlisle St.) Recreation Ground
Engine House
Meadow Head
Hall
Brown & Firth's Steel Works
Brown & Firth's Steel Wks.
Clayton Terrace
Abbeyfield
Pitsmoor
Park
Hall Car Cottage
Brown & Firth's Goods Siding
Woodlands
BURNGREAVE CEMETERY
L.M.&S. Goods Siding
L.N.E.R. Goods Depot
Sanderson Bros & Newbold Works
Ivy Lodge
Brown & Firth's Steel Wks.
Atlas Steel & Iron Works
Cooks Wood
Dr. Barnardo's Homes
CHRISTCHURCH RD.
MELROSE ROAD
Club
Brown & Firth's
Atlas Steel Works
DON
Allotments
Church & Schs.
East Gun Wks.
SHEFFIELD DISTRICT RAILWAY GOODS STATION
Engine Sheds
Chapel & Schools
Atlas Brown & Firth's Steel & Iron Works
West Gun Works
Celtic Wks.
Brick Works
Recreation Ground
Attercliffe
Neepsend
Schools
Baths
Atlanta Wks.
Industrial Steel Wks.
Club
Continental Steel Wks.
Carlisle Works
Atlas Norfolk and Atlas Works
Novo Steel Works
GOWER ST.
Neepsend Spring Wks.
East Aetna Forge Works
Brown & Firth's Works
Cyclops Works
School
Cyclops Works
Brown & Firth's
Neepsend Rolling Mills
Victoria Flour Mills
Don Foundry
Globe Wks.
Adelaide Wks.
Mowbray Wks.
Waverley Works
WINDSOR ST.
Attercliffe Bridge
Fitzalan Works
Canal
L.M.&S. Railway Goods Depot
Nunnery Colliery Coal Depot
Royds Mill
Brooklyn Wks.
Green La. Works
L.&N.E. Railway Goods Depot
Albion Works
Attercliffe Rd. Station
Universal Steel Works
Crescent Steel Wks.
School
Sheffield (Bacon Lane) Recreation Ground
Kelham
Globe Steel Works
Schools
Sheffield Forge Mills
WALKER ST.
EFFINGHAM
Gas Works
Clarence Steel Wks.
Davy Bros. Boiler Wks.
City
LONDON

Figure 10.5 (following page)

Development Sites Let and To Let Adjacent to the Midland Station and Railway on the Norfolk Estate, Brightside, 7 June 1849



SHEFFIELD + WAKEFIELD TURNPIKE
CARLISLE STREET
CARLISLE STREET EAST
TO LET 6d PER SQ. YD.
LET
LET
TO LET
2·5d
PER SQ. YD.
MIDLAND STATION
MIDLAND
RAILWAY (S&R)
TO LET
6d PER
SQ. YD.
c. 5,800 SQ. YDS.
LET
TO LET
3d PER
SQ. YD.
c. 11,200
SQ. YDS.
LET
SAVILE STREET
SAVILE STREET EAST
TINSLEY ROAD
N
1" = 3 CHAINS

Figure 10.6a & b (following page)

a. Proposed Layout of Lumley Street/Worthing Road, NorfolkEstate, Brightside, 1854
b. Actual Layout of Lumley Street/Worthing Road, 1903

AN ABORTIVE ROAD PLAN

MAIN PLAN: PROPOSED LAYOUT OF WORTHING ROAD AND RE-ALIGNMENT OF BACON LANE, 1854, TRACED FROM ACM/LB/473-4 (SCALE 3 CHAINS TO ONE INCH APPROX.)

INSET: ACTUAL STREET PLAN FROM 1903 OS MAP, SHOWING BACON LANE ON ORIGINAL ALIGNMENT OVER CANAL AND NEW STREETS UNBUILT (SCALE 15": 1 MILE APPROX.)

Figure 10.7 (following page)

Proposed Route of Kenninghall Street Between Carlisle Street East and Midland Railway, Norfolk Estate, Brightside, 1860

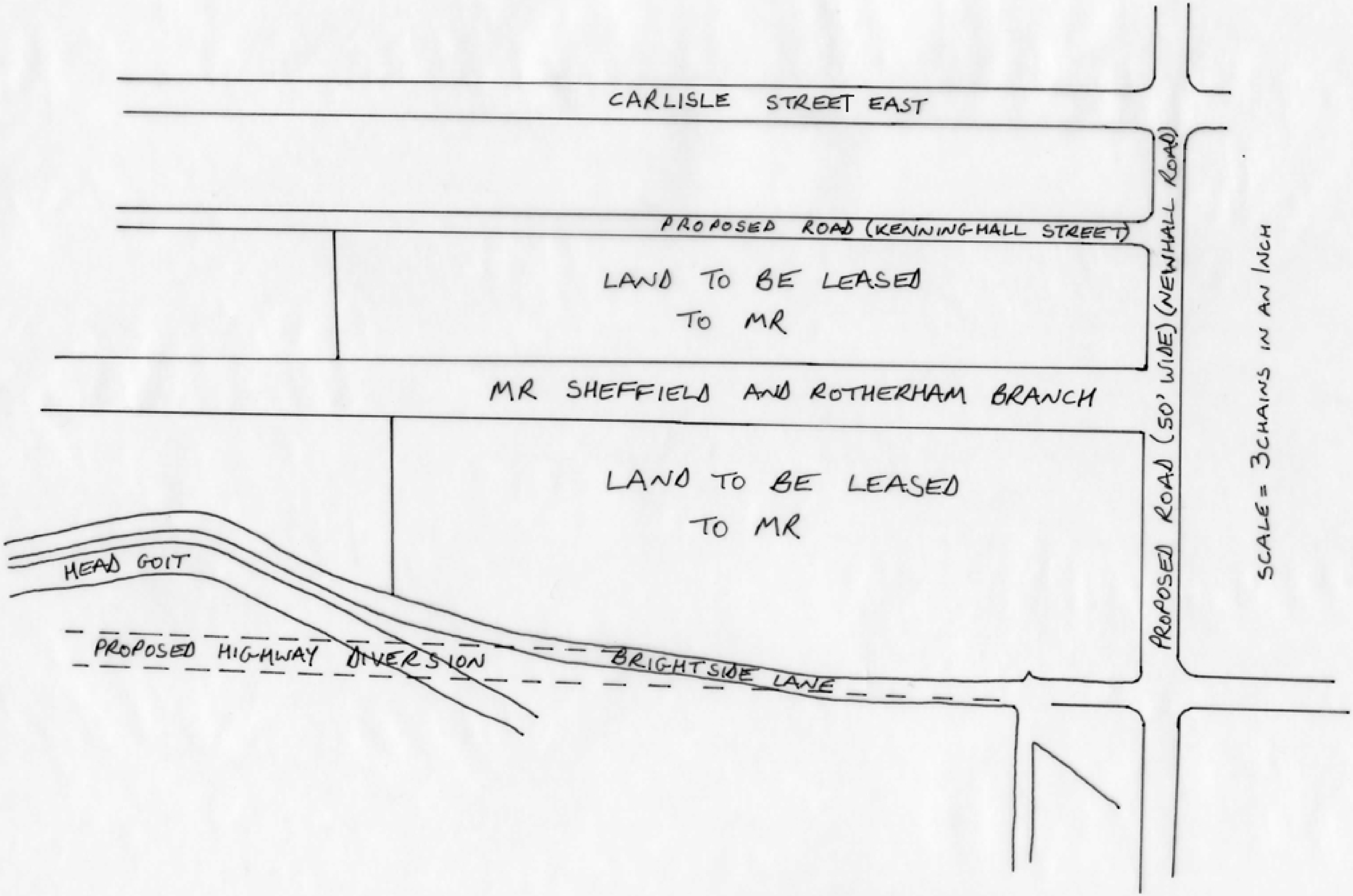

CARLISLE STREET EAST
PROPOSED ROAD (KENNINGHALL STREET)
LAND TO BE LEASED TO MR
MR SHEFFIELD AND ROTHERHAM BRANCH
LAND TO BE LEASED TO MR
HEAD GOIT
PROPOSED HIGHWAY DIVERSION
BRIGHTSIDE LANE
PROPOSED ROAD (50' WIDE) (NEWHALL ROAD)
SCALE = 3CHAINS IN AN INCH

Figure 10.8 (following page)

Route of Branch Railway from Midland Railway Sheffield and Rotherham Line, Proposed by Norfolk Estate Agent to Serve Industrial Land in Attercliffe, October 1871

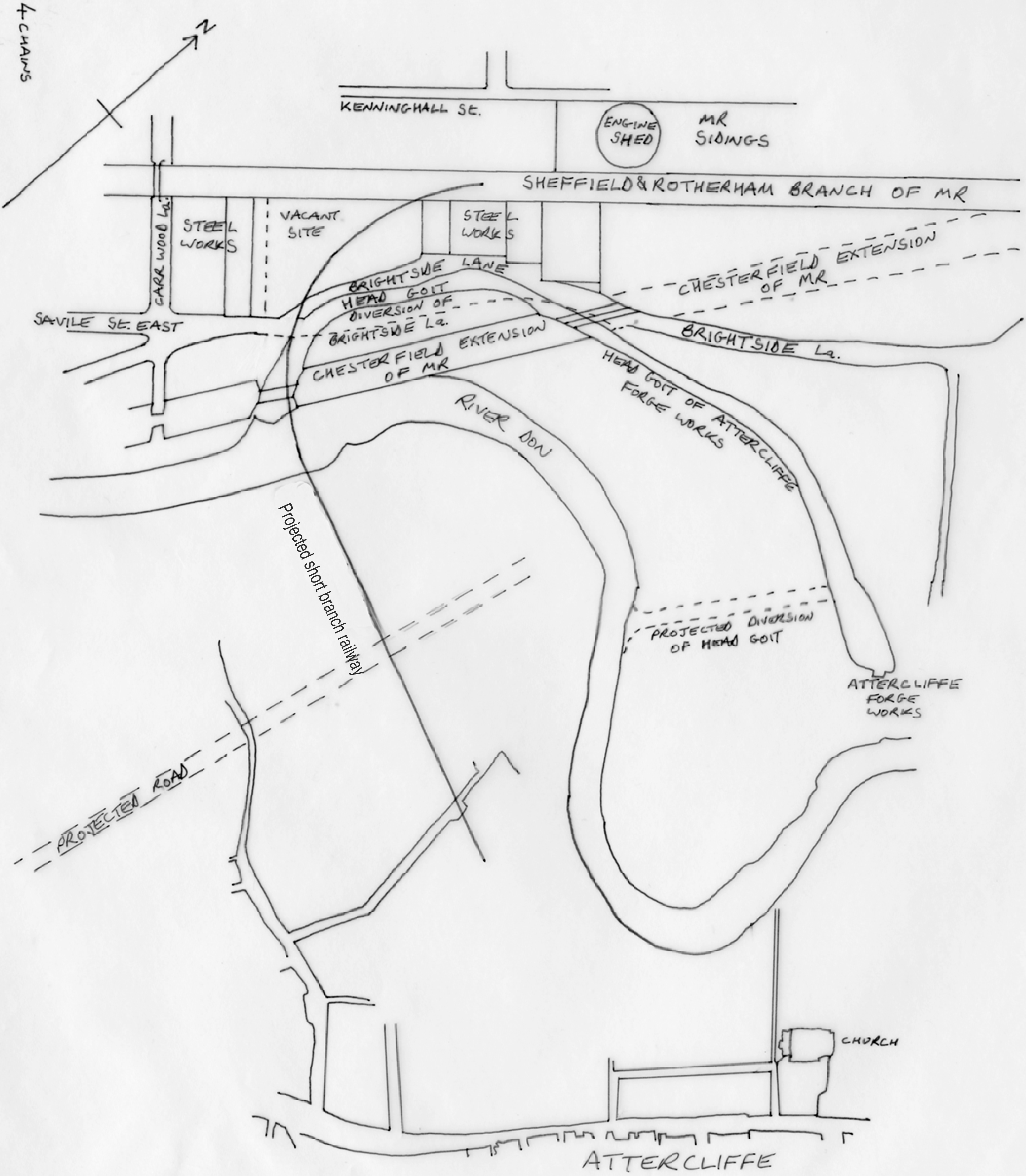

1" = 4 CHAINS
N
KENNINGHALL ST.
ENGINE SHED
MR SIDINGS
SHEFFIELD & ROTHERHAM BRANCH OF MR
CARRWOOD La.
STEEL WORKS
VACANT SITE
STEEL WORKS
BRIGHTSIDE LANE
HEAD GOIT
DIVERSION OF BRIGHTSIDE La.
SAVILE ST. EAST
CHESTERFIELD EXTENSION OF MR
CHESTERFIELD EXTENSION OF MR
BRIGHTSIDE La.
HEAD GOIT OF ATTERCLIFFE FORGE WORKS
RIVER DON
Projected short branch railway
PROJECTED DIVERSION OF HEAD GOIT
ATTERCLIFFE FORGE WORKS
PROJECTED ROAD
CHURCH
ATTERCLIFFE

Figure 10.9 (following page)

Sketch Map Showing Chronology and Geography of Development of Main Steelworks and Other Large Plants and Facilities inthe Lower Don Valley, Sheffield

Scale = 6":1 Mile

Key to Dates of Development

Pre-1850	No colour
1850-59	Red
1860-69	Blue
1870-79	Green
1880-89	Yellow
1890-99	Brown
1900-10	Grey
1910+	Purple

Key to identity of sites follows map

Figure 10.9

Chronological Plan of the Development of Industrial Works in the Lower Don Valley - Key to Works Names and Owners

Ref.	Date Begun	Works
1	1835 & 1846	Aetna Works - Spear & Jackson
2A	1844	Cyclops Works - Cammell's
2B	1848	Cyclops Works - Cammell's (later appears to incorporate land leased to Messrs. Brookes in 1850)
2C	1851	Cyclops Works - Cammell's
2D	1850	Aegenoria Works - Beet & Sons, then Paece, ward & Co., then Cammell's
2E	1864	Grimesthorpe Works - Cammell's
3A		Norfolk Works - Firth's
3B	1863	Norfolk Works - Firth's
3C	1870	Norfolk Works - Firth's
3D	c.1860	Midland Works - John M. Stanley & Co. Ironfounders, later Firth's who extended to east, probably in 1885 (ACM/LB/359 & 364)
3E	1907-8	Tinsley Rolling Mills - Firth's
4A	c.1851	Queen's Works - Frankish Bros. & Barker, became Brown's Atlas Works 1854
4B	1859	Atlas Works - Brown's
4C	1862	Atlas Works - Brown's
4D	1860	J.Sales' Railway Carriage Works, later part of Brown's Atlas Works
4E	1870	Atlas Works - Brown's
4F	1860s	Sundry Small Leaseholds, later absorbed into Brown's Atlas Works
5A	1862	River Don Works - Vickers
5B	1870s/80s	River Don Works - Vickers
5C	post 1914	River Don Works - Vickers, later English Steel Corporation
5D	post 1914	Attercliffe Common Works - Vickers
6	1835+	Brightside Works - Jessop's
6A	post 1914	Brightside Works - Jessop's
7A	pre 1872	Hecla Works - Hadfield's (but took over an existing factory)
7B	1897	East Hecla Works - Hadfields

8	1870	Sheffield Steel & Iron Works - Brown, Bailey & Dixon
10	1857	Bessemer Works - Hy. Bessemer & Co.
12A	pre	Imperial Steel Works - J.Edgar Allen & Co. (but took over existing works)
12B		Imperial Steel Works - J.Edgar Allen & Co.
14	1853 & 1859	Carlisle Works - Wilson, Hawksworth & Co. (eastern part leased originally to Stephenson, Blake in 1854)
15	1853	President Works - Moses, Eadon & Sons
17	1860s	Brightside Boiler & Engine Works - Hawksley & Wild, then W.Griffiths & Co.
18	1860s	Cardigan Steel & Iron Works - Humphrey Turner & Co., later Cardigan Steel & Iron Co. Shown on 1905 OS Map as Midland Works
A	1838+	Sheffield & Rotherham Railway Station, later Midland Station then Wicker Goods post 1870
B	1860	Midland Railway Mineral Sidings
C	1870	Midland Railway - Brightside Goods Sidings
F	1864	South Yorkshire Railway (later MSLR) - Broughton Lane Goods Sidings
G	1900	Sheffield District Railway (later MSLR) - Attercliffe Goods Station
M	1900	Sheffield District Railway (later MSLR) - Tinsley Road Goods Station
N	1860	Midland Railway - Engine Sheds
iii.	1860s	Salmon Pastures Coal Depot (Norfolk Collieries)
vi.	1866-98	Grimesthorpe Gas Works

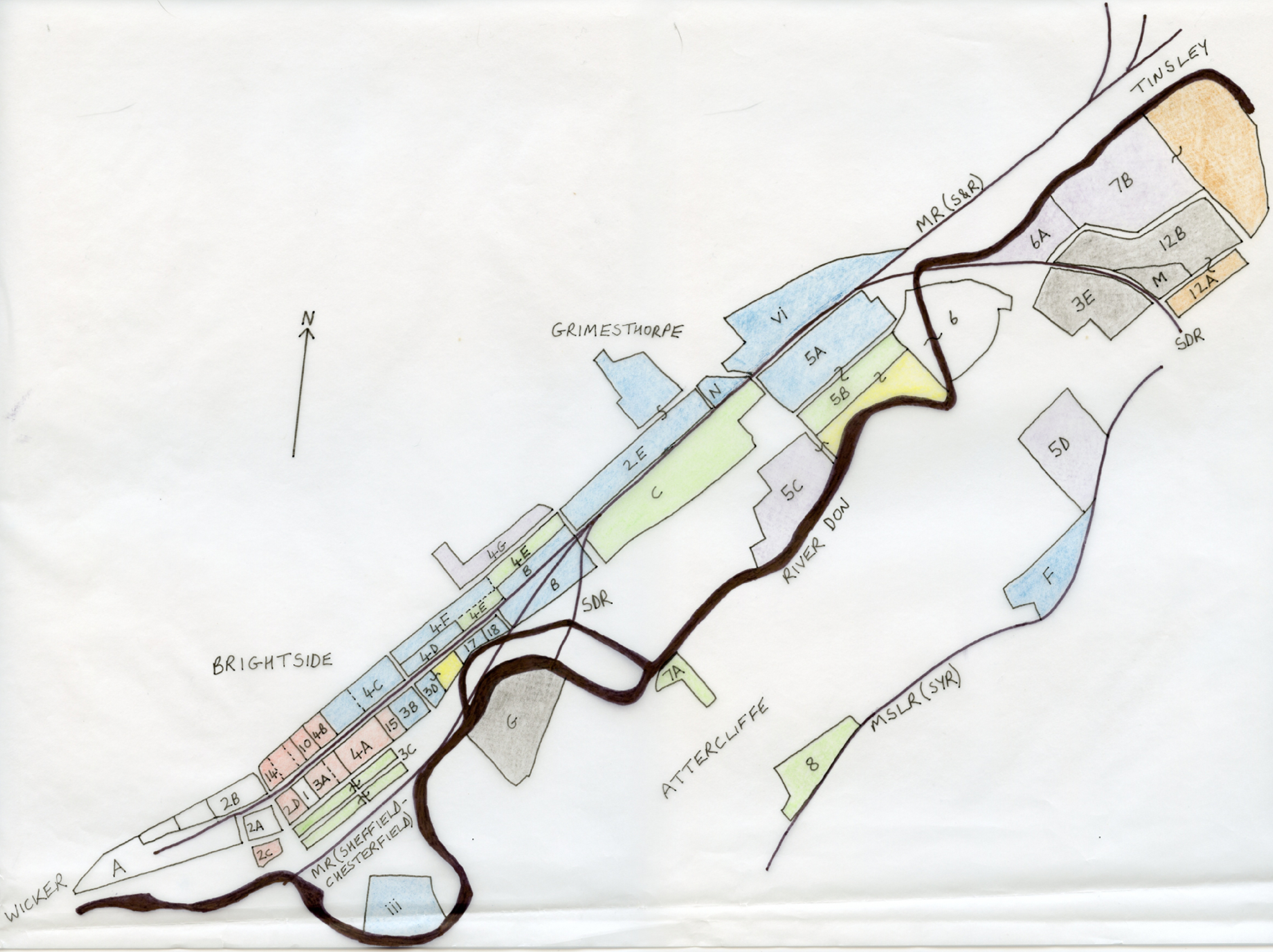

N
TINSLEY
MR (S&R)
GRIMESTHORPE
BRIGHTSIDE
ATTERCLIFFE
WICKER
RIVER DON
SDR
SDR
SDR
MR (SHEFFIELD-CHESTERFIELD)
MSLR (SYR)
A
2A
2B
2C
2D
1
3A
3B
3C
3D
3E
4A
4B
4C
4D
4E
4E
4F
4G
10
14
15
17
18
B
B
C
2E
N
N
Vi
5A
5B
5C
5D
6
6A
7A
7B
8
12A
12B
M
F
G
iii

Figure 10.10 (following page)

Graph Showing Frequency Distribution of
Plots of Land Leased on the Norfolk Estate, 1825-99

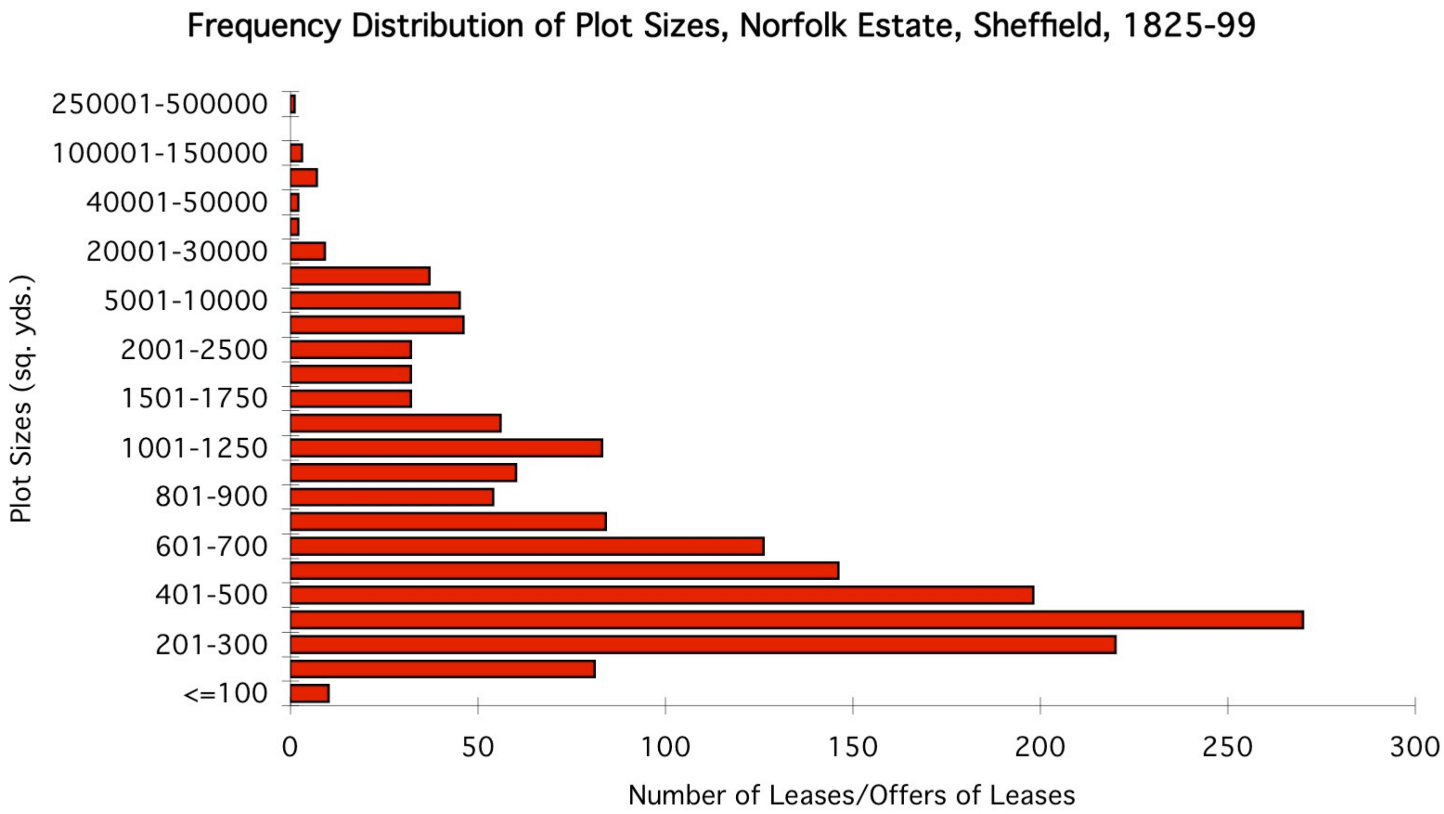

Frequency Distribution of Plot Sizes, Norfolk Estate, Sheffield, 1825-99
250001-500000
100001-150000
40001-50000
20001-30000
5001-10000
2001-2500
1501-1750
1001-1250
801-900
601-700
401-500
201-300
<=100
Plot Sizes (sq. yds.)
0
50
100
150
200
250
300
Number of Leases/Offers of Leases

Figure 10.11 (following page)

Sketch Map of Locally Perceived Districts of Sheffield (see Table 10.1)


SHIRE GREEN
BLACKBURN VALLEY
HIGH WINCOBANK, WORKING MENS' SUBURB
LOW WINCOBANK
WADSLEY BRIDGE
HILLSBOROUGH
MEADOW HALL
FIRTH PARK
TINSLEY
OLD PARK WOOD
GRIMESTHORPE
OWLERTON
NORWOOD
BURNGREAVE
CARBROOK
NEEPSEND
PITSMOOR
BRIGHTSIDE
ATTERCLIFFE
PHILADELPHIA
BRIDGE-HOUSES
KELHAM
WICKER
WALKLEY
DARNALL
CROOKES
CROOKESMOOR
UPPER + NETHER THORPES
CROFTS
MILLSANDS
PARK/ATTERCLIFFE
BROOKHILL
St GEORGES
TOWN CENTRE
MARKETS
HYDE PARK
PORTOBELLO
ROCKINGHAM STREET
PONDS
RANMOOR
BROOMHILL
ALSOP FIELDS
THE MOOR
PARK
ENDCLIFFE
BROOMHALL
EAST BANK
MANOR
MANOR PARK
HIGHFIELD
FARM
NORFOLK PARK
SHARROW
LOWFIELD
BOUNDARY OF MAIN BUILT UP AREA BY 1919
NETHER EDGE
CHERRY TREE
HEELEY
MEERSBROOK
INTAKE
SKETCH PLAN OF LOCALLY PERCEIVED DISTRICTS OF SHEFFIELD
N
* = TEMPLEBORO', ROTHERHAM
MILLHOUSES
1 MILE

CHAPTER 11

LAND OWNERSHIP AND INDUSTRIAL LOCATION (3) - LAND VALUES ON THE NORFOLK ESTATE

In this Chapter the nature of the market in Norfolk land is investigated as it affected industrial development. The main questions are:

- Were land prices determined by the market or did the Estate set values arbitrarily as a monopolist?

- Were prices affected by accessibility - was there a distance decay effect, with values falling as distances from the town centre or other focal points such as railway termini increased?

- How did industrial land fit into the land price structure and how might this have affected location decisions?

1. The Norfolk Estate Land Market

We have shown that the Estate did not operate a perfect land market:

- land was reserved speculatively;

- land uses were controlled at least to some extent, and often allocated to, or encouraged to select, certain areas;

- minimum plot sizes were set;

- prices were regarded as non-negotiable where several bidders could be found;

- the siting of the key means of access - roads, canal and railways - was determined or heavily influenced by the Estate.

The Estate was in a strong position to choose land prices because of its size; political, economic and social power; and the underlying tendency to seek stable long term benefits, which influenced decision making in favour of holding some land speculatively to achieve increments in value. Nevertheless, land prices did vary from place to place and over time. They must therefore have been subject to external influences as well as Estate policy.

2. <u>Assumptions About Land Values and Analytical Conventions</u>

In this Chapter some assumptions are made about the significance of basic land prices, and certain conventions are used in analysis:

i. The cost of laying out streets is assumed to be a constant between all sites of equal size. The cost of other infrastructure (e.g. industrial water supply pipes and drainage) is assumed to be equal between similar land uses. These costs are therefore assumed to be insignificant when comparing the price of sites. This is reasonable given that the Estate appears to have imposed these obligations universally and to consistent standards;

ii. Although the cost of paying the Tenant Right varied slightly by season and type of crop on the site in question it is assumed that this would have been regarded as an inevitable cost which would not, therefore, have been a significant influence when choosing between sites. As we saw in Chapter 9, the actual cost was sometimes not known until after the lease was granted in any case.

iii. Rates and taxes are assumed to be neutral in effect between sites for equivalent industrial uses. This is not so much because of the uncertainty referred to in earlier chapters about what the level of rates would be, important though this undoubtedly was. Evidence from Marsh Bros. (Chapter 6) and Edgar Allen & Co. (Chapter 12) shows that local taxes were considered by industrialists as part of land costs, albeit discounted against other factors in the case of Marsh Bros. and of uncertain importance for Edgar Allen's since they are not referred to in the costs of setting up a new plant, but only in later correspondence about running costs. What is more significant in making the assumption is the land use control policy of the Estate, which meant that for the larger steel companies the only real choice was between sites in Brightside Bierlow, where tax rates would have been uniform. Smaller, less polluting firms and residential developers would have had the choice of Highfield or the Park in Sheffield Township but these are less important to this study. It is also noteworthy that firms continued to prefer locations in Sheffield to sites in Rotherham, even though the latter had the advantage of lower machinery taxes for part of the period. This may have had a lot to do with inertia and accessibility to the Sheffield workforce but it shows that land taxes were not necessarily an overriding factor in location decisions.

iv. Values from the outlying districts listed in Chapter 10 are also ignored. Only values for the Sheffield urban area and immediate suburbs are assessed. Values for these peripheral areas are recorded in the database and appear to show significant growth between the 1830s and '90s.

v. Freehold disposals are not counted as these tended to be for special purposes.

vi. Short and long leases are not separated except where renewals for premises are excluded because we are only interested in sites. This ensures that the full range of terms available to lessees is represented fairly.

vii. All values are in d per sq. yd. unless otherwise specified.

viii. Only basic ground rent values are analysed. Data for sub and under-leases are not available but in any case it was shown in Chapter 10 that industrialists tended to be head lessees.

3. Market Effects on the Norfolk Estate

The fact that Norfolk land was influenced by the wider land market, and not subject solely to arbitrary monopolistic price setting is seen most clearly in the trend of land values over the period covered by the Applications Registers and Letter Books. These are shown in Table 11.1.

The table averages the unit price of leasehold transactions across the whole Estate, smoothing out local effects on value, annual fluctuations and variations in data availability. It provides a rough guide to the order of magnitude of land costs lessees would have faced in each decade. It shows that land values were broadly in tune with the wider local economy. Thus there was a rise in land prices during the 1830s, when the secular trend in manufacturing was rising, with a stabilisation signified by a slight fall in the average during the leaner 1840s. The growth of the steel industry and prosperity in cutlery is mirrored in rising values during the 1850s and '60s. Unfortunately the data for the '70s are skewed by the absence of Letter Books for the years when a severe slump was experienced, and may reflect only more buoyant times at each end of the decade.

The continued rise in values during this period is not, however, inconsistent with the overall trend of the data or with the expansion of certain firms against the general recessionary trend, especially as the rate of increase in values fell. The greater economic uncertainty and trends in land values at the national scale show through in the stabilisation and slight decline in average values in the last two decades of the century. In the last decade a number of more distant suburban streets begin to appear at lower values than more central sites. Examples include Roe Wood Lane and other streets in Norwood, and Intake Road. This may not be significant in itself - each decade includes its fair share of cheaper streets - but it probably indicates an emerging tendency for inner residential values to be eroded by competition from cheaper outlying suburban land made accessible by the tramways.

i. <u>Variation in Land Values Across the Estate</u>

To assess whether industrialists were paying higher prices for railwayside sites or for other locations it was necessary to examine the variation in land prices across the Estate over time. This proved difficult. Although the database is reasonably big it covers over 75 years, and 314 streets and other locations within Sheffield and its immediate suburbs alone. It is apparent from the database that building of streets took place in a disjointed and incremental fashion over many years. For long periods there were gaps in the urban fabric. This comes as no surprise. A handbook for bankers in 1885 warned that holding building land as security was highly speculative because:

> There is not a town in England where you may not find secluded plots of building land which the tide of building has passed by on either side from no apparent cause and left in abandoned sterility.[1]

Briggs records another Victorian commentator describing '... desolate gaps so familiar to all dwellers in great towns at a period of expansion ...'.[2] The consequence of this effect is to make statistical analysis of variations in values on the Norfolk Estate difficult. It is not easy to compare values over time. A street may appear consistently in the record for two or three years, then disappear for a time, or altogether. Sometimes many transactions occurred in a single year, though not necessarily all at the same price. Sometimes they are sporadic over decades. So it is virtually impossible to establish, for example, that there is a

[1]Quoted in Offer, 1981, 114
[2]Briggs, 1968, 29

clear distance decay effect in values as a general tendency by comparing large volumes of data annually or even decennially.
It was decided, therefore, to average values over twenty five year periods for streets which exhibited multiple transactions/offers over a number of years. Where such streets were identified, the average value of all transactions was mapped on three plans for the period up to 1850, 1851-75 and 1876-99 (Figures 11.1 - 11.3). Where a street exhibited multiple transactions in one or two of the twenty five year periods and a single value in other periods the single value was also mapped. The streets and values are listed in Table 11.2. One year, 1860, was found to contain a range of transactions from a broad spectrum of streets right across the Estate. 1860 was a year at the heart of the period of expansion in the steel industry and before the onset of decline in more traditional trades, so it is not surprising it produced a high level of development activity.
Transactions/offers for 1860 were also mapped (Figure 11.4) and are listed in Table 11.2.

The distribution of values was also plotted according to distance from the centre of the town. In considering accessibility as it was perceived to affect land values, the centre was taken by contemporaries to be what is now the Cathedral, around which many business houses were centred,[3] or the Post Office nearby in the High Street prior to its removal in 1872.[4] The Cathedral is used here because it was the more permanent of the two. Tables 11.3 - 11.6 show the distribution of values in streets less than 0.5 mile, 0.5 - 1 mile and 1 - 1.5 miles from the Cathedral as the crow flies. These distances are also indicated on the maps. Some streets run across the half mile and one mile boundaries, so it is not always possible to apportion values accurately between distance bands. Where streets crossed these boundaries they were included in both categories of the frequency distribution shown in Tables 11.3 - 11.6 and Figures 11.5 - 11.8. The frequency for streets 1 - 1.5 miles from the Cathedral was also recalculated omitting streets which also occurred in the 0.5 - 1 mile category ('Repeats'). This was on the assumption that sites closer to the town centre were more likely to be developed first. There were too few streets in the 0 - 0.5 mile category to calculate a worthwhile distribution.

Figures 11.5 - 11.8 show the frequency distribution of land prices graphically for each of the ranges of years by distance from the town centre.
From these analyses and evidence from the Letter Books it is possible to conclude:

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[3]See for example the discussion about Iron Merchants in Chapter 7
[4]Transcript of Arbitration Proceedings, Marsh and Others v. The Midland Railway Co., SC Marsh 64

a. The most valuable source of income to the Estate in terms of unit price was premises. In 1881, two office rooms were let in the Corn Exchange for £17-10-0d p.a. and a tender of £30 a quarter for a shop was rejected.[5] Advertising was also lucrative. A site was let on the approach to one of the stations for £2 per month in 1881 and again for the same rent in 1894.[6]

b. The Estate's central land was always highly valued. Although it was mostly let before the data become usable, those transactions which are recorded show rents which were not to be achieved on more suburban sites for many years, if ever. In the period up to 1850 the average value for an amalgam of central sites was 4.81d. The figures derive mainly from the 1830s when sites around the new cattle market were fetching between 4d and 8d in 1831-2, while properties in Exchange Street and Furnival Road near the canal basin reached 8d - 10d in 1835-6. These figures were well above the average of all values of 1.98d for this decade and show that there was a considerable premium placed on accessibility to the town centre, the markets and canal basin. There is a paucity of data for later years, presumably because most central sites were let early on long leases. A 402 sq.yd. central site in Blonk Street, close to the properties referred to above, was let on an 18 year lease in 1894 at 4/6d per sq.yd. It is not clear from the Letter Book if premises were involved - this could be the tail end of a lease or deferral of a reversion - but the price suggests that properties in this area had kept their value in the market throughout the century.

c. The statistical evidence about stratification of suburban land values is less clear. Most Norfolk sites let in the study period were more than half a mile distant from the town centre as the crow flies. Because the Applications Registers and Letter Books frequently do not permit the location of properties to be pinpointed it is only possible to carry out analysis at a street by street level. The frequency distributions do not show a clear picture of values declining with distance away from the town centre, even when repeats are removed. The proportions of properties in the various price categories tend to be similar, taking account of the tendency for there to be more occurrences in the 0.5 - 1 mile band throughout the period. The same applies in 1860.

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[5]ACM/LB/P/607 & 737
[6]ACM/LB/P/281 & Z/193

This lack of statistical variation may reflect the smoothing effect of averaging values over 25 years. It may be that the Estate did not differentiate significantly between residential land values over wide areas of the Estate, though this does not seem to be consistent with evidence from individual transactions. It may also be that because of the constraints on movement imposed by the need to cross the Don and Sheaf, and the steepness of some of Sheffield's roads, the prices represent a more complex picture of accessibility than simple straight line distances from the centre. This is certainly true of accessibility to the railway termini.

d. Looking at the mapping of the average values there are some noticeable effects. References in brackets are to street numbers in Figures 11.1 - 11.4:

- Property by the canal (8) and in neighbouring streets (19, 20) (between which there is some overlap in the analysis) seems to have carried a higher than average value throughout most of the study period.

- Similarly, land by the MR in Brightside (9, 10, 11, 43, 44, 45) on the railwayside appears, on average, to have maintained higher values than surrounding property, suggesting a premium on access to the railway. In particular, properties in Savile Street (45) and Carlisle Street (11) immediately next to the original Midland Station commanded high values. The average for 1851-75 in Savile Street is distorted slightly by a very high rent of 12d next to the station, granted originally to a timber merchant in 1853 and assigned to the MR for a station extension in 1860 (counted once only in the average). This shows how high prices could be pushed by the Estate once railwayside land had become scarce in the most sought after locations.

- It is less easy to detect significant variations in values close to Bridgehouses Station on the MSLR although there was a clear uplift in values in the surrounding streets after 1851 - the station opened in 1845 and converted to a goods station in 1851. Most streets in the averages were residential on the slopes north of the station. There does, however, seem to be an increase in average values in streets with easy access to the new Midland Station opened in 1870 just to the north of Highfield and west of the Park (eg. 52, 33, 25, 17, 41). At the Marsh Bros. arbitration two independent valuers said that proximity to the town centre or the MR or MSLR goods stations increased the cost of industrial land. One considered proximity to the railway station would more than double the value of a site for trade purposes.[7] This perception that industrial land values were higher near goods depots is consistent with Kellett's findings (see Chapter 4 above) and seems to be borne out by the performance of land prices in Highfield. Land values for all transactions in Norfolk streets in Highfield were averaged for the periods before and after 1870. Although fairly crude, this shows that average values ran at 2.26d before 1870 and 5.12d afterwards. This is a ratio of 1:2.265 compared to a ratio of 1:1.768 for all properties on the Estate (2.29d:4.05d), suggesting that the railway did indeed make a difference to values. It therefore seems reasonable to assume a link between increased values on the Norfolk Estate and accessibility to the railway stations.

- Land in the Park seems, on average, to be valued lower than land in Brightside and Highfield. This is consistent with the contemporary view, already reported, that the Park was perceived to be less accessible, even for working class housing. The Park did, however, show a similar average increase in values after 1870 when it was, of course, much closer to a railway terminus. Average values before 1870 were 1.79d. After deducting a number of high values which probably derive from renewal of leases on premises, the average after 1870 was 3.44d, a ratio of 1:1.922, suggesting at least a marginal rise in values after the railway arrived.

- The database in Appendix 11 shows that there was often no fixed price for properties, even within particular streets, with price variations between deals in the same year in many cases. This suggests either that the Estate was prepared to negotiate prices, or that there were market fluctuations within years, or that other factors (perhaps bad neighbours or distance along the street) affected prices. There is no evidence to prove which explanation applies. It seems probable that this is another indicator that market forces affected the price at which each deal was struck, otherwise the Estate would surely have dictated single fixed prices for each street.

ii. Industrial Land Beside the Midland Railway, Brightside

[7] Ibid., evidence of Edwin Fox and Frederick Fowler

It is possible to compare these broader land value findings with the specific performance of land prices for property leased for commercial, industrial and railway uses alongside the MR's S&R line into Sheffield Wicker Station. Table 11.7 lists the prices paid by rail connected firms and the MR for sites in Brightside.

The figures in Table 11.7 show a definite distance decay effect, confirming the data from the 25 year averages showing a premium on sites nearer to the Wicker Station. This is particularly clear in the figures in Table 11.7 for 1860. There also seems to have been added value in the merchanting function if the lease at 12d in 1853 is significant.

Sites in Carlisle Street and Savile Street exceeded the overall decennial average land prices on the whole Estate for most of the period. Those in the more easterly streets stayed below the decennial averages until the mid-1860s, when there was a doubling of prices from 3d to 6d. Presumably the Estate was able to make this draconian increase in spite of the protests of the steelmakers recorded earlier (see Chapter 10 above - Did the Estate Hoard Land for Industry?) because of the growing scarcity of accessible railwayside sites at a time of continuing demand from expanding companies. This advantage could only really be exploited in respect of firms already committed to sites on the Norfolk Estate which wanted to develop extensions near existing works. It was around this time (1863) that Vickers avoided the Norfolk Estate altogether to establish the River Don Works on Fitzwilliam land immediately east of the Norfolk boundary at Upwell Street/Brightside Lane.

Railwayside sites do not seem to have been excessively expensive compared with other industrial locations. Rents of 2d were charged for canalside land in 1826 and 1842, 6d in 1855 and 1859 and 9.99d in 1867. Joseph Peace and Co. paid 3d for 6,000 sq.yds. in Neepsend Lane in 1854 - although not directly accessible to the railway this was about 0.5 mile from the MSLR's Bridgehouses Goods Station. A fork manufacturer paid 3d in 1860 for land in Carlisle Street East not connected to the railway. A 5,688 sq. yd. site was let in 1868 in Warren Street off Attercliffe Road, 0.5 mile from the Wicker Station, for use as a rolling mill at 6.18d. A 2,780 sq.yd. site in Royd's Mill Street by the Don went for 6d in 1864. Firth's extensions across Savile Street East from the Norfolk Works in Greystock Street/Fersfield Street/Windsor Street, which were not railway connected, cost 5.37d and 6.17d in 1870. These and other similar sites were, however, within easy reach of railway or canal termini. In Queen's Road, Highfield in 1860 a 1,996 sq.yd. site was leased to a steel manufacturer for only 1.5d. An industrial site on the Porter in Turner Street next to where the Midland Station would be built five years later went for 2.5d in 1865. After the MR Chesterfield Extension opened, prices changed in Highfield. In 1881, 1,084 sq.yds. was leased to an electro-plater for 7d in St. Mary's Road. This road joined Queen's Road close to the new MR Pond Street Goods Station opened in 1870. Although Queen's Road values never quite matched those of St. Mary's Road they also rose considerably to 5d-6d in the 1870s-80s.

Not all factories conformed to this norm. For example Shipman & Sons' Attercliffe Steel and Wire Works in Sutherland Road - a street leading off Carlisle Street into Pitsmoor - was leased at 2d for 4,739 sq.yds. in 1884. It is not clear why, when another smaller site in the same street and the same batch of leases was let at 5.5d.

4. Conclusions About Land Values

Whatever the reason for this and other anomalies (such as the lease of a site not on the railway in Savile Street East for 12d per sq. yd. in 1871), the usual tendency was for sites with best access to the railway termini to fetch above average prices. Canalside sites were, if anything, more valuable for most of the period. Sites with direct access to sidings were less valuable but began to exceed average values in the 1860s. Sites without good access to rail or canal facilities were only likely to achieve above average values if they had other advantages such as proximity to the central business district or other valuable locations such as the markets. The giant steelmakers were not initially paying excessive sums for sites. From around the mid 1860s this changed as the Estate exploited the scarcity of remaining railside land close to existing factories. It seems it applied similar principles in increasing the cost of industrial land with good access to stations. The setting of industrial land values was essentially driven by market forces, modified by the Estate's land use controls, which limited the choice of sites for heavy industry.

Table 11.1

Decennial Average Values of Sites on the Norfolk Estate, Sheffield, 1825-99

Decade	Average Site Value (d per square yard)
1825-30*	1.65
1831-40	1.98 (+20%)
1841-50	1.83 (- 7.6%)
1851-60	2.54 (+38.8%)
1861-70	3.61 (+42.1%)
1871-80**	4.62 (+28%)
1881-90	3.87 (-16.2%)
1891-99***	3.73 (- 3.6%)****

Notes:

* No significant data available before 1825.
** Letter Books missing/illegible for 1872-6 and 1879-80.
*** No data available for 1900.
**** Figures exclude certain high values for short leases believed to be renewals or relettings of premises. All were in the Park except one in Blonk Street.

Table 11.2

Streets and Land Values Described in Figures 11.1-11.4 (d per sq. yd.)

No.	Street	Up to 1850	1851-75	1876-1900	1860
1	Andover St. **2**	1.75	2.13	2.50	
2	Andover Street West **2**		2.50	4.25	
3	Aston St. **2**		7.00*	4.67	
4	Bernard St. **2**	1.25		3.00	
5	Brammall La. **2**		3.00*	4.44	
6	Brightside La. **3**			2.52	2.00
7	Burngreave Rd. **3**		2.29	3.13	2.00
8	Canalside **2**	2.74	4.56	3.00*	
9	Carlisle St. East Railside **3**	2.50*	3.61		9.00
10	Carlisle St. E. Non-Rail **3**		2.59	4.00*	10.00
11	Carlisle St. **2**	3.62	5.24	5.70*	6.00
12	Central Streets **1**	4.81			
13	Corby St. **3**		2.75	5.00*	4.00
14	Ditchingham St. **2**		3.67	4.67	
15	Earsham St. **2**		3.10	3.88	4.00
16	Edgar St. **3**		5.00	4.08	
17	Edmund Rd. **2**			5.00	
18	Edward St. **2**	1.04	3.62		3.00
19	Effingham Rd. **3**		6.50	6.42	4.00
20	Effingham St. **2**	3.36		8.33	
21	Firs Hill Rd. **3**			2.81	
22	Fitzalan St. **2**	1.06	3.83		3.00
23	Fox St. **2**			3.75	
24	Granville Rd. **2**			2.75	
25	Granville St. **2**	2.03	2.83	8.25+	
26	Greystock St. **3**	1.83	3.41	5.00*	3.00
27	Harleston St. **3**		3.50	3.88	
28	Hereford St. **2**		3.70	3.87	4.00
29	Intake Rd. **2**			2.50	
30	Lord St. **2**	1.81	3.00*	6.00*	
31	Lyons St. **3**			4.43	
32	Marcus St. **2**	1.19	2.44	3.25	
33	Mary St. **2**		4.00	7.50	4.00
34	Matilda St. **2**	2.75	2.50		
35	Myrtle Rd. **3**			2.83	
36	Neepsend La. **2**		3.50		
37	Norfolk Rd. **2**	0.93	1.60	2.25	
38	Nottingham St. **2**		2.25	3.75	3.00
39	Park Hill La. **2**	1.53			
40	Pond Mill La. **2**	1.06	1.25*	3.00*	
41	Queens Rd. **2**	0.9*	1.50*	4.88	1.50
42	Rock St. **2**	1.46	2.56	3.01	2.00
43	Savile St. East Railside **3**	2.33		5.33	
44	Savile St. E. Non-Rail **3**	2.00*	4.60+		3.00

No.	Street	Up to 1850	1851-75	1876-1900	1860
45	Savile St. **2**	2.66	7.25+	6.00*	12.00
46	Sheaf Gardens **2**	1.58	2.00*	4.00	
47	Shoreham St. **2**	2.75		4.24	
48	Shrewsbury Rd. **2**	1.63			
49	South St. **1**	1.43	2.00*	0.40*	2.00
50	Spital Hill **2**	2.50		4.50*	
51	St. John's Rd. **2**	1.50*	2.00	2.00*	
52	St. Mary's Rd. **2**	2.00	2.10	7.00	2.00
53	Stafford Rd. **2**		1.50	2.63	1.50
54	Stafford St. **2**	2.00*	1.88	3.38	
55	Suffolk Rd. **2**	1.93	2.00*		
56	Sutherland Rd. **3**		3.00*	4.25	3.00
57	Talbot St. **2**	1.76	3.00*	2.83	3.00
58	Thorndon Rd. **3**			3.40	
59	Tinsley (Attercliffe) Rd. **2**	1.63	3.17	3.25*	4.00
60	Weigh La. **2**	1.17	1.50*	9.25+	
61	Blackmore St. **3**				3.00
62	Carr Wood La. **3**				2.00
63	Clun St. **2**				3.00
64	Not Used				
65	Fersfield St. **3**				3.00
66	Forncett St. **3**				3.00
67	Lovell St. **3**				3.00
68	Princess St. **3**				3.00
69	Windsor St. **2**				3.00
70	Tom Cross La. **2**				1.00
71	Turner St. **1**				3.00
72	Catherine St. **2**				3.00
73	Montfort St. **2**				3.00
74	Verdon St. **2**				2.50
75	Ellesmere Rd. **2**				3.00
76	Gower St. **2**				3.00
77	Bungay St. **1**				3.00
78	Cricket Inn Rd. **2**				3.00
79	Duke St. **1**				3.00
80	Handley St. **2**				3.00

* Single occurrence only during period in question.
\+ Average distorted by one high value.

1 - All or part of street less than 0.5 mile from the Cathedral
2 - All or part of street 0.5-1 mile from the Cathedral
3 - All or part of street 1.1.5 miles from the Cathedral

Table 11.3

Frequency Distribution of Norfolk Estate Average Lease Prices By Straight Line Distance from the Cathedral Up To 1850

d Per Sq.Yd.	A. 0.5 - 1 Mile	B. 1 - 1.5 Miles	B. Less Repeats
0.51 - 1.00	2	1	-
1.01 - 1.50	8	-	-
1.51 - 2.00	10	3	2
2.01 - 2.50	2	3	1
2.51 - 3.00	4	1	-
3.01 - 3.50	1	-	-
3.51 - 4.00	1	-	-
4.01 - 4.50	-	-	-
4.51 - 5.00	-	-	-
5.01 - 5.50	-	-	-
5.51 - 6.00	-	-	-
6.01+	-	-	-

Table 11.4

Frequency Distribution of Norfolk Estate Average Lease Prices By Straight Line Distance from the Cathedral, 1851-75

d Per Sq.Yd.	A. 0.5 - 1 Mile	B. 1 - 1.5 Miles	B. Less Repeats
0.51 - 1.00	-	-	-
1.01 - 1.50	4	1	-
1.51 - 2.00	5	-	-
2.01 - 2.50	7	1	-
2.51 - 3.00	5	5	2
3.01 - 3.50	3	4	2
3.51 - 4.00	4	1	1
4.01 - 4.50	1	-	-
4.51 - 5.00	1	3	2
5.01 - 5.50	1	-	-
5.51 - 6.00	-	-	-
6.01+	3	1	-

Table 11.5

Frequency Distribution of Norfolk Estate Average Lease Prices By Straight Line Distance from Cathedral, 1876-99

d Per Sq.Yd.	A. 0.5 - 1 Mile	B. 1 - 1.5 Miles	B. Less Repeats
0.51 - 1.00	-	-	-
1.01 - 1.50	-	-	-
1.51 - 2.00	1	-	-
2.01 - 2.50	3	1	-
2.51 - 3.00	6	4	3
3.01 - 3.50	5	3	-
3.51 - 4.00	4	3	2
4.01 - 4.50	5	4	3
4.51 - 5.00	4	3	2
5.01 - 5.50	-	1	-
5.51 - 6.00	3	-	-
6.01+	6	2	-

Table 11.6

Frequency Distribution of Norfolk Estate Average Lease Prices By Straight Line Distance from Cathedral, 1860

d Per Sq.Yd.	A. 0.5 - 1 Mile	B. 1 - 1.5 Miles	B. Less Repeats
0.51 - 1.00	1	-	-
1.01 - 1.50	2	1	-
1.51 - 2.00	4	3	2
2.01 - 2.50	1	-	-
2.51 - 3.00	15	10	9
3.01 - 3.50	-	-	-
3.51 - 4.00	4	4	1
4.01 - 4.50	5	-	-
4.51 - 5.00	4	-	-
5.01 - 5.50	-	-	-
5.51 - 6.00	3	-	-
6.01+	6	2	-

Table 11.7

Prices of Leases for Rail Connected Land in Brightside (d per sq.yd.)[8]

Year	Savile St./Carlisle St.	Savile St. E./ Carlisle St. E./ Brightside Lane (Sutherland Rd. - New Hall Rd.)	Brightside La./ Savile St. E. (East of New Hall Rd.)
1844	1.75		
1846	2.00-2.50	1.65	
1850	3.50	2.70	
1851	2.50	1.84	
1853	12.00[a]	2.00	
1857		2.00	
1859		2.00	
1860	6.00	2.00-3.00	2.00
1861		3.00	
1864			3.00
1865		2.00-6.00[b]	
1870		6.00	
1871			6.00[c]
1881	6.00[d]-9.00		
1886		6.00	
1890		4.00[e]	

Notes:
a. Lease to a timber merchant assigned to MR in 1860.
b. Brown's also took assignment of an earlier lease at 6d. The original lease was let at 2d, so this may represent an option in that lease.
c. Brightside Sidings leased to MR.
d. Renewal of lease to Savile St. Foundry Co.
e. Probably assignment of an earlier lease.

Carlisle Street and Savile Street extended from about 0.5 mile - 1 mile from the Cathedral. Carlisle Street East and Savile Street East between Sutherland Road and New Hall Road ran from about 1 mile from the Cathedral to slightly over 1.75 miles. Savile Street East and Brightside Lane continued for about 0.5 mile to the edge of the Norfolk Estate.

[8]Norfolk Applications Registers and Letter Books - details of most of these transactions are in Appendices 4 and 5.

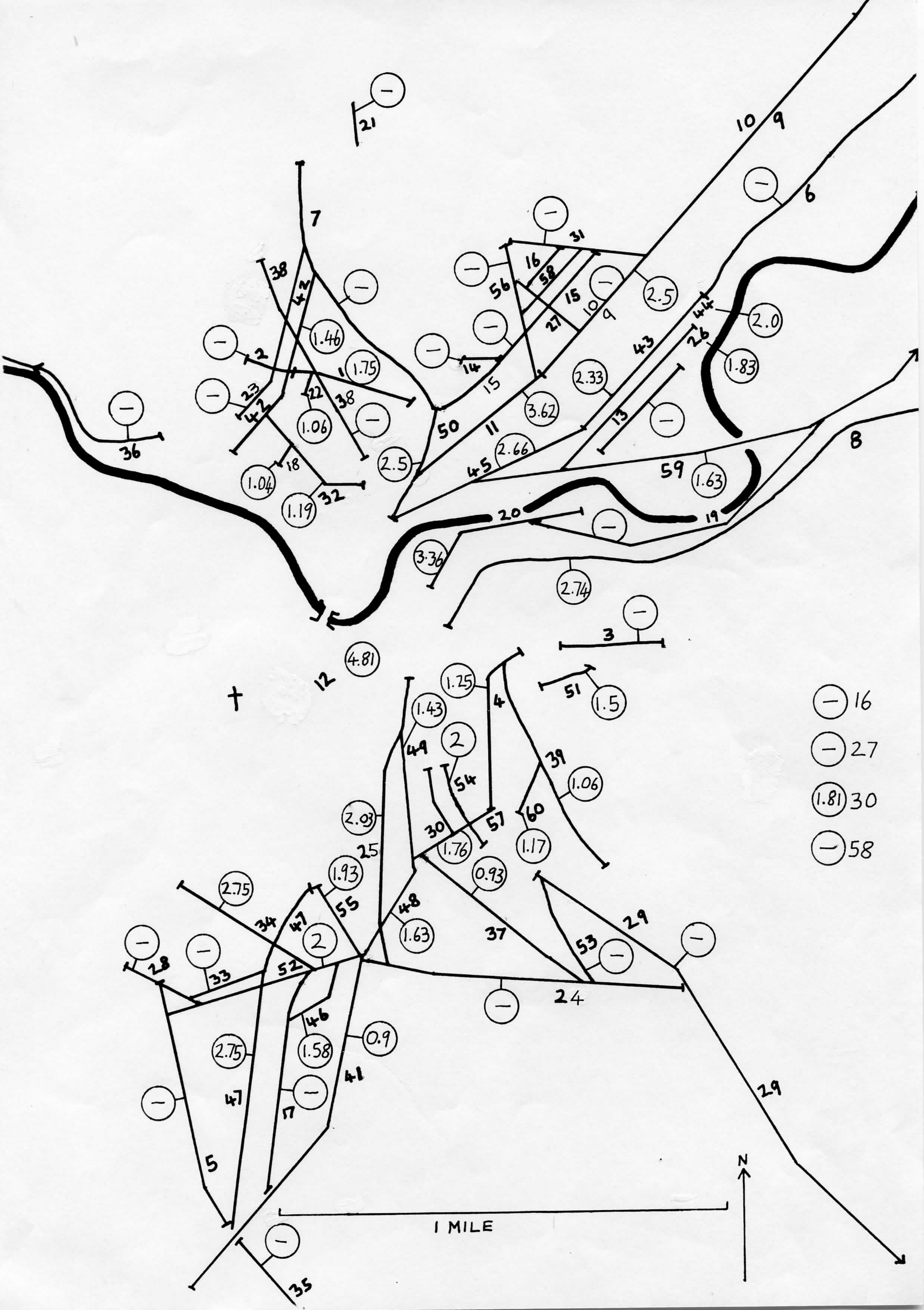
Figure 11.1 (following page)

Diagramatic Map of Average Land Values on the Norfolk Estate, 1825-50

Uncircled numbers identify street name (see Table 11.2)

Circled numbers show average price for leases of land in d per sq. yd.

Numbers not associated with a street relate to roads which lie beyond the map's boundary



16
27
30
58
1 MILE
N

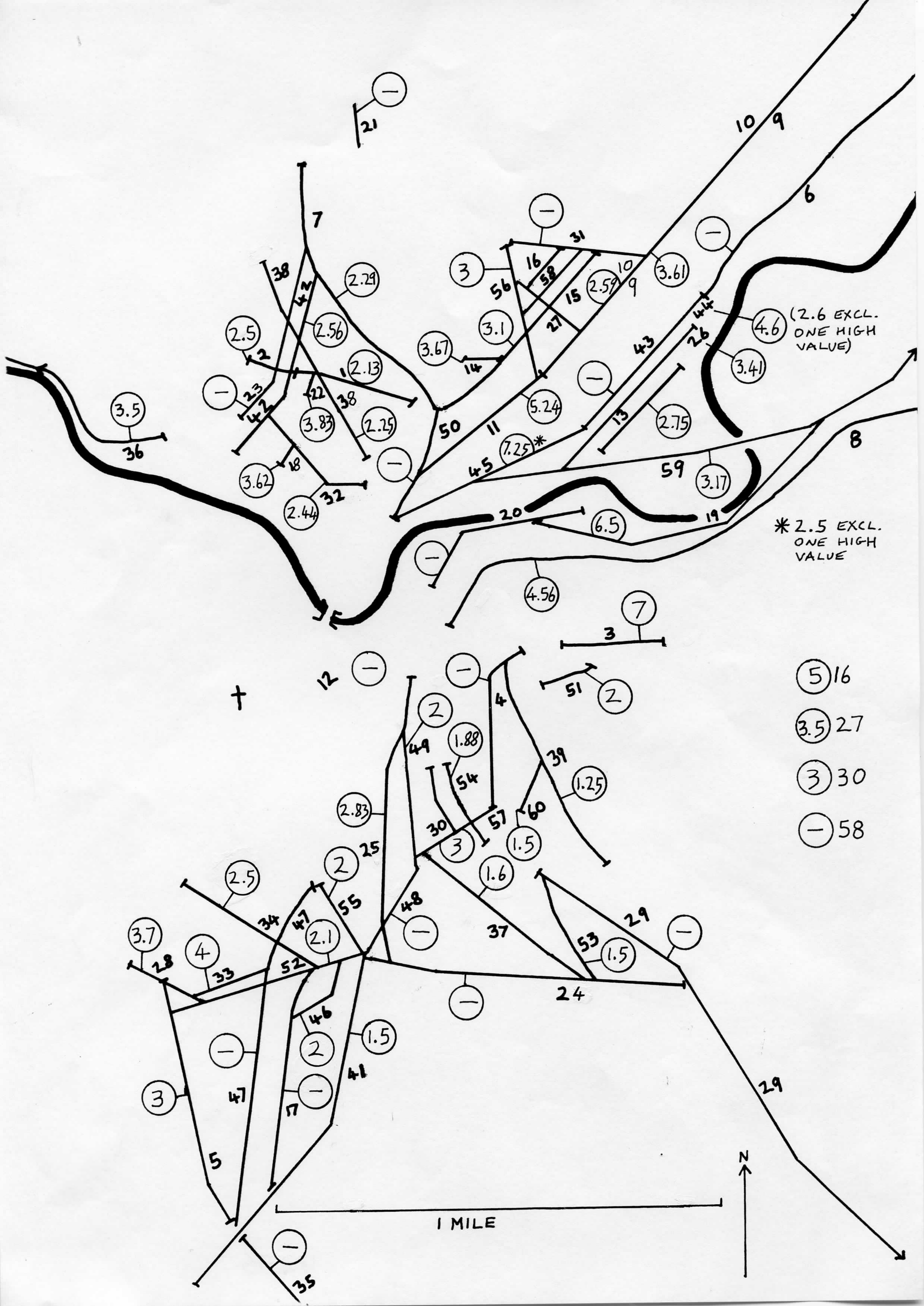
Figure 11.2 (following page)

Diagramatic Map of Average Land Values on the Norfolk Estate, 1851-75

Uncircled numbers identify street name (see Table 11.2)

Circled numbers show average price for leases of land in d per sq. yd.

Numbers not associated with a street relate to roads which lie beyond the map's boundary



(2.6 EXCL. ONE HIGH VALUE)
* 2.5 EXCL. ONE HIGH VALUE
5 16
3.5 27
3 30
— 58
N
1 MILE

Figure 11.3 (following page)

Diagramatic Map of Average Land Values on the Norfolk Estate, 1876-99

Uncircled numbers identify street name (see Table 11.2)

Circled numbers show average price for leases of land in d per sq. yd.

Numbers not associated with a street relate to roads which lie beyond the map's boundary

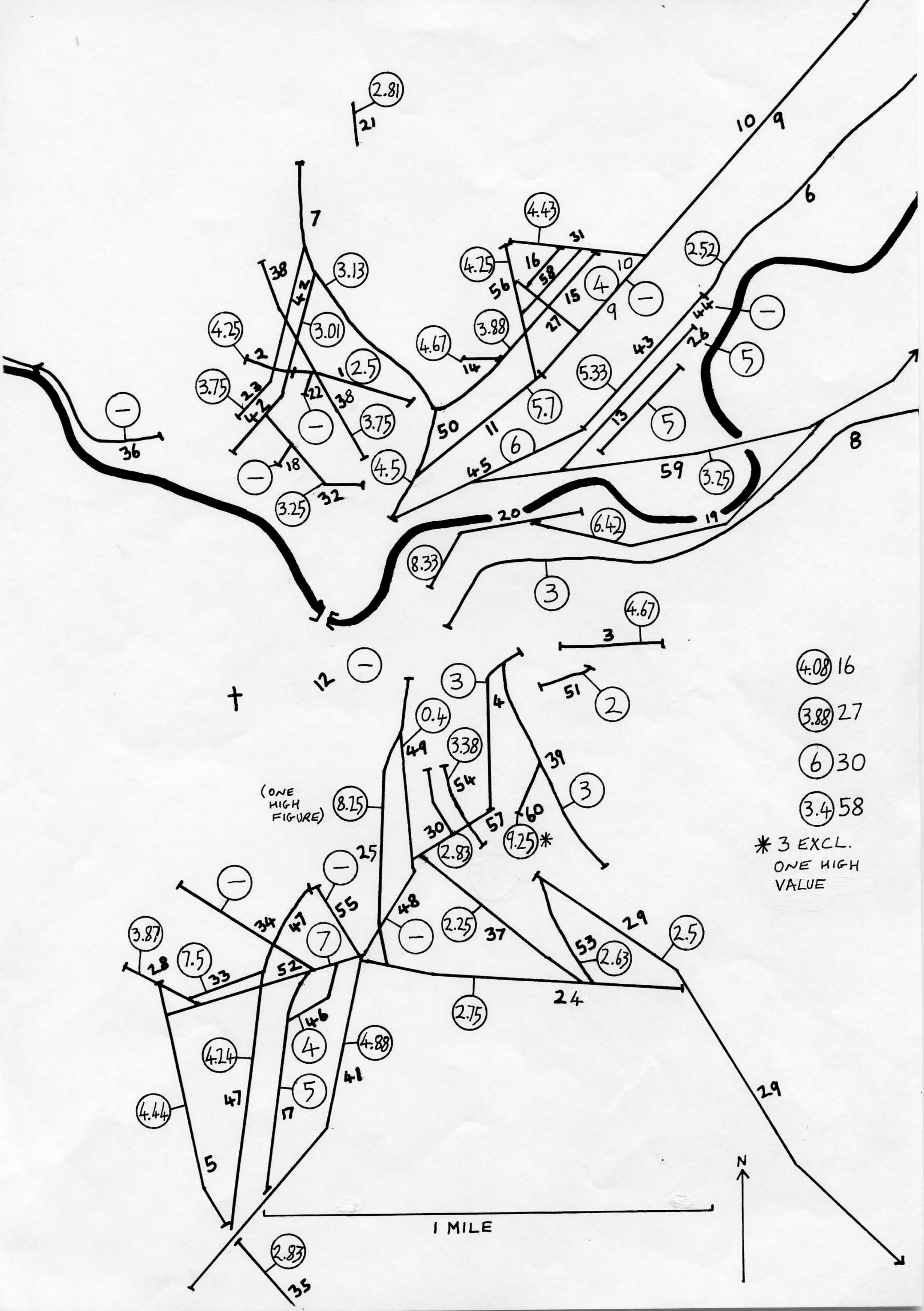

(ONE HIGH FIGURE)
4.08 16
3.88 27
6 30
3.4 58
* 3 EXCL. ONE HIGH VALUE
1 MILE
N

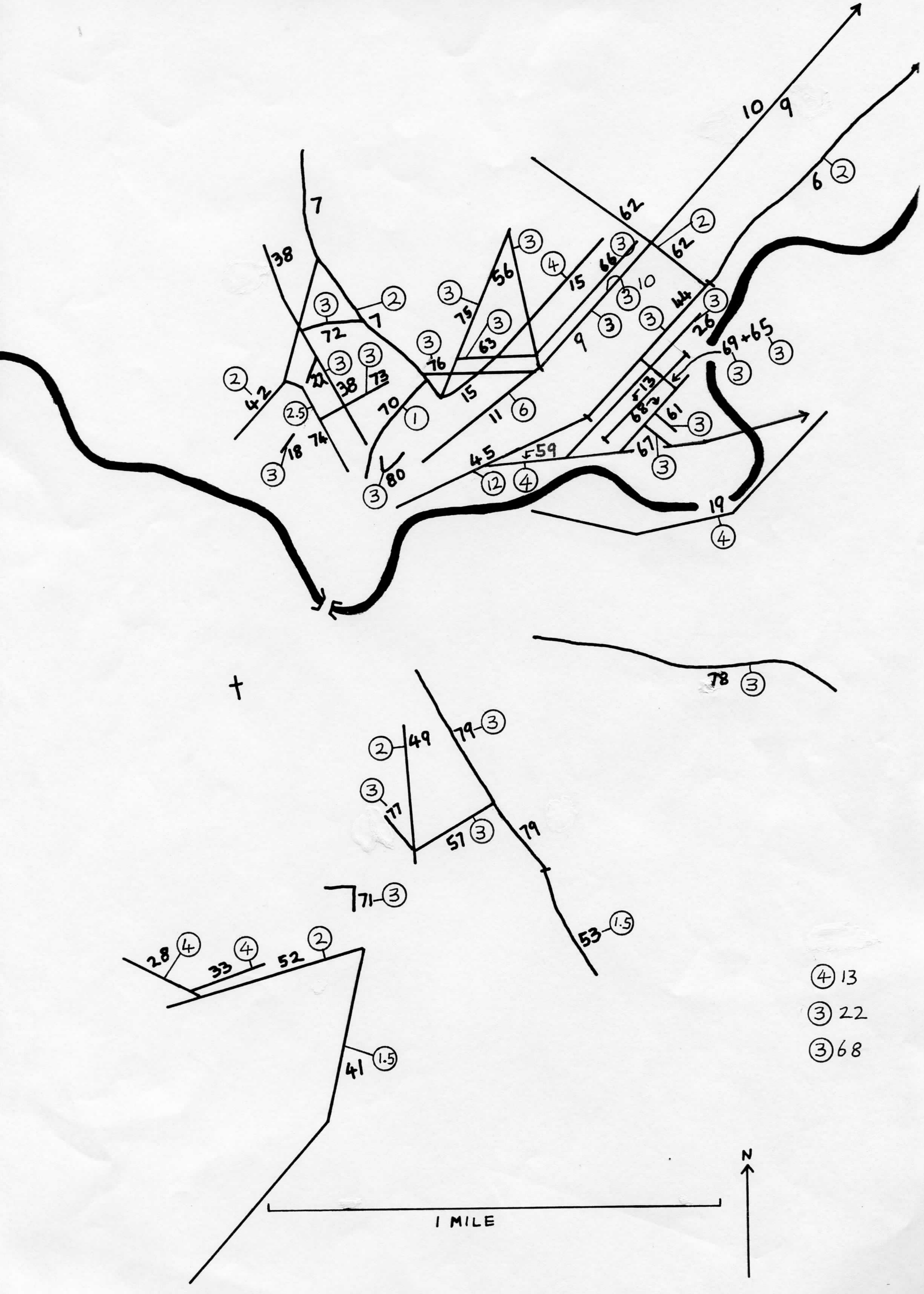
Figure 11.4 (following page)

Diagramatic Map of Land Values on the Norfolk Estate, 1860

Uncircled numbers identify street name (see Table 11.2)

Circled numbers show average price for leases of land in d per sq. yd.

Numbers not associated with a street relate to roads which lie beyond the map's boundary



1 MILE
N
④ 13
③ 22
③ 68

Figure 11.5 (following page)

Graph of Frequency Distribution of Average Land Prices on the Norfolk Estate, 1825-50

Norfolk Estate, Sheffield

Distribution of Average Land Values, 1826-50

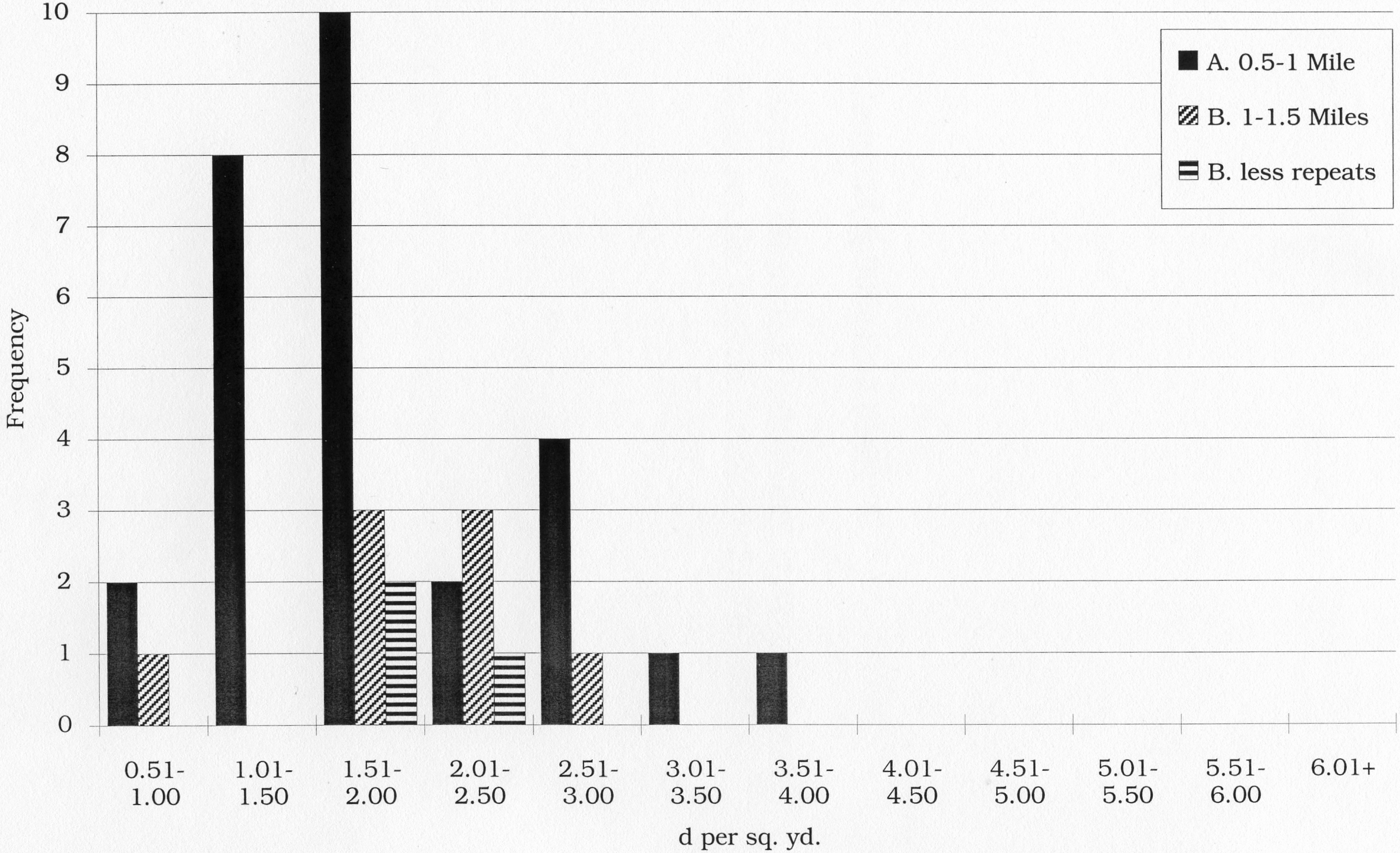


Figure 11.6 (following page)

Graph of Frequency Distribution of Average Land Prices on the Norfolk Estate, 1851-75

Norfolk Estate, Sheffield

Distribution of Average Land Values, 1851-75

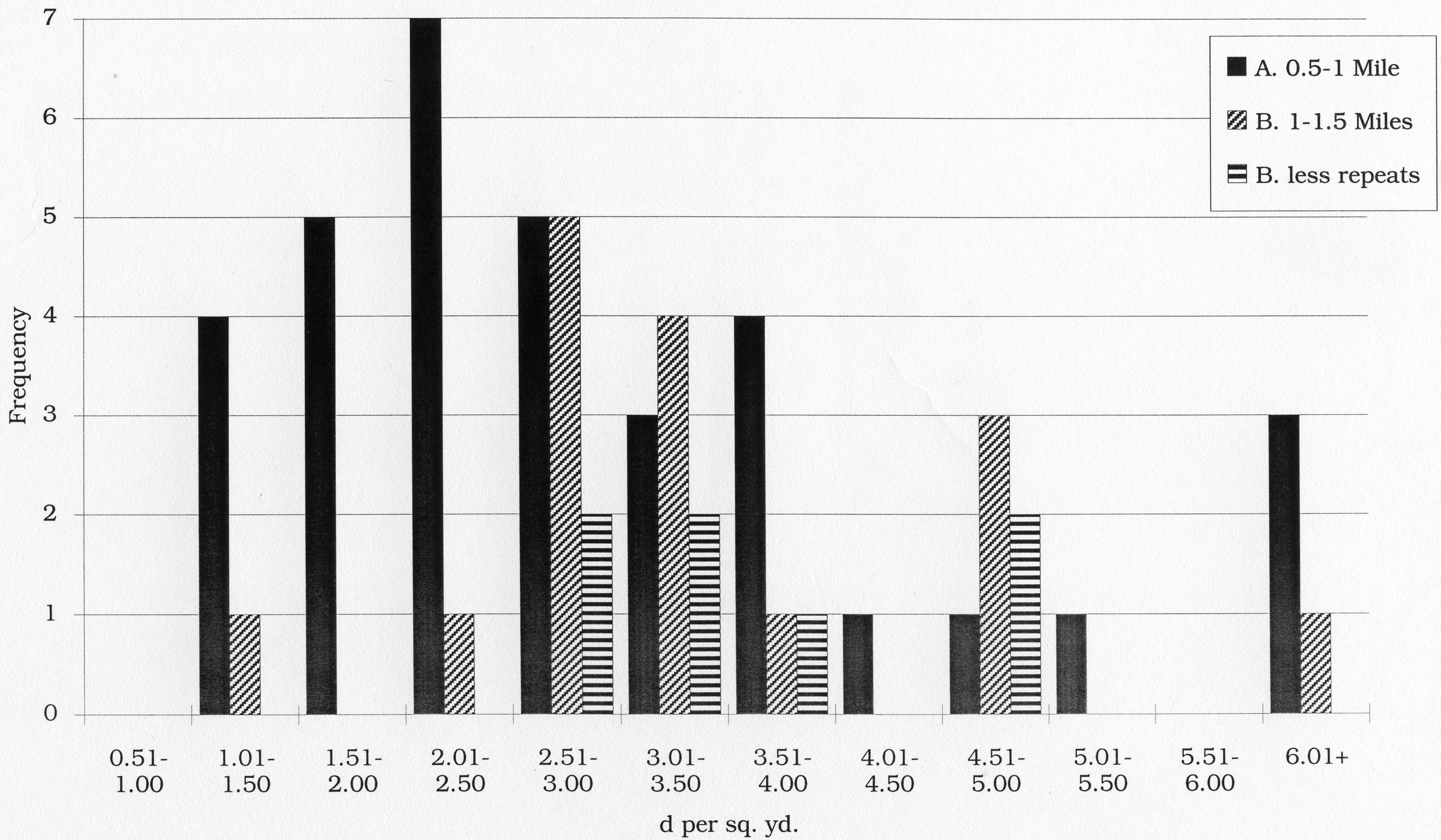


Figure 11.7 (following page)

Graph of Frequency Distribution of Average Land Prices on the Norfolk Estate, 1876-99

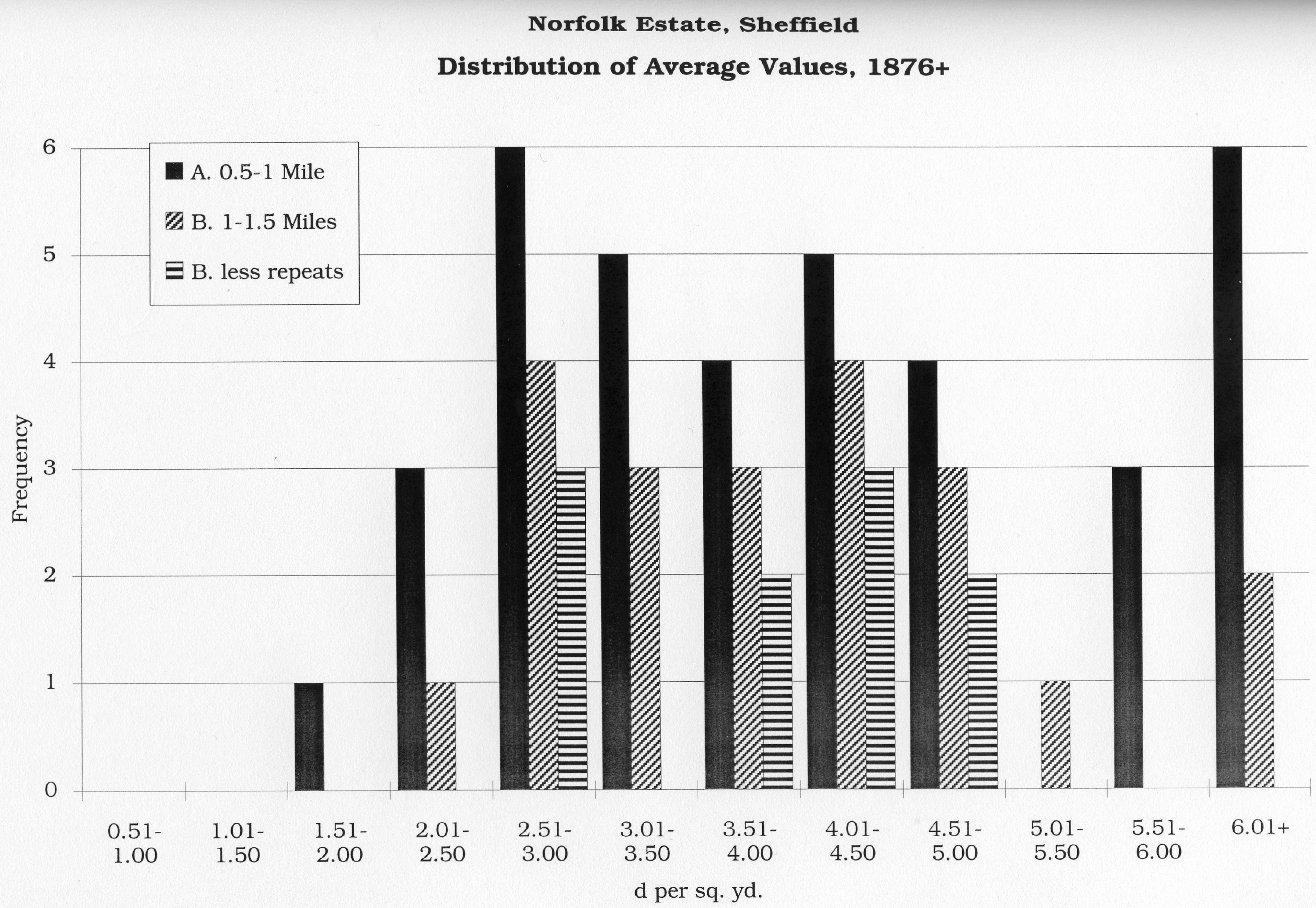

Norfolk Estate, Sheffield
Distribution of Average Values, 1876+
A. 0.5-1 Mile
B. 1-1.5 Miles
B. less repeats
Frequency
0
1
2
3
4
5
6
0.51-1.00
1.01-1.50
1.51-2.00
2.01-2.50
2.51-3.00
3.01-3.50
3.51-4.00
4.01-4.50
4.51-5.00
5.01-5.50
5.51-6.00
6.01+
d per sq. yd.

Figure 11.8 (following page)

Graph of Frequency Distribution of Land Prices on the Norfolk Estate, 1860

Norfolk Estate, Sheffield
Distribution of Land Values, 1860
16
14
12
10
8
6
4
2
0
A. 0.5-1Mile
B. 1-1.5 Miles
B. less repeats
0.51- 1.00
1.01- 1.50
1.51- 2.00
2.01- 2.50
2.51- 3.00
3.01- 3.50
3.51- 4.00
4.01- 4.50
4.51- 5.00
5.01- 5.50
5.51- 6.00
6.01+
d per sq. yd.

CHAPTER 12

J. EDGAR ALLEN & CO. - A CASE STUDY OF THE RELOCATION OF A STEELWORKS 1890-1900

One example survives of correspondence relating to the establishment of a steel works, arising from the re-location of a steel company. Although it dates from the end of the century it still provides useful insights into the process of location decision making which illuminate the deductions made in the rest of this thesis from more indirect sources. The firm is J. Edgar Allen and Co. Ltd., whose Directors' Private Letter Books for 1883-1900 survive in two volumes in Sheffield Archives. It was necessary to examine some 2,000 copy letters, mostly of a mundane nature and often barely legible, to extract the information relating to the new works. In the early 1980s, some additional correspondence was added to the Sheffield Collection after the liquidation of Aurora Holdings, which then owned Allen's. This too was reviewed.

From the correspondence it is possible to build up a picture of the process by which the new factory came to be established. Because of its intrinsic interest and its bearing on the main arguments of the thesis, the evidence is presented as a case study. This gives some idea of what the important considerations may have been in planning a new establishment, and some insight into the motivations of Sheffield entrepreneurs.

1. The Company and The Decision to Relocate

Edgar Allen and Co. was a well established company, with a trademark granted by the Cutlers' Company as far back as 1733. Their development as a significant steel company does not seem to have come until the 1870s. Although they do not advertise in the 1862 version of Pawson and Brailsford's Guide, the 1879 edition contains a full page advertisement for 'Edgar Allen and Co., Well Meadow Steel Works, Sheffield ... Manufacturers and Shipping Merchants[1]. The firm appears at this address and 251 Upper Allen Street in White's 1879 Directory, as 'Steel Converters, Refiners and Manufacturers'. By 1891 the works had moved to Cross George Street near Bramall Lane, Highfield. By 1901 the address was Imperial Steel Works, Tinsley. This last move is examined here. The relative locations of the works are shown in Figure 12.1.

Their 1879 advertisement boasts a wide range of products:

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[1]Pawson and Brailsford, 1879, Advts. 38

> Cast Steel of Every Description, Spring Steel, Blister Steel and Silver Steel. Steel and Iron Forgings. Carriage and Wagon Bearing Springs. Locomotive and Tender Springs, Conical and Volute Springs. Steel Tyres, for Engines and Tenders. Cast Steel Files, Ramps and Saws. Solid Cast Steel Hammers. Screwing Tackle, in Complete Sets. Solid Stamped Eye Picks. Gravel and Foundry Shovels. Anvils, Vices and Portable Forges. Lifting Jacks and Transverse Screwing Jacks. Pulley Blocks, Screw-Keys, Ratchet Braces. Boiler and Condenser Tubes. Bolts, Nuts and Rivets, etc.[2]

The diversity in this list shows that the firm was acting largely as a merchanting company. This is confirmed by a letter from the firm's new managing director, R. Woodward, to J. Edgar Allen, referring to the state of the company before he joined it: '... the Merchant Trade was a declining one and would have to be replaced by Trade in Goods from our Manufacture ...'[3].

This problem of declining trade may (together with the attraction of limiting liability under the Companies Act) help to account for the fact that the firm, hitherto under the sole ownership of J. Edgar Allen, became a private limited company in 1890. Two new directors, R. Woodward and A.A. Wells, brought capital into the firm. Another motive seems to have been Allen's wish to take a less direct part in the running of the firm. In 1891 he departed for London and the Continent, and remained there for over a year. Subsequently he was frequently overseas, at least in part for health reasons. Overseas trips were, however, combined with business. Allen used his travels to drum up trade for the firm.

Friction resulted from the takeover of the Managing Directorship by Woodward. A heated correspondence developed with Allen in which the costs and problems of setting up a new works are discussed. Only the half of the correspondence sent from Sheffield survives, but one can normally deduce the content of Allen's letters from Woodward's replies. Before analysing this correspondence, it is worth noting a letter from Wells to the company's London Agent which throws light on nineteenth century trading practices. The letter is headed Private:

> Just a word regarding tramcar wheel trade -

[2]Ibid.

[3]SC MD 3970, J. Edgar Allen and Co. Directors' Private Letter Book No.1, 1883-92 (referred to below as E.A.L.B. I)

> We believe you will find palm oil necessary in some cases to get orders from tramway Managers. You can feel your way in this respect and if we can assist you we will do so.
> You will find a strong feeling in favour of Miller's chilled wheels but I think it can be overcome in course of time -
> I have had the pleasure of ousting Miller from several good tramways in the provinces, where results outside have been considered ... [4]

The letter demonstrates that it is very hard to get at all the true costs of running a firm. Obviously bribery would have to be passed off as commission or entertainment, or smuggled through the books in some other way.

In mid 1890 the Directors formed their Company. On 9th June 1890, a payment for the new Tinsley Works was despatched, and an enquiry was sent to the Robert Steel and Iron Co. of Paris asking about the royalties it would charge if Robert's process was introduced to replace the open hearth (but not crucible) furnaces (presumably those left on the site by the previous owner).[5]

Woodward subsequently wrote to Robert's London office:

> If we put down a 1 ton Robert Apparatus we shall endeavour to work it to its utmost capacity, but as we shall have plenty of room at our new Works we shall hope to put down more Converters if the first one turns out satisfactorily. The growth of a business is of course a question not only of time but of the state of trade generally ... [6]

The implication is that one reason for the creation of a steel works at Tinsley was the need for plenty of room. Woodward's reason for approaching Robert is given in a letter to Allen the next month - '... We intend to adopt a cheaper process of melting than by Crucibles (as a supplement to that process) because we must be in a position to compete with the Open Hearth process ...'.[7] Edgar Allen and Co. specialised in tramway equipment by this time.[8] It seems the demand for this sort of product was expected to remain fairly stable given the boom in tramway construction. This might help to explain Edgar Allen's decision to invest during a depression (see Chapter 6 above).

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[4]E.A.L.B. I 18 Aug. 1890
[5]Ibid., 9 June 1890
[6]Ibid., 21 June 1890
[7]Ibid., 8 July 1890
[8]Pollard, 1969, 162

It was the scarcity of capital which led to the dispute between Edgar Allen and Woodward. On 29 November 1890, Woodward wrote to the manager of the London and Yorkshire Bank:

> We shall be glad to know upon what terms the Bank will allow us an overdraft of £5,000 up to the end of June next? The accommodation is for the extension of our business chiefly in connection with our New Works at Tinsley.
> We bought these works from Mr. J.W. Sales, the price being £8,000. We paid £3,000 and Mr. Sales has a mortgage of £5,000 @ 4.5%. We may pay off £1,000 a year at our option.
> When we took over Mr. Allen's works in Cross George Street Mr. Fletcher valued the property at £4,220 and Mr. Radford valued the Fixed Plant, Machinery and Loose Tools @ £1,538. These are exclusive of Office Furniture, Stocks of Steel, Iron etc. etc. ...

He goes on to add that another £4-£5,000 of expenditure is anticipated at Tinsley. This gives the cost of purchase of the Tinsley Works and that this was achieved by mortgage to the owner with a large premium. Given the estimated value of the existing works and plant at Cross George Street, this move represents a substantial one for the company - the purchase of a property double the value of their existing investment. It would seem that the new directors were stretching their available capital to the limits if it was necessary for them to seek such a large overdraft.

Allen was not impressed by Woodward's business methods. He wrote condemning the idea of taking an overdraft at the bank and objected to having to provide a personal guarantee on a third of the sum. He laid the blame for the need to seek financial assistance squarely with Woodward and Wells. Woodward's reply is strongly expressed:

> ... When we agreed to form this Company our respective Shares were settled. We were agreed that we should add a Steel Foundry to your then business. Wells and I estimated the Expenditure on a Plant to produce 450/700 tons Castings per anm. at £6,000 exclusive of Land and Buildings.
>
> Then came up the question of buying Tinsley. Wells said No.1 lot would be ample for the accommodation of the Foundry and for Cross George Street too (i.e. for the re-location of the Cross George Street processes at Tinsley). Ultimately it was agreed that we had better purchase the lot ... Then cropped up the Cottage question and we found it ... desirable to include that in the purchase.
>
> Then came the carrying out of the purchase. We had to pay £3,000 down. I assert emphatically that I said then that such a payment did not enter into my calculations. This payment alone

> is sufficient (almost) to account for our present shortage of Capital.
>
> I must disclaim for Wells and Myself exclusive responsibility for our (i.e. your and our) acts in regard to this matter ... I really do not see the object of your harking back on the 'ample accommodation at Cross George Street' ... We did not go into this business merely to carry on the then trade carried on at Cross George Street ...
>
> There is one other step in this Foundry Expenditure and that is the B. Dept. This was no part of our ... proposal to spend £6,000. We were drawn into it by a train of events ... The chief of these events was the fear that (indec. name) was then at liberty to (indec.) in putting down the plant and that later he might not be ...[9]

This letter shows how stretched was the capital of the firm. It also sheds light on the central concern of this thesis - the reasons underlying the location decision. The firm was seeking to expand and was looking for a site to establish a Steel Foundry. It would almost seem from the way the letter is expressed that the original plan had been to expand the Cross George Street works. Whether or not this is so, it would appear that an important consideration in buying the site was the space available. Another implication from the letter is that aspects of the relocation were unplanned.

The firm was ready to expand, but it does not seem that a conscious decision was necessarily made to look for a site in the Don Valley. Rather, the question of Tinsley 'came up' - the opportunity was presented and taken. There are other features which suggest the opportunistic nature of the decision: 'However, ultimately, it was agreed we had better purchase the lot ...'; 'Then cropped up the Cottage question and we found it ... desirable to include that in the purchase'; '... the B. Dept. ... was no part of our proposal ... We were drawn into it by a train of events ...'.

This confirms that there was a speculative element to the re-location, and a tendency to approach the whole matter piecemeal rather than with an overall investment plan, though with the clear desire to allow for the future. The directors were prepared to go beyond the limits of their available liquid capital (albeit using personal guarantees) to take the opportunity of obtaining a site on which they would have room not only for present needs, but for later expansion.

The heated correspondence between Allen and Woodward continued. On 8 January 1891, Woodward reminded Allen that the cost of purchasing Tinsley did

[9] E.A.L.B. I, 29 Nov. 1890

not take into account £5,000 credit allowed to customers, and the purchase of 40 Tons of ingots. The same letter refers to a statement by Allen that he had never before had to resort to borrowing but had always provided capital for his business from his own funds. Woodward did not feel this attitude was appropriate to a large firm. It also emerges that the re-location was to be complete and the Cross George Street Works were for sale.

On 19 January Woodward replied to yet another angry letter from Allen, this time offering to provide the capital needed from Allen's own pocket. Woodward felt Allen had underestimated the difficulty of establishing the Foundry, and what had been achieved already: '... We have equipped a Foundry capable of turning out 700 tons of Castings night and day working and got it to work in very little under 7 months ...'. Reference is also made to the hidden costs of expansion - the added burden of managing a large plant '... Pray remember the work of examining invoices, allocating, posting, adding up Journals and Ledgers has been almost doubled by the Tinsley Extension ...'.

Allen seems to have resented delegating responsibility for a firm in which he had once exercised sole control. He also seems to have had doubts about the amount of capital expenditure necessary. Perhaps he did not altogether trust his new partners or doubted their competence. To mollify Allen, Woodward had to provide complete accounts of expenditure involved in setting up the Steel Foundry. This are set out in Appendix 8. They give an interesting picture of the costs of plant and buildings in a reasonably large works, though not of the magnitude which Brown's or Cammell's had reached by that time.

We see from the 'General Services A/c (relaying sidings etc.)' that the works was already connected to the Midland Railway. The cost of establishing a link to the main line did not have to be met. The cost of altering the railway connection to suit the firm's needs was minimal, compared with the other outlay - only about 1.9% of a total outlay on plant of around £6,721.

Edgar Allen was now in Spain. Woodward continued to supply him with information about the profitability of the firm. Two days after the above account he wrote concerning their chances of remaining afloat '... On 20th Dec. I wrote you to say "We are working 36 Pots 3 rounds daily at Tinsley." If we can keep the furnace working <u>such</u> full time at the prices [at] which we are executing orders the work, as far as we can see, will be profitable ...'. The survival of the firm must have been marginal during the period following the upheaval of expansion and re-location. It was being run on about three to four weeks credit. Woodward suggested that if they raised £3,000 by a call on their own shares, this would keep them in the black for three or four weeks, after which he hoped money owing to them would be forthcoming.

Woodward's letter of 21 January included yet more accounts of additional expenditure. These are listed in Appendix 9. The details of the items to be transferred from Cross George Street show that a number of essential processes, such as making crucibles and possibly even production and storage of coke, were still being conducted there. This would have involved carting these items between the two premises. It is not surprising, therefore, that on 5th February 1891, Woodward wrote to Allen '... It is of the utmost importance that we should concentrate at Tinsley as soon as possible and give up Cross George St. It will save both time and money ...'. Difficulties must have been created by the separation of the offices from the production process. This led to Wells taking responsibility for Tinsley, while Woodward remained at the offices in Highfield. Such inconveniences were 'invisible' costs of relocation.

We see further evidence of rail connections within the site in expenditure on extensions of sidings to serve the Coke Furnace, Cupola, Pot-shed and Fettling Shop. Rail connections between parts of the works played an important part in making the production process more efficient. Allen's constructed not only standard gauge sidings but also a narrow gauge tramway.

These sidings and tramways added £190 to the estimated cost of the works. The firm were able to keep the cost this low by providing their own rails. This is disappointing because it does not allow us to see the true cost of laying down sidings. It does make the point that many steel companies were in a good position to offset the money costs of providing sidings by such means.

There was provision for a railway truck weighing machine (£30), but also for a Cart Weighing Machine (£50). No firm could depend on railways alone. Road transport always represented a vital part of the communications system. Even works with a direct rail or canal connection could not fail to send and receive goods at least locally by cart.

At this point we can summarise the figures which Woodward quoted as the capital costs of establishing the firm as one capable of producing 700 tons of castings per annum:

<u>Costs of Developing the Imperial Steel Works</u>

Purchase of Works	£ 8,000

Foundry Capital Debts	£ 5,279
B. Dept. (i)	£ 1,217
C. Dept.	c.£ 500
B. Dept. (ii)	c.£ 1,200
B. + C. Depts.	c.£ 250
Cross George Street Transfer	£ 3,000
Other Expenditure	£ 2,300
Working Capital	£ 3,000
Total	c.£24,746

Offset against this would be the sale of Cross George Street at about £5,000, giving a total capital expenditure of around £20,000. Another £5,000 might also be offset in outstanding credit, giving a total of £15,000 to be met out of the capitalists' own resources. While £25,000 represents the actual capital outlay necessary to establish the works from scratch, the lower figure would have been the significant one for the directors contemplating the move. The transfer from a works worth £5,000 to one worth £25,000 must have represented a substantial risk. It is easy to understand Edgar Allen's unease.

Of the £25,000, only £316 is directly attributed to capital expenditure on transport hardware by Woodward - about 1.25% of total capital expenditure. This could not have been seen as a significant major cost to be considered in deciding on a location. This does not represent the full real cost of railway connection. The works were already connected to the main line, so the added value of having sidings would have been included as a part of the sale price.

The costs included in the first set of accounts were for relaying sidings. Later extensions used rails already in the possession of the firm. Most of the lines referred to in the accounts were within the site, and do not represent the cost of the main line connection. However, a works railway does represent an important part of the transport network, being a vital link with the main railway. If one estimates that the total real cost of provision of a works railway and main line connection was in the region of £1,000, this represents 4% of total capital outlay. This does not seem to be an over-large slice of the total budget. It would not be difficult to justify the construction of such a link in terms of returns on capital alone. Of course, this was not the only factor to be taken into consideration, as will be seen later. It would seem that by 1890, a railway connection was not the main consideration amongst the costs of building a new foundry. It might almost be taken for granted as a minor element of inevitable expenditure. The effect of a rail link on the price the new owners were prepared to pay for Sales' site cannot be quantified.

At this point, discussion of capital outlay in Woodward's letters stops. Allen seems to have returned to England in June or July, 1891. Before then, relations with Woodward had eased. Woodward's letters became more sociable.[10] Capital expenditure on the plant did not cease, but it is likely that the main outlay which could have been foreseen by the partners when they planned the move is expressed in the figures above.

Vacant land was still available by the railway as late as the 1890s. Although it seems that there were already works on the site when Allen's bought it, not all the land purchased was in use. On 13th February 1891, Woodward sent the Inland Revenue details of rates and rent at Tinsley as follows:

Local rates paid £521.15.0

	£	s	d	
Ground rent	92	1	2	occupied position
"	14	0	4	cottages
"	60	18	8	on unoccupied land

Some idea of the total land costs faced annually by the firm may be gauged from a letter from Woodward to a Mr. Brining of Chesterfield (possibly a solicitor). In his letter to the Inland Revenue, Woodward states that £521 has been paid out in local rates. In this private letter, the figures are different - the reasons for this are obscure:

29 September 1892

-	Rent, Rates and Taxes 1890 - 91			Rent, Rates and Taxes 1891 - 92		
	£	s	d	£	s	d
Ground rent, Tinsley after deducting Tax	162	16	8	162	16	8
do Minerva	42	19	2	42	8	4
Poor rate "	18	12	6	14	18	0
" Tinsley	12	0	11	17	9	4
District Rate, Minerva	27	6	4	29	16	0
Liverpool Rent	20	0	0	20	0	0
London Rent	18	15	0	25	0	0
Water, Minerva	2	0	5		-	
Property Tax, Schedule A						
Minerva	5	15	0	5	15	0
Tinsley	7	11	6	8	15	0

[10] 27th Feb. 1891: 'I hope your cold and cough are gone and Rheumatism too'

	317 16 8	
Water Rate, Tinsley		5 12 6
" Minerva		5 0 0
Newcastle Rent		20 0 0
Income Tax, Schedule D		71 2 0
		428 12 11

These costs suggest that ground rent was not a particularly significant factor as a proportion of total running costs. Wherever works were established on leasehold land, the cost would have to be met. Though ground rent at Tinsley was four times that at the Minerva works at Cross George Street, it was paid for a larger works and would not have been an undue burden in the context of the larger turnover achievable. In fact, there seems to have been some benefit attached to the Tinsley site, for it did not attract the District Rate which was payable on the Minerva works within Sheffield Township. The growth of Tinsley at the expense of Minerva is shown by its rising rateable value and increases in property tax. The expansion of the firm is also reflected in rent for a Newcastle office to add to the Liverpool and London offices.

The Ground Rent for property in the Bramall Lane area seems to have been comparatively high. In a letter of 28th May 1891, Woodward discusses the sale of Cross George Street. For an area of 2,422 square yards, the total Ground Rent (on a lease with 500 years to run) was £48.10.0d per annum. This gives a figure of about 4.75d per square yard - consistent with evidence from the Duke of Norfolk's estate records for other leases in this area, though these were normally for only 99 years. Land was cheaper per unit area at Tinsley.

Paying rent to a ground landlord was not the only way to acquire a site, as one would expect. An interest in a lease could be bought for a premium. On 14th April 1892, Allen was informed that Mr. Sales' trustees had offered the firm their interest in the lease of the late Highfield Crowther's Wireworks at Tinsley.[11] The works had an area of 3,896 square yards, with a ground rent of £28.8.2d - 1.75d per square yard. Woodward reckoned, however, that the trustees would capitalise a rent of 2.25d per square yard over ten years' purchase - a total of £365.0.0d premium.

Although the figures quoted from Woodward's letters may be taken as an approximation of the capital outlay necessary to construct a steelworks, the Tinsley project was not complete, for the Directors decided to change their plans.

[11]The 'British Steel and Wireworks' was a short-lived concern, appearing in local directories only between 1883 and 1890

In February 1891 the company were considering substituting the Tropenas Process (see Chapter 5) for the Robert Process. Edgar Allen and Co. were operating Tropenas converters by 7th February 1892, and by 4th March they had completely abandoned both the Siemens and Robert processes in favour of Tropenas. Steel technology had a high rate of obsolescence[12] and the Robert converters, which formed an important part of the initial outlay, were replaced within one or two years by a more efficient process. This stretched capital still further. The partners advertised for another director to bring more finance into the firm, as well as essential draughtsman's skills. In March 1892 they appointed a suitable young gentleman who provided both draughtsmanship and a much needed £2,000 addition to the capital of the firm.

The Annual Report of 18th July 1892 reported a loss. This was put down to the high cost of staff compared with the overall turnover of the firm, the cost of abandoning the Siemens and Robert processes, the investment in Tropenas plant and the decrease in foreign trade due to unfavourable rates of exchange and high tariffs. This was the heavy cost of establishing the new works. Not unnaturally Allen (again on his travels) was none too pleased. His relations with Woodward deteriorated again. On 15th September 1892 Woodward had to reply to more criticisms, probably about the substitution of the Tropenas process so soon after the plant opened. Allen complained about high overheads. Woodward replied:

> ... You do not appear to take into consideration the fact that a great proportion of the Salaries and Travelling Expenses and other dead charges <u>would have been incurred if there had not</u> been a Foundry ...We require more Machinery to deal with Castings instead of sending them out at much expense and loss of time ... and there are several other items of Capital Expenditure (... Tramways account in works) to lessen wages and facilitate working.

This letter throws light on two aspects of cost accounting. Firstly, some charges were regarded as 'dead' or fixed costs which could not be reduced below a basic level if business was to be maintained. Secondly there were conscious efforts to minimise variable costs such as contracting out and associated local transport costs. Such cost minimisation was seen as one benefit of relocation.

2. <u>Summary of Evidence to 1892</u>

Is it reasonable to take Edgar Allen and Co. as a fairly typical new steel works, and do they fit the concept of the 'marginal relocating firm' as far as large scale

[12]Pollard, 1969, 162

works on a new site goes? Edgar Allen and Co. were one of the later firms to establish in the Don Valley. This late development means they cannot wholly typify firms such as Firth's, which took the bold step of relocation in the 1840s and 1850s. Allen's had already seen the success of large scale production, so the risks involved could be rationalised by comparison with the success of other companies.

Yet it would be over hasty to dismiss the company as atypical. They were specialising in products which were just beginning to take off as municipalisation, electrification and expansion of tramway systems took place. In this respect, their growth follows the same sort of pattern as the companies which grew out of the expansion of railways, or the development of steel armaments. They may be seen as both paralleling and progressing from expansion of the earlier companies - a progression in geographical as well as economic terms. We have already established that the growth of the Lower Don Valley as an industrial area was not a sudden burgeoning in ten or twenty years, but a long drawn out process. Coming towards the end of this period, Allen's could have learnt from the errors of their predecessors, but this does not make them any less a part of that process. The development of the Imperial Steel Works may be taken to be fairly typical of the way in which other major firms were developed. The pattern of J. Edgar Allen and Co.'s relocation - the piecemeal changes to investment plans, the problems with supplies of capital, the emphasis on technological change and economies of scale, the concern with obtaining large areas of well accessed land, using plant efficiently and minimising variable costs - was probably shared by those other companies which dominated the valley.

If we accept that Edgar Allen and Co. was at least similar to the general model of firms which were able to establish themselves in the East End, does it represent the size of firm which was close to the margin of available capital below which it was not possible to locate on a railway connected site east of the Wicker? Edgar Allen's made the jump, typical of many Don Valley steel manufacturers, from a firm involved in disintegrated merchanting and production, with processes carried on by outworkers and contractors, to one engaged in a more vertically integrated production process, converting steel and producing finished castings. The former method of organisation would rely on proximity to a variety of different small traders, with raw materials, part finished goods and the final products moving constantly around the streets between their workshops. The latter was better served by a single large site where all these operations could take place in close proximity to minimise the inconvenience of carriage between processes, and where the quantities of raw materials (notably coal and coke) needed for large volume production could be delivered and assembled with comparative ease.

Allen's previous works at Cross George Street had an area of about 2,400 square yards (the figures for land area vary slightly according to whether the company was paying tax on it or selling it. This figure is the largest given). At Tinsley, if the ground rent payable was about 1.75d per square yard, and the total paid was about £162 after tax, then the area must have been in the region of 22,000 square yards - a change from half an acre to anything between one and four and a half acres represents about the usual comparative size of old and new works for firms such as Brown's and Firth's on their initial moves to the Don Valley. It would take a number of years to fill a new site. In the case of Allen's, about eight years elapsed before further expansion was begun. What is also suggestive is the degree to which the capital of the company was now stretched by the move. Borrowing was heavy, and the company actually made a loss in 1892. One could not come much closer to the margin of failure.

It would seem, therefore, that (at least in the 1890s) a firm of about 700 tons casting capacity, occupying a site of about 4.5 acres, was close to being the 'marginal firm' which could choose to locate on the railwayside in the Don Valley and take advantage of the scale of operation which such a location would permit. The fact that they came so close to failure and yet developed into a firm which continued in existence at Tinsley until the latter part of the twentieth century indicates that the problems of marginality were successfully overcome. Edgar Allen and Co. seem to be representative of the scale of operations just necessary to become established in substantial railway connected premises.

There are fascinating parallels between the findings of this case study and Newton's examination of the financing of the establishment of the Yorkshire Engine Co. Ltd. in 1865.[13] Yorshire Engine was an entirely new company and it had to acquire land and build a works. The firm experienced an immediate shortage of capital during its construction phase, which had to be covered by an overdraft at the bank, and a call on the shareholders. The directors were not able to obtain a mortgage on terms acceptable to them, so further shortfalls were also met by calls. It seems that the works was planned in an incremental manner similar to that adopted by Allen's - for example the directors decided to add a gasworks to the project in May 1866, although this was not part of the original plan. These problems led to the disgruntlement of the shareholders, who were complaining of the slow progress of construction in October 1868. One

[13]Newton, 1993, 306-20

went so far as to say "'I consider the Management of the Company has been disastrous and certainly the reverse of able'".[14] At the shareholders' meeting in November 1870 it was reported that in four years of operation, no profits had been made. Unlike Allen's, Yorkshire Engine never became a success and was sold to new owners as a going concern after its liquidation in 1884. Nevertheless, its early experiences tend to confirm the fragile nature of firms being set up on large new sites; their need to make calls on substantial capital resources from the promoters' own pockets and the banks; and the strain these problems placed on the relationships between the capitalists involved, which were also the hallmarks of Allen's move to Tinsley.

The next part of this chapter will examine the relationship between the firm and the railway companies to which it was connected.

3. Operation After Relocation - The Transport Element

Although there was still 'about £5,000' prospective expenditure on melting and moulding capacity to be carried out by March 1892, the disputes between Allen and his fellow directors seem to have been resolved by the end of the year.

Allen continued his European travels. The fact that he was seeking a divorce from his wife may help to account for his exile, together with concern for his health. We can follow something of the trade of the established company from selected letters and observe some of the negotiations leading to the purchase of land for expansion of the works.

In the 1892 company accounts transport costs were incorporated under the heading 'General Services'[15] but it is possible to see the proportion of costs taken up by transport on various items, and to attempt to judge whether a direct transport link was a significant cost benefit to the company. The company had a siding from the Manchester, Sheffield and Lincolnshire Railway as well as the Midland. The firm made use of its sidings even for small amounts of goods when they were transported over long distances. In May 1892[16] one or two hundredweight of Greensand for casting were to '... come in a good strong sack addressed to us at our Tinsley Siding'. Private sidings were not, therefore, for bulk freight alone. Woodward favoured casting sand from Fontenoy in France.

[14]Ibid., 309
[15]SC MD 3971, J. Edgar Allen and Co. Directors' Private Letter Book No.2 (referred to below as E.A.L.B. II), 4th Mar. 1892
[16]E.A.L.B. II, 5th July 1892

The sand cost[17] 8/- for 4 Tons 6 Cwts. Carriage amounted to 18/3d. Even so, Woodward's letter to Allen justifying this comments 'Is there anyone else who would sell us sand equally good at half the price?!' This illustrates that transport cost minimisation was not the priority. The aim was to get the lowest cost for the overall production function, consistent with desired quality. In September 1894 the company asked for a quotation for 100 to 150 tons of sand. This time, however, carriage was by steamer from Port St. Nicholas, Paris, because 'Il y a des vapeurs que vont tres prochainement, faire le service de Paris a Manchester et nous croyons que cette route nous serait plus convenable que cette par voie de Rouen ...'.[18] Once again the suggestion is that speed and convenience were of the greatest importance.

The terms of Edgar Allen and Co.'s sidings agreement with the MSLR were not as restrictive as those imposed by other railway companies towards the end of the century (see Chapter 7). In 1897 the MSLR became the GCR. Probably as a part of this reorganisation, the Railway signed a new Sidings Agreement with Allen's on 16th May 1898.[19] Allen's did not pay for installation of sidings directly. This was done by the railway company. Even so the financial burden fell on the steel company through Clause 3. This stated that:

> The Limited Company (i.e. Allen's) will during the continuance of this agreement consign and forward by the Railway Company's line and in the Railway Company's trains such an amount of traffic as shall produce to the Railway Company a yearly payment of £500 and the Limited Company will pay the rates in force for the time being charged in respect of similar traffic carried between the several places to which such rates shall apply and Tinsley and Sheffield stations respectively without being entitled to any rebate or allowance from such rates for the reason that the Railway Company do not provide any station accommodation or perform the ordinary terminal services it being agreed that the services to be rendered by the Railway Company relating to the said traffic ... will be equivalent for station and terminal services ...

The clause goes on to state that if the Limited Company did not provide business up to the value of £500 they must make up the difference between the actual value of traffic and that sum until such time as the cost of installing the siding had been met.

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[17]On 23 May 1892
[18]E.A.L.B. II, 7th Sept. 1894, Woodward to Ms. Gustave, Martine, Jeune at Fontenoy-aux-Rouen
[19]Sidings agreement between the Great Central Railway and Edgar Allen & Co. Ltd., Tinsley, Sheffield, 16th May 1898, BRERO 24028

Considering the restrictive agreement operated by the MR, Edgar Allen and Co. were fortunate that they could choose to consign goods above the £500 limit by another railway if they wished. In 1892 the firm were paying 17/6d per ton on File Steel sent to Liverpool. If the same rates were applied as under the 1898 agreement the carriage of about 571 tons of finished cast steel would account for the firm's obligation to the railway company. Given that the furnaces were designed to produce 700 tons per annum at full production, the company should have had no difficulty in fulfilling this quota providing they were operating near full capacity. They would have been left with options as to the placing of the rest of their traffic, including raw materials. The evidence suggests, however, that Allen's were not offered any special benefits to choose a site by their line.

Presumably the MSLR felt convenience of access would encourage the company to send its traffic by their line or that inertia would lead it to use the connection habitually. The railway was bound to get some benefit from the traffic clause, even if this was only the eventual recouping of the laying down and maintenance costs. Allen's were not 'entitled to any rebate or allowance' and had no guaranteed financial advantage over firms without sidings, supporting the view that productivity gains were one of the principal advantages of direct connection to the railway. They might, perhaps, have negotiated a separate deal on traffic rates but this is not recorded.

In 1892, Allen was in Turin, and asked for a quotation on the price of file steel for export. Woodward supplied the following breakdown:

	£	s	d
23 Cwts ingots @ 8/-* cwt	9	4	0
22 Cwts Cogging @ 32/6d Ton	1	15	9
21 Cwts Rolling @ 56/- Ton	2	18	9
	13	18	9
Warehouse expenses say 5%		14	0

Carriage to Liverpool		17	6
	15	10	0 per Ton

* This is price charged by Foundry to Steel Dept. and leaves a profit for Foundry.

In this case the transport costs from the works to Liverpool represent about 5.6% of the total cost per ton of the item.

At about the same time Woodward produced another estimate:

Tues 5 July, 1892

Cost of Steel Cylinder for Portilla, White & Co.

The Casting only (With 10% for Waste and including pattern making) will cost us £13.15.0 p ton here. Suppose we take the casting @ 21/6d per cwt. delivered Liverpool : the Cylinder would come out as under:

	£	s	d
Casting 16 C @ 21/6d per Cwt =	17	4	0
Tooling cost £1/1/08d			
Add 150% £1/11/06d	2	13	2
Testing	1	0	0
Per Cylinder F.O.B. L'pool	20	17	2

Of course we could sell at less than £20.17.2 p. cylinder, because between 13/9d p. cwt here and 21/6d per Cwt. F.O.B. L'pool there is a margin of over 30% ...

Woodward was allowing about 35% for transport and loading costs on this transaction. Although the cost of transporting a finished casting would have been higher than for file steel, the 30% difference allowed a margin for profit. Together with the 150% added to the casting as profit, the company was clearly selling at prices well above its marginal costs at this time.

Income came not only from production but also from licensing and developing the Tropenas System. In 1899 the firm was discussing licenses with seven firms.[20]

Technological and organisational innovation continued into the new century. In 1907, Edgar Allen's were involved with Tropenas in setting up a US operation, subscribing $50,000 from a total capital of $225,000. In March 1908, talks were

[20]Dowlais Iron and Steel Co./Dugald and Rennie of Glasgow/Vickers in Sheffield/Dearne and Dove Steel Works/Barrow Iron Co./Sorby of Sheffield/An unspecified firm in Horwich, Lancs. - SC Aurora 54/a

held with Tropenas about conversion to electric smelting, but a decision was delayed until the pilot plant in America had proved itself.[21]

4. Works Expansion, 1897-1899

Progress towards the end of the century was such that in June 1899 the firm had 12 acres 3 roods 8 perches of land for expansion under offer, and was employing surveyors to ascertain how much fill would be required to bring the site up to the level of the highest point of the adjacent new road, or to the level of the railway company's warehouse.[22] The land was in use as an agricultural holding. The ground rent was to be £400 per annum, or about 1.5d per square yard - a level supporting the evidence of distance decay of railside land values in Chapter 11.

In January the following year the deal was still under negotiation. Part of the expansion was to take place on the land referred to above. This would be leased from Earl Fitzwilliam, with whom terms had been settled. However, a further four acres adjoining was to be bought outright for £3,500 from the SDR. This sum was bid up in competition from £3,000 agreed by the Edgar Allen Board in July 1899.[23] A dispute arose because the railway company wished to impose a condition on the sale requiring Allen's to send all their freight by the company's route. The SDR described this as the 'usual traffic clause' but it was introduced late in the negotiations. It caused difficulty for the steel company because they not only had the siding agreement referred to above with the GCR, but also a traffic agreement with the MR[24]. Woodward described these agreements as 'practically inoperative' because of the working arrangements between the various railway companies for exchange of traffic, when he wrote to the MR to ask if they had such an arrangement with the SDR[25]. In writing to his lawyers he said that 'We divide our traffic chiefly between the Midland and the Great Central and we must continue to exercise our freedom in this respect'.[26] Although Woodward warned the MR that he would have to give in to the SDR or lose the offer of the land, this seems to have been sabre rattling to persuade the MR to reach a traffic agreement with the SDR, for he also pointed out to them the

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[21]SC Aurora 54/b

[22]SC MD 3972, J. Edgar Allen and Co. Directors' Private Letter Book No.3 (referred to below as E.A.L.B. III), 7 June 1899, Woodward to Messrs. Holmes and Watson

[23]E.A.L.B. III, Woodward to Messrs. G.J. Simpson, Solicitors, 9th August 1900

[24]Ibid., Woodward to Simpsons, 6 Oct. 1899 and to G.H. Turner, General Manager, MR, 24 Oct. 1899

[25]Ibid.

[26]Ibid., Woodward to Simpson's, 6 Oct. 1899

advantages of MR rights to use the SDR's Tinsley Road Goods Station 'to give your Co. access to new works we may erect'.[27]

The notion that there was no real intention to concede to the SDR is confirmed by correspondence with Edgar Allen in Gibraltar, when it was resolved that if the SDR would not agree to the original terms of sale 'with the original traffic clause', the Earl Fitzwilliam's land would suffice for the proposed expansion and 'They (the SDR) will keep their land, and we will keep our traffic'.[28] Two months later the SDR gave way and the transaction was concluded on the original terms.[29] At this point Allen's found themselves in another lull in trade with a 'shortage of advances' to cover costs, and times especially hard for crucible steel manufacturers.[30]

This episode illustrates very well the complex interaction between the large scale manufacturer, dependent on good railway access, and the railway companies, dependent on traffic from the manufacturers. In this case Allen's already had sidings access from the GCR and MR, and therefore the upper hand over the new SDR, eager for opportunities to create traffic for the GNR network and the Dukeries coalfields. The degree of interdependence is well illustrated by Woodward's letter to the MR[31] in which he complains that Allen's get far more orders for their products from the GCR than from the Midland and that 'We are strong advocates of reciprocity'. Clearly the ability to retain freedom of choice about the company used to carry goods was valued by manufacturers, even if, as Woodward admitted, it brought little financial advantage.

This part of the case study demonstrates again the high profile which considerations about rail access had assumed in decisions affecting the location and growth of very large operations. There is also further confirmation[32] of the precariousness of planning for growth in a cyclical industry even when a company had achieved considerable scale.

At this point, the case study of Edgar Allen and Co. ends, though the firm continued to grow and extend its interests well after the study period - for example taking over Askham Brothers and Wilson Ltd.,[33] a steel company based

[27]Ibid.
[28]Ibid., Woodward to Allen, 1 Feb. 1900
[29]Ibid., Woodward to Simpson's, 8 Mar. 1900
[30]Ibid.
[31]Ibid.
[32]In the last letter referred to
[33]Pollard, 1969, 226

in Napier Street, Highfield[34] in the early years of the twentieth century, and continuing to expand its international business connections. However, as the final section of this chapter demonstrates, the Edgar Allen papers contain one more document of significance to this thesis.

5. How Rational Were Location Decisions? - A Postscript

We saw earlier in this case study that there appeared to be at least some degree of opportunism about the move from Cross George Street to Tinsley. This is not in itself an indication that the decision to locate at Tinsley was not based on rational criteria. Business planning was not as sophisticated in Victorian companies as it is in modern corporate organisations, but Woodward did attempt to cost the move to Tinsley. The process must have been similar to that described by Kellett for railway investments. Decisions were often taken with a view not to short term profit, but to longer term trade and new markets, or to remaining ahead of the competition.

> Our insight into the exact nature of the calculations which led to these decisions must continue, in most cases, to be founded upon deduction, because of their extremely confidential nature and the empirical and unsystematic way in which the calculations were made. The Victorian railway entrepreneur was guided by experience and commonsense, raised to a very high order, not by systems analysis.[35]

The study of Edgar Allen and Co. shows the same to be true of steel entrepreneurs.

The very nature of a rapidly changing, innovative industry requires successful companies to adapt quickly and seize opportunities as they arise. A past president of the RICS was questioned on this point by the SCTH when discussing the way that 'merchants and tradesmen' made decisions about land. He felt that on average, such people decided rationally and that one 'should assume the sanity and intelligence of the people who are dealing with property'.[36] However, it proved especially hard to find direct evidence showing whether rational criteria lay behind location decisions in the minds of the entrepreneurs who took them. While much can be deduced from the evidence which has been reviewed in this thesis, the testament of those involved would be most valuable in confirming or denying its findings. It was gratifying, then, to find in a loose bundle of odd

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[34]White's Directory, 1901
[35]Kellett, 1969, 25
[36]SCTH, M. of E., PP1886XII, QQ 7983-7992

letters archived after the winding up of Aurora Holdings in the early 1980s, the following typed letter from J. Edgar Allen in Paris to Woodward. Although it does not refer directly to the Sheffield plants, it is a clear statement of the principles underlying Edgar Allen and Co.'s location decision making:

> 26 May 1908
>
> FOUNDRY IN FRANCE
>
> It is amusing to listen to RIVIERE discoursing on this subject. He thinks it may require some £80,000 or so Capital to work it, and 'there you are', the thing is done and you have at once a roaring trade and large profits. I was suggesting to him points for consideration, such as selecting the District, the site, where to find suitable workmen under economical conditions, the cost of Fuel, sand, raw material and transporting it and their carriage. Also cost of delivery of Castings and, not the least, the Works Management. Also if he pins his faith on our exclusiveness in the manufacture of Mn Steels, how long it would remain so in France when made by French Workmen?[37]

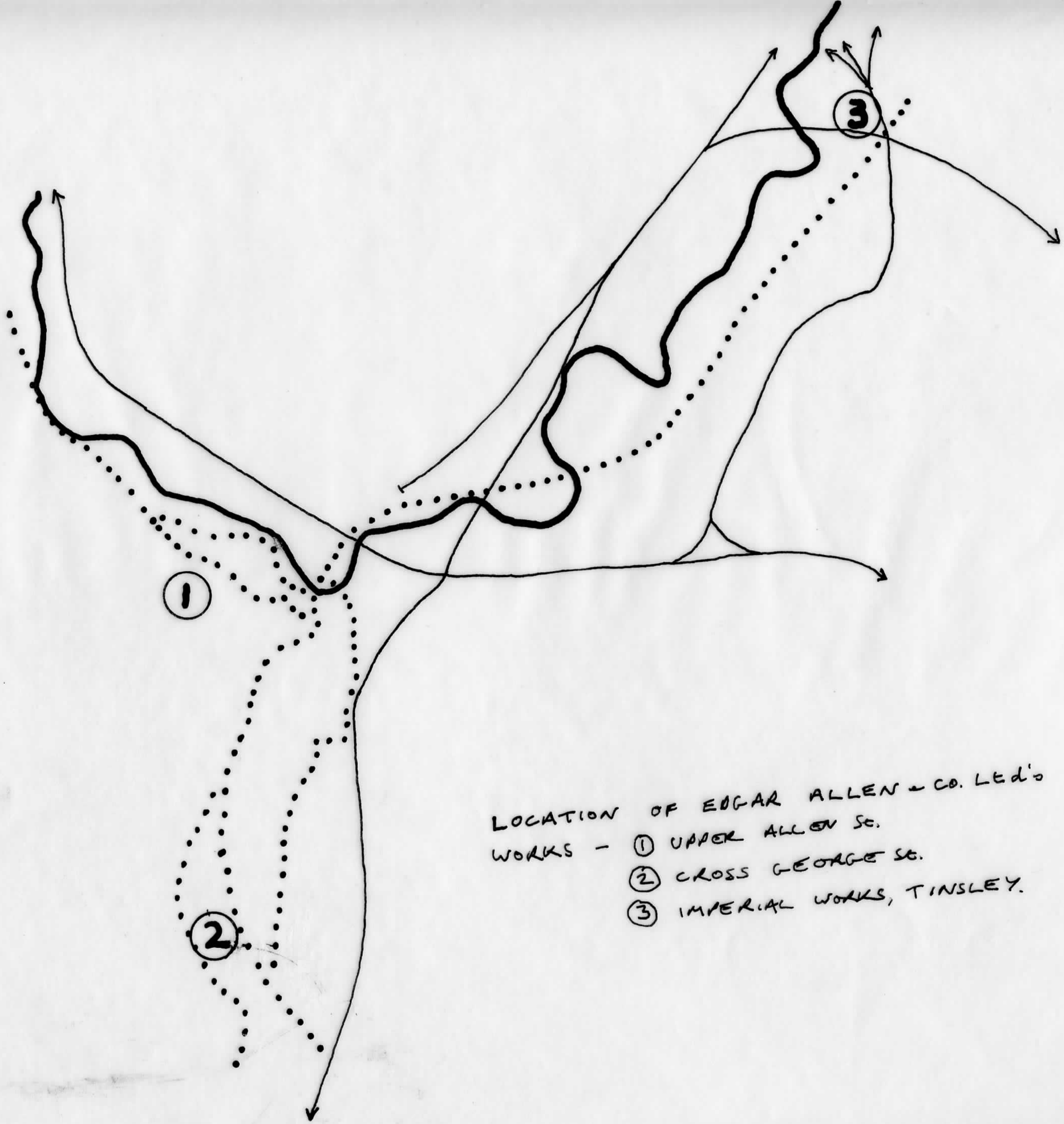
This eloquent statement needs little expansion, save to say that it confirms the rationality of steel industry location decisions, and the centrality to them of those issues which have formed the focus of this thesis. Questions of management, transport costs, convenience, site suitability and access to a skilled workforce were all taken into account, and a judgement made in the light of the entrepreneur's judgement of the economic rationales of production and logistics.

[37]SC Aurora 54/b

Figure 12.1 (following page)

Locations of J.Edgar Allen & Co.'s Sheffield Works

The map shows the 'classic' location path adopted by the firm, beginning with a works in the inner industrial ring around the town centre, moving to larger premises in the suburb of Highfield, and then to a much bigger site with rail connections in the Lower Don Valley.



LOCATION OF EDGAR ALLEN & CO. Ltd's WORKS – (1) UPPER ALLEN St.
(2) CROSS GEORGE St.
(3) IMPERIAL WORKS, TINSLEY.

CHAPTER 13

CONCLUSIONS

The conclusions of this thesis are presented as a behavioural model for an archetypical Sheffield steel firm growing from initial start-up to large or giant status (as defined in Chapter 5), with some more specific points following. The model addresses the influences on location decision making described in the first four chapters.

1. A Location Decision Model for Nineteenth Century Sheffield Steel Firms

i. The Initial Location Decision

The first decision for any firm was the choice to go into steel making. An entrepreneur or entrepreneurs (invariably male) probably experienced already in the manufacture of steel (for example the Firths) or merchanting steel or other metal products (for example John Brown) or both (for example Samuel Osborn), would see an opportunity to make money. Partners would be sought, or family members recruited. A partnership or family firm would result. The firm might concentrate on production, or retain a merchanting role as well.

The partners would decide to locate in Sheffield, probably because some or all were local people; knew they could find skilled labour in the town; could inter-trade locally; could have access to the associated skills and crafts they could not supply themselves; could trade under the banner of Sheffield's reputation for quality; and could take advantage of an established infrastructure for the supply of raw materials and distribution of products.

The partners would almost certainly include one or two individuals who would continue to dominate the firm's decision making unless (like John Brown) it was judged that they were no longer guiding it to commercial success. Even then (as in the case of Samuel Osborn) the entrepreneur's standing might be such that they could ride out commercial storms on the strength of their reputation. In some firms there might be a division of labour, with partners taking specific responsibility for production, design, sales, financial management and so on. Sometimes sleeping partners provided capital but did not participate in management.

The firm would seek premises in one of the existing industrial areas clustered around the town centre, unless it intended to pursue rolling or tilting as well as melting, in which case a water mill would be required in the first thirty or forty years of the century. If possible an existing workshop would be desirable, though new premises might be built. Our firm is assumed to have sought an existing factory, perhaps one which had belonged to a company which had gone bankrupt or where the previous proprietor had died. The factory might have been advertised in the local paper but word of mouth was probably sufficient in the small firm sector. If a lease was taken it might well be mortgaged to provide capital. The company would construct new furnaces or refurbish those on the site. Other firms in the locality might provide services such as rolling or forging. Sometimes these processes would be carried out further afield.

Raw materials would arrive by cart. After the canal opened, much of this traffic would be short distance from the canal basin. Later it came from the railway termini. The Duke of Norfolk's collieries would be a principal source of coal, carted from the colliery yards on the edge of the Park. Products would leave the factory by hand or pack horse in the early part of the century and later by cart. The most important factors in the location decision would be availability and cost of existing premises; agglomeration with other small firms; access to a skilled workforce to operate the craft based steel making processes; access to water if a source of mechanical power were required, either to power a wheel or supply a steam engine; and somewhere where bulky raw materials (albeit in relatively small quantities) could be delivered easily. A ring of steel manufacturers and cutlers surrounded, and thus vented smoke over, the town centre. The need to minimise pollution would not have been a serious concern. The ability to pollute watercourses was seen as an asset.

ii. <u>The Expanding Business</u>

The firm could expand or otherwise generate a demand for relocation as a result of one of four factors, or a combination of them:

a. Product based expansion, in which demand for an innovative product would lead to growth (for example John Brown's patent sprung railway buffer);

b. Volume led expansion, in which demand for the firm's basic products grew because of their reputation for quality and/or price, or because they opened up new markets. This appears to be what happened to firms such as Spear and Jackson;

c. Process led expansion, in which the firm gained a competitive edge through the adoption of new production technology. Bessemer's might be an example, although they did not follow the more conventional small-to-large firm growth path. Vickers and Hadfield's would be cases in point. Sometimes (for example Hadfield's invention of manganese steel) leaps in technological competence even ran ahead of demand for products;

d. A change in company structure such as the family quarrel which split Naylor, Sanderson or the decision of one or more partners to go into business in their own right.

Important groups of customers for the firm's products and services would have been other local companies; manufacturers in other towns; merchants; and end purchasers such as railway companies.

For the astute firm an important place would be given to selling, and seeking out new product areas and markets. Representatives would be used but one or several of the partners would also undertake selling expeditions in Britain, America and Europe. Efforts would be made to learn the secrets of other firms' technologies, either by visiting their place of production or examining their products[1] or by hiring their key workers. This tactic was exemplified when Brown, Bayley hired Harry Brearley after he fell out with Firth's, and began to make stainless steel.[2] Firms took great care to protect their own techniques, as in the case of Mushet and Osborn's elaborate measures to guard the mysteries of RMS Special Tool Steel.

As the demands of production outgrew the initial site, the firm had three options:

a. Expand into adjoining land or premises if available - probably the preferred course of action;

b. Acquire additional premises elsewhere. A primary requirement would be a location close to the initial factory;

c. Acquire new premises or build a new factory and move from the initial production location.

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[1]Sometimes secretly, as when John Brown investigated French armour plate - Tweedale, 1976, 16
[2]Ibid., 1976, 9

All three courses of action were pursued by firms in Sheffield. A successful firm might well move to new premises and then have to take on additional property later. Some firms such as Firth's used the occasion to establish separate premises for different craft functions.

As firms moved from small to medium size and had more capital or better security to raise loans, they had the opportunity to build works suited to their own needs. Our typical firm would certainly have considered a canalside location, but might have been deterred by comparatively high land prices or the prospect of a more suburban milieu, away from traditional industrial quarters. The new Sheaf Bridge would, in any case, have helped communication to the Basin from other parts of town. There was certainly no frantic rush for canalside land. Probably, the scale of most firms did not necessitate the volume of raw materials movements which made proximity to a high volume transport artery essential, for land remained in Norfolk ownership to supply the demand for iron wharves from giant steelmakers well into the last quarter of the nineteenth century.

After 1838 an alternative opportunity existed - to locate near the railway. Again there is no evidence of a rush to take up railwayside sites. Partly this would be a result of the small size of most firms, but it seems the Norfolk Estate also played a role by limiting the supply of land to benefit larger firms by land banking and planning bigger sites next to the railway. Non-railwayside sites for expansion before 1855 included land near the Wicker and in the Green Lane/ Shalesmoor area.

Another important factor creating greater flexibility in locational choice would be the decision to adopt steam power to provide mechanical energy.

iii. The Large Firm

As the firm continued to expand it began to become more integrated and self sufficient, undertaking a wider range of processes itself. It remained a collection of craft workshops but integration would undoubtedly have provided a motive to organise the works better. From the 1850s, some firms such as Brown's began to adopt new production technologies which required more space, organised in ways different from traditional converting and refining furnaces. Others such as Vickers simply needed to multiply their furnaces to produce bigger ingots, castings or engineered products. The diseconomies of transporting part-finished goods between works (including molten steel in crucibles in some cases) would begin to weigh on production costs and schedules. Greater volumes of factor inputs had to be transported and accommodated. The firm had to move.

At this point the temptation to build a new works on a virgin site would have been strong, although moving to existing premises and modifying them might still satisfy - as in the cases of John Brown's move to the Queen's (Atlas) Works and J. Edgar Allen's to the Imperial Steel Works. In deciding to move, the firm often chose also to re-equip with the most modern production technology. from the mid-1860s there might have been a restructuring of the company's ownership through flotation and/or limited liability.

We will follow the path of a firm deciding to build its own new works, having found nothing existing on the market to suit its needs. The large firm could choose one of a number of locations to set up its works - generally over one acre in extent and possibly up to four or five. There were railwayside sites in Brightside after 1838; non-railwayside sites (for example the land chosen by Jessop's in Brightside); land in Neepsend; or Philadelphia. From the 1840s in Brightside and the 1850s in the other two areas, these were the locations of choice for the larger steelworks. All had relatively good access to goods stations. Neepsend was close to Bridgehouses Station, while Philadelphia and Shalesmoor had reasonable routes to it across the Don. One advantage of sites in Brightside was that some offered the direct connection to the railway that could not be provided by the MSLR because of awkward levels. Another was the laying out of broader new streets (also found in Neepsend) which could cope with heavy goods traffic. Over a period of 20-25 years, the steel industry and its associated crafts took the pick of the best suburban factory sites within easy reach of the central goods stations and the town centre.

Although our firm had to compete for land with other steel and engineering companies, it would not have had much to fear from cutlery manufacturers. There were increasing numbers of cutlery factories but they were more compact, multi-storey affairs which tended in general to keep to more traditional locations round the town centre. In all probability it was the cutlers who could not compete with the steelmakers for large sites.

iv. <u>Finding a Site</u>

The firm would be looking for a relatively flat site, which would limit choice in a hilly town like Sheffield. Given perceptions of land ownership, the aspiring factory owner would probably have approached the Duke of Norfolk's Land

Agents to enquire about land in the proto-streets laid out with edge stones in the East End or Neepsend.

The research did not uncover how sites in areas such as Philadelphia came to the market. One can imagine enquiries being made of the Duke's Agent (since most witnesses to the SCTH seem to have assumed the Dukes owned most of the town) only to be redirected to the rightful owner. No doubt such development land was also advertised or laid out to attract developers.

Our firm might, especially after the opening of the MR Chesterfield Extension in 1870, also enquire about land in Highfield, only to be told that covenants in the lease would preclude heavy industrial processes. The choice of site would depend on a number of factors, including:

a. the view of the decision makers in the company about the importance of a direct rail connection;

b. the balance decided on in the production function and relocation costs between land prices, terminal costs and other factors;

c. whether, in the light of a. and b. above the firm was willing to pay the marginal additional cost of land beside the railway which prevailed throughout the period (though at much higher levels after 1865);

d. whether the Norfolk Estate was willing to lease a site beside the railway to the firm. Although the Estate's attitude was initially laissez faire provided the firm was prepared to lease a big enough site, it would have become harder to get a new site as the Estate hoarded land speculatively to capitalise on the expansion needs of a few giant firms;

e. ability to meet the costs of compensating former tenants and of new urban capital (surfacing streets and drainage) which came with a Norfolk Lease.

It seems reasonably certain that there was a marginal firm size above which relocation coupled with expansion could be achieved successfully. The size of such a firm would have varied with trade conditions but Hadfield's (on moving to the East Hecla Works) and J. Edgar Allen (on moving to the Imperial Works) seem to be good examples. The upheaval and expense of building a new works stretched capital and generated stressful periods for the firm's managers and owners. Some firms such as Armitage, Frankish and Barker (owners of the Atlas Works before John Brown) did not survive the disturbance.

At this distance from central Sheffield, access to a good labour supply was still not a problem. Employees could walk to work from home easily, and new houses for the steel workforce began to be built in the East End at a pace to match factory building. For part of the period machinery tax levels might have been considered as a factor, but few firms chose Rotherham rather than Sheffield, probably because the skilled labour supply was in the latter town. Differentials between local taxes in Sheffield Township and Brightside Bierlow were rendered more or less immaterial for large companies by Norfolk land use controls.

The ability to operate without pollution controls was, if anything, more important for the large firm than the small. In Brightside and Neepsend, Norfolk leases imposed minimal restrictions on land use, nuisance and eventually chimney heights. The Estate did not, however, impose unrealistic standards which would have limited production potential. Given the intermittent interest of the public authorities in smoke control, a location which allowed it to blow towards neighbouring Rotherham might have been perceived to have advantages, especially as many manufacturers of substance moved their homes to the south west and west of Sheffield.

The firm would aim to take a site big enough to accommodate its immediate needs. Given its past experience of having to move to grow, it might seek additional space for future expansion. This would help to account for the delay between initial acquisition and further expansion, as when Brown's took over the four acre Queen's Works with only one acre developed. This lag might also be explained in part, however, by the period of recovery following the dislocation of the move or by rationalisation within the site as the firm sought to accommodate increased business without having to take more land.

During the 1840s and '50s there was a good chance that firms which had sufficiently large needs for land (usually over one acre) could lease a railside site in Brightside on the Norfolk Estate. About a dozen works were originally accommodated next to the lines in Savile and Carlisle Streets, Savile Street East and Carlisle Street East and Brightside Lane, though this number was later reduced by takeovers.

The more ambitious or perceptive industrialists would have grasped the necessity of a railside site to enable continued growth. Many other firms seem to have been satisfied (or perhaps satisficed) by locations within easy carting distance of the rail termini. Perhaps, like Marsh Bros., they failed for a combination of reasons to cross the marginal threshold which enabled the top half dozen firms to achieve giant status. Such reasons included failure to grasp managerial or technological change; failure to innovate to meet the demands of new markets; failure to re-organise or rationalise production or make productivity savings; under-capitalisation or failure to find a profitable way through recessions (the two could be linked). Re-organisation and rationalisation measures could include relocation to more appropriate premises, so failure to pick an optimal location could be included in these factors. It is important to remember, though, that in a high added value business the scale of the plant may not be the best indicator of company performance. Osborn's, for example, continued to trade from the Clyde Iron and Steel Works[3] in the Wicker. This substantial works covered about 2.2 acres but was far smaller than those of Firth's or Brown's. Even so, Samuel Osborn created enough wealth from production of high value special steels through craft methods to become an important local public figure and a well known industrialist on the national scene.[4]

Nor did the move always entail abandoning older works. Although the Edgar Allen case study shows the additional costs which could result from operating from more than one site, Jessop's retained their Park Works for years after they moved to Brightside and even added the Soho Rolling Mills. Bury's and the Globe Steel Works both operated from two works.

The decision not to locate by the railway when undeveloped sites were available there may have been quite rational. Not all firms would have wanted to run a new building project. It would also have allowed firms which felt they could manage with carted deliveries to choose between different transport modes more easily. Although the railways did not use traffic clauses in sidings agreements at first, firms without sidings may still have felt more independent. The canal also remained an important route for raw materials throughout the study period, so a site on a main road with access to all goods stations and the canal wharf might have been seen as optimal. Probably the smaller firms could not compete so effectively for higher priced railside land, though the marginal extra cost does not seem to have been great before 1865. It is not at all clear that the marginal extra cost of local carting would have been seen as a very significant part of the production function, although the evidence from marsh Bros. and Hadfield's (Chapter 6 above) shows that the opportunity to reduce local carting costs could be one factor in a more complex locational equation. As railway rates evolved there were savings for companies with sidings through zoned pricing but it is uncertain when these came in. The inefficiencies of terminal services and the

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[3]Purchased as a going concern from Shortridge and Howell with working converting and refining furnaces

[4]Tweedale, 1986, 61

congestion which reduced the benefits of private sidings seem to have been equally irritating. If, however, we want to follow our firm up the next rung of the growth ladder to giant status we must assume it had railway connections.

v. <u>The Giant Firm</u>

Many large firms with sites of 1.5 - 6 acres (sometimes in more than one set of premises) existed happily without their own sidings, relying on the horse and cart, though some firms of this size did have sidings. No firm seems to have occupied a site much larger than this without rail access. One of the necessary, though not sufficient, conditions for growing into a giant firm was connection from the rail system into the works.

The railways were essential, not so much for local delivery cost savings (though these would be taken if the opportunity arose) but for productivity gains and logistical reasons. No horse and cart based system could have coped with the amounts of coal and iron needed to feed the furnaces of Brown's, Firth's, Cammell's, Vickers, Hadfield's, Jessop's, Brown, Bayley and Dixon or Steel, Peach and Tozer. All the factors which made the Lower Don Valley attractive for industry applied in double measure to these huge undertakings.

If our firm was one of those which had occupied Norfolk land beside the MR in Brightside it would find itself hemmed in by other companies by the 1860s. Expansion would have to take the firm down the same road it had already trodden when expanding in earlier years. Its plant would become fragmented again, the components separated by the railway line, neighbouring works and roads. Two expansion routes were followed:

a. leasing additional vacant land from the Norfolk Estate;

b. taking over the works of other firms.

Such firms found land prices rose dramatically as their need for sites continued and vacant land became scarcer.

Companies like Vickers and Hadfield's which did not have a longstanding relationship with the Estate to help them gain access to the Norfolk land bank leapfrogged onto Fitzwilliam property to the north east. They seem to have learned a lesson from the fragmentation of Firth's, Brown's and Cammell's and aimed deliberately to free themselves from the complexities of land assembly. Not all firms did this. Edgar Allen's adopted a more incremental approach around 1900. Even so their acquisitions were large by earlier standards.

For firms such as Hadfield's, J. Edgar Allen, Steel, Peach and Tozer, Firth's and others who constructed works at Tinsley and Templeboro' in the last years of the nineteenth century and the first twenty years of the twentieth, a new locational factor was probably important. Even the River Don Works would have been able to draw on a local residential population from Brightside and Attercliffe (over the Abyssinia footbridge). There were some homes in Tinsley, but access to an adequate labour market surely depended also on the growing, affordable electric tramway system which could draw in the workforces of the whole of Sheffield and Rotherham.

The ability to communicate by telephone may also have contributed to greater locational flexibility. This may have been especially true for companies which were developing vertical and horizontal integration beyond Sheffield, when top managerial control may have become geographically separate from production for some firms.

We have followed the development of an archetypical firm, assuming a relatively smooth growth path. This is, of course, a simplified model of company change. The reality was that firms also faced periods of recession, when contraction of production might have been the order of the day. Some companies, though, combatted slumps by diversification of products and adoption of new technology.[5] For these firms, it was sometimes necessary to extend or relocate even when adverse economic conditions prevailed, so our model is not complete without reference to the locational effects of anti-recessionary behaviour and counter-cyclical site development.

3. <u>The Rationality of Decision Making</u>

Having completed our descriptive model we can begin to summarise findings on some more specific issues, beginning with the economic rationality of location decision making.

The evidence suggests that intra-urban location decisions were usually made on economically rational grounds. Decision makers in steel firms at the periods of greatest works development were mostly experienced either as producers or merchants of steel. This applied even during the start-up phase of company development. Although one or two of the senior managers who gave evidence to the SCSDR were ignorant of the details of plant operation, there is plenty of evidence from other witnesses and other Select Committees that industrialists

[5]Newton, 1993, 335 & 341

involved in the production side of the business understood very well the economics of location.

One or two decisions are difficult to explain, notably the move made by Jessop's to Brightside and the decision (admittedly outside Sheffield) of Sam'l Fox to establish a rail mill at Stocksbridge. Fox had begun as a maker of wires for the textile trade and umbrella frames, which are light and which presumably required relatively low volumes of raw materials. The Stocksbridge location in a water powered works made sense for this product at the time. The move into rolling rails and using Bessemer furnaces was probably opportunistic and the firm preferred to extend at their existing site rather than move. Jessop's may have felt that ownership of their own site and the opportunity for unrestricted expansion outweighed other disadvantages. They may simply have preferred to be closer to the Don Navigation at Tinsley because of its problems of communication with the Sheffield Canal, explained before the SCS&RR. They were in any case exceptions to the norm.

The economic logic of location decisions is, ironically, shown most clearly by the demise of rail mills. The closure of Brown's and Cammell's mills in Sheffield and Dronfield and the removal of the latter to the coast to reduce transport costs demonstrate very well that Sheffield manufacturers understood and acted upon the economic forces governing location.

We have the words of one of Sheffield's most successful steel magnates, J. Edgar Allen, to tell us that industrialists did not consider transport costs alone, but balanced a variety of factors to select what was perceived to be an optimum location. Allen's experience extended beyond Sheffield to setting up works in the USA and France. He was widely travelled and would have seen factories in many countries. Although Sheffield manufacturers are often portrayed as conservative, many had been overseas and some were involved in foreign manufacturing ventures. They quickly appropriated profitable technologies from elsewhere. They had a sense of pride in Sheffield and its craftsmanship, and some failed to perceive that quality was tradeable against price in mass markets. Although their rationality was generally bounded to some extent in this way, and this was the downfall of some in the cutlery and steel industries, they managed as a class to continue to capitalise on specialist quality products well into the twentieth century. They were well equipped to make sound financial judgements based on a solid knowledge of the economics of production.

Probably the most serious shortcoming by decision makers in many firms was an apparent failure to foresee the potential for growth which would necessitate the expansion of their works. This led to underprovision of land and the consequent pattern of incremental development on discontinuous sites which characterised all but two or three of the largest steel manufacturers. It is, perhaps, not surprising that the pioneers of large scale steel making did not anticipate the increases in size which lay ahead, given the often dramatic growth in demand and rapid technological change. Having said this, companies such as Brown's had already experienced fast growth and the inconvenience of multi-plant operation before setting up very large works. It is conceivable that limitations on site size were imposed not only by failure to predict the ultimate extent of the operation but also by restrictions on available capital. Since several firms came close to bankruptcy soon after (and probably partly as a result of) relocation and expansion, it is reasonable to assume that site size was one of the factors restricted by the firm's ability to raise money to finance the move. Apart from the rent, cash also had to be found on the Norfolk Estate, and presumably on Fitzwilliam land too, for the tenant right and for road surfacing, drainage and water supply pipes. Cammell's and others delayed making these payments in the years after they took new leases. This might have been canny cash flow management but it might equally have been a symptom of scarcity of funds. This hypothesis must remain tentative, because Newton's work on company finance suggests that capital was not a scarce commodity, and that expansion was relatively easy to finance using recycled profits, bank borrowing, directors' personal wealth, calls on shareholders, or the issuing of debentures.[6] She did find, however, that the expansion to large scale of certain firms put a strain on the ability of local banks to finance them, and that the provision of advances to new businesses often failed to operate successfully when recession followed soon after the setting up of a firm in a boom, The Yorkshire Engine Co. Ltd. being a pertinent example.[7] It is, therefore, conceivable that there were externally generated financial limits on the development of companies on large sites. Such limits might also have been self-imposed, given the innate preference of Sheffield companies to fund change from internal sources, and the need to temper the propensity to expand with commercial caution.

4. Transport Infrastructure and Location Decisions

Decision makers, then, weighed many variables before choosing a site. Accessibility was not the sole determinant of location. Nevertheless, the evidence shows that the development of the canal, railway, tramways and suburban road network did exert influences on locational choices. Their effects were, however,

[6]Ibid.
[7]Ibid., 370

not the same for all firms and were intimately connected with other influences such as the scale of production, type of manufacturing technology, availability of land, industrial organisation and topographical factors.

The canal did attract several factories to its banks and the area around the canal basin shortly after it opened. These were a mixture of cutlery and steel firms.[8] However, the effect of the canal on the overall location pattern of the steel industry was marginal.

A similar effect can be observed with the railways. A small number of firms set up alongside the railway in the first five years after it opened, mainly edge tool and steel companies. It was over 20 years before all Norfolk railside land was taken and the shift in the overall distribution of factories was only really marked after the 1850s or '60s. The ring of firms around the town centre continued to exist and the comet's tail of companies stretching down the Lower Don Valley was an addition to the existing pattern and not a substitute for it. The best explanation for this is probably a relationship between plant size and the need for accessibility. The inevitable locational attraction towards direct connection exerted first by the canal and then the railways was over the biggest firms. On railside sites these were the large and giant steel and engineering firms. Only after the plant got above a certain critical size was it impossible to do without a wharf or siding. The gaps alongside the railway over a number of years are explained partly by estate management policy but mainly by the need for enough firms to grow big enough to consume the land available. Unlike Manchester there was no strong competition for land from a merchanting sector. Cutlery was not well enough organised or industrialised to be a serious rival for land. Only when the steel and engineering sectors had generated the demand could industrial land uses absorb all railside locations.

5. <u>The Impact of Landowner Behaviour</u>

The Lower Don Valley was undoubtedly better suited to large scale industrial development than most of the rest of Sheffield. It was relatively flat, although land filling was necessary before most works could be constructed. It had a plentiful water supply. The railways and canals passed through it. Their terminal facilities were easily accessible by road, and direct wharf and sidings connections could be made. It lay north east of the town centre so that smoke would be blown away by the prevailing winds. It faced in the direction from which bulk supplies of coal and iron were delivered. As such it was bound to

[8]The Sheaf Works being built as a cutlery works but later developed as a steel works

attract demand from firms which needed to build big, polluting plants which used bulk raw materials.

The valley may have had all the characteristics necessary to attract industry, but these would not have been sufficient without the release of land for large scale factory building by the landed estates. It is possible to demonstrate conclusively that the Norfolks were more than passive responders to market forces. They sought deliberately to exploit the potential of their land to produce enhanced income from industrial development. This was due at least in part to a realisation of the positive effect of the railways in increasing ground rents. It may also have been a response to the need to generate alternative sources of income to accommodate a fall in the value of coal sales as competition from other coalfields increased.

At the very least the Norfolk Estate co-operated with the market in north east Sheffield to create an extensive industrial suburb. Given that the type and size of industrial use was restricted by covenants on other parts of the Estate, it can be argued that the role of the Norfolks and their Land Agents was more than that of simple ciphers for the market - they modified or amplified its effect to ensure higher quality development took place south west of the town centre and that heavy industry continued to go to the only other feasible location - the East End. This was the area with most advantages for industry. The Estate behaved in an economically rational way in planning to enhance industrial growth and speculating in land value increases by rationing the allocation of scarce railside sites. The Estate may have had more influence over the form and timing of development than over its type, given the comparative advantage of Brightside for steel production. Nevertheless the actions of the landowner were an important ingredient in the factors affecting industrial location decisions.

The same is probably true of the Earls Fitzwilliam. If anything they were more influential by allowing the very largest sites to be developed in Grimesthorpe, Tinsley and Templeboro'. Hadfield's and Vickers were permitted to take surplus land and effectively maintain their own land banks until expansion justified their development - seemingly a quite different approach from the Norfolk Agents' husbanding of land.

We can conclude that although the landlords could not buck the market they could and did exploit and expand its wealth generating potential at the expense of industrial capital.

6. <u>The Steel Industry and the Formation of the City</u>

Given the very adverse topography of Sheffield, one of the more interesting findings of the study is the conventional neo-classical location pattern evolved by the steel industry. Steel firms formed part of a belt of industry ringing the town centre. This withdrew a little from the centre itself as the century wore on and the CBD expanded, although the ring of steel firms did not add much to its outer periphery. Larger firms in the heavy industries migrated to an area well served by railways facing regional raw material supplies and (to a lesser extent) markets. Land values peaked in more accessible locations. We do not see the degree of topographical distortion of the typical neo-classical urban structure which might have been predicted.

The thesis has also confirmed that the urban fabric was created by a process which was interlocked with industrial change and growth, in ways which were at times discontinuous. City building was inextricably entangled with the building of commercial empires. A significant amount of the urban capital invested in the town was derived by the Norfolk Estate directly from the manufacturers. We can conclude that the steel industry not only built a substantial part of the economy of Sheffield. It built much of the city's fabric itself.

APPENDIX 1

THE RAILWAY RATES CONTROVERSY

The question of goods transport rates, especially on the railways, became extremely controversial during the nineteenth century. Initially, canal companies were seen to be offering a valuable public service and the tolls they could charge were not limited unduly. Once the large profits from the more successful companies were seen, those who wanted goods carried cheaply successfully pressed Parliament to intervene to reduce the maximum limits for toll charges.[1] When canal companies themselves began to act as carriers under the pressure of railway competition they were able to vary their rates to get or keep business, since there was no legal control over carriers' charges.[2] These same principles of Parliamentary control over maximum rates for carriage, and attempts to set special rates to encourage business naturally came to be applied to railways as well. The ways in which the railway companies attempted to circumvent Parliamentary control on special rates have a direct bearing on micro-locational decision making, since terminal services and carting were rapidly drawn into the armoury of the railway companies as they looked for loopholes in the legislation controlling the rates they could charge.

The railway companies, unlike the canal companies, came very quickly to be the main carriers on their routes rather than mere providers of track to others. Also, they had almost complete control over reception, storage and loading of goods, as well as arranging collection and delivery where this was required.[3] Initially, they faced the problem that they were trying to take trade from other routes (principally the canals) and had little experience of the traffic in freight - in the early 1840s goods accounted for only about 35% of total railway receipts.[4] Yet the railways had spent, and continued to spend, huge sums on gaining access to the cities and providing substantial passenger and goods termini - as much as 17.5% of total capital outlay[5]. They were limited in the rates they could charge per ton mile, and in what they could levy for some of their terminal services. A typical example is provided by the Manchester, Sheffield and Ashton under Lyne Railway Act, 1837. The Company was allowed to raise and lower tolls provided that set maxima were not exceeded,[6] tolls had to be charged equally to all

[1] Hadfield, 1971, 66
[2] Ibid., 69-74
[3] Kellett, 1969, 81-2
[4] Pollins, 1971, 60-1
[5] Kellett, 1969, 81
[6] HLRO, Local and Personal Acts, 7WillIV & I Vict, Vol.1, Cap xxi, Cl. CLXXXII

persons for every class of goods[7] and charges could be made for wharfage and cranage - again within given limits.[8] However, ways were soon found by most railway companies to get round such controls. Discriminatory pricing could take place so long as undue preference was not shown[9] and further confusion arose because many railway companies had different levels of pricing per ton mile for the same goods included in their Acts.

With growth in traffic, the categories of goods in the original private Acts were quickly outmoded. Regulatory Acts in 1845 and 1854 sought to introduce equality in mileage rates, forbade undue preference and directed that reasonable facilities should be offered for all traffic. However, charges for collection and delivery of goods and terminal services were not limited by statute.[10] In spite of the legislation and a ruling in 1845 by Lord Chief Justice Jarvis, it was alleged by one author lobbying for the carriers at the end of the century that between 1844 and 1854 private carriers on the railways were being charged ten times the rates charged for the railways' own freight services.[11]

In the case of Baxendale v. Great Western Railway Company in 1858 it became clear how cartage and terminal charges were being used to enable the railway companies to control pricing policy, obtain a monopoly of town cartage, and attempt to keep prices at a level which would enable them to recoup their substantial investments. The GWR had been charging 3/6d per ton for carriage between Paddington and Reading and both they and Pickford's charged 4/10d per ton cartage in Reading and London. The railway company then announced it would charge 8/4d per ton for carriage but provide the carting service free of charge. The Court of Common Pleas ruled this to be illegal because the complainant was being made to pay for a service he did not require.[12] In another case involving the GWR, free carting was defended because no profit was made on it.[13] In fact, most companies seem to have used the device of combining terminal charges, carting and mileage rates without breaking down the elements of their charges as a means of obscuring their real rates from scrutiny. Railways were not required to publish tariffs, so traders could not compare prices and thus it was impossible to police the rules forbidding undue preference.[14] Cartels were set up to ensure unanimity on rates, as in the case of the agreement between the

[7]Ibid., Cl. CLXXXIII
[8]Ibid., Cl. CLXXX
[9]Pollins, 1971, 69
[10]Dyos and Aldcroft, 1969, 176
[11]Waghorn, 1909, 4
[12]Ibid., 6
[13]Ibid., 8
[14]Dyos and Aldcroft, 1969, 176; Kellett, 1969, 82

three railways serving the Black Country signed in 1863 and preventing any of them from reducing freight rates without the consent of the others.[15]

The Parliamentary Select Committee of 1872 concluded that because of the general convergence of carrying practices which had taken place on different railways under cover of these obscure charging systems there was 'no active competition between different railways in the matter of rates and fares'.[16] Some areas were given preference over others, and railway companies could pick and choose the rates applied to different traders at will.[17] Evidence given to the Select Committee indicated that the railway companies were covering not only running costs but also making what amounted to a rent charge to cover the cost of constructing terminal facilities.[18] An Act of 1868, followed by The Railway and Canal Traffic Act 1873 required publication of rates from every station and the disintegration of rates if requested by customers. The 1873 Act set up the Railway Commissioners to oversee the provision of reasonable facilities and prevent undue preference. Unfortunately, the Commissioners lacked teeth, there was still no effective control over special rates permitted under Local Acts, and in spite of the efforts of the companies under the auspices of the Railway Clearing House, the number of rates proliferated. The Clearing House Classification expanded from 300 articles initially to 2,753 by 1887. In the 1880s there were 20 million rates in force on the London and North Western Railway and 13 million on the Great Western.[19] On the North Eastern Railway, freight rates for ore and coal were varied at the company's discretion, based on its view of the level of trade.[20]

Further Select Committees considered the question in 1881 and 1882. Amongst the evidence given to the 1881 Committee was confirmation that possession of a private siding did not guarantee preferential rates. A Mr. Hickman, a Black Country ironmaster, complained that the railway companies had refused to give a reduction to those ironmasters and colliers who had built their own sidings despite the fact that the sidings allowed trucks to be shunted and marshalled away from the main lines.[21]
The Railway and Canal Traffic Act 1888 made it legal to charge for carting but the railways failed to come up with standard goods classifications in the time laid down in the Act, there were many objections to the new rates from traders, and it

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[15]Le Guillou, 1975-6, 110
[16]Pollins, 1971, 72
[17]Waghorn, 1907, 22
[18]Kellett, 1969, 84-5
[19]Ibid.; Barker and Savage, 1974, 94; Dyos and Aldcroft, 1969, 176
[20]Le Guillou, 1975-6, 113
[21]Ibid., 1975-6, 112

was not until 1891 and 1892 that the Railway (Rates and Charges) Order Confirmation Acts finally brought about a simplification of the complex system of railway rates.[22] Because the Board of Trade and the Parliamentary Committee agreed that it would be impractical to lay out all the carting charges from every station, it was left that a charge could be made when a carting service was rendered, the service should not be rendered when it was not required, the charge made was to be in addition to normal tonnage rates and arbitration was possible in the event of disputes.[23] In fact, traders making complaints could find themselves victimised and denied service by the railways[24] and so the effectiveness of the legislation was doubtful.

Further legislation followed in 1894 after yet more complaints from customers.[25] Even so, Thomas Waghorn could still complain in 1907 that legislation regarding carting charges was overlapping and remained confused. For example in Manchester three rates (10d, 1/- and 1/6d) could apply for carting one ton of soap from the same factory to the same station.[26] It was alleged that railway companies seeking a monopoly of town carting avoided the legislation by claiming not to book to their stations but from one cartage area to another.[27]

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[22]Dyos and Aldcroft, 1969, 178
[23]Waghorn, 1907, 14
[24]Barker and Savage, 1971, 96
[25]Dyos and Aldcroft, 1969, 179
[26]Ibid., 15 & 22
[27]Ibid., 12

APPENDIX 2

LAND REFORM

At the start of the nineteenth century, much of the potential urban land in England was held under settlements as part of aristocratic estates. It was, of course, usual for settlements to be renewed regularly to avoid creation of a perpetuity,[1] but 'once settled "an estate tended thereafter to be bound by a chain of settlement and resettlement approaching perpetuity - son succeeding father generation after generation, each limited in his powers of alienation"'.[2] In other words the terms of the settlement would tend to act as a barrier to the granting of novel or innovative forms of tenure such as those needed to facilitate some types of urban development.

Much has been made of this limitation by Marxist writers such as McMahon, who attempts to demonstrate the role of the State in liberating the capitalist land market in the nineteenth century by legislating against strict settlement. The restriction on the market caused by settlements is also accepted by writers in other traditions such as Offer. It was a perception held also by contemporary radicals and led to a process of land reform which is still being played out in legislation such as the Leasehold Reform, Housing and Urban Development Act, 1993.

Landowners had been one of the early targets of the Chartists,[3] but it was middle class reformers who began to challenge the rights of the landed gentry and the position of the aristocracy effectively. After the repeal of the Corn Laws in 1846, Cobden turned to freehold land reform, amongst other assaults on aristocratic privilege.[4] The Manchester Reformers' programme of 1848 included abolition of the Laws of Entail and Primogeniture.[5]

In 1867, John Ruskin attacked the exaction of unjust rents and in particular aristocratic landholdings in one of a series of published letters to 'a working man of Sunderland' in characteristically radical and eccentric style:

> ... so much land ought to be granted to them [the great old families] in perpetuity as may enable them to live thereon with all circumstances of state and outward nobleness; but their

[1]Offer, 1981, 24-25; Mackenzie and Phillips, 1986, 148
[2]Spring, quoted by McMahon, 1985, 92
[3]Briggs, 1970, 305
[4]Ibid., 432; Best, 1985, 261
[5]Beal, 1876, V

> income must in no wise be derived from the rents of it, nor must they be occupied ... in the exaction of rents ... [6]

Liberal agitation against alleged land monopolies led to a closer examination of the ownership of property. The New Domesday Book published in the 1870s showed that around 60% of England and Wales was owned by no more than 4,000 people.[7] The Laws of Settlement meant that the trading of landed interests was often severely hampered[8] and contemporaries estimated that as much as 75% of the land surface of the United Kingdom was affected by these laws.[9]

The existence of settlements did not always prevent the sale or development of land. The Settled Estate Acts of 1856 and 1877 gave powers to life tenants to lease, sell, partition and exchange settled land with the consent of the courts - the 1877 Act even allowed 21 year leases to be granted without this consent. The Improvement of Land Act, 1864 allowed greater freedom to improve estates.[10] The leasehold system allowed estates to be built upon while yet remaining in the hands of the fee simple owner in the long term.[11] Nevertheless, there was pressure for change. As Offer explains it:

> For capitalist leaseholders the old-established landowner tenure fulfilled no self-evidently necessary social or economic function. With commercial goodwill accumulated on and tied to the landowner's site the urban capitalist leaseholder considered himself to be faced with monopoly power.[12]

The State was no longer so much at the landowner's bidding. In 1879 a stinging magazine article gave vent to middle class resentment, suggesting that leaseholds gave rise to slipshod construction, profiteering and an unhealthy preference for the fleeting over the permanent.[13] Support for reform crossed the political divide, with Joseph Chamberlain attacking the monopoly power of landowners in 1883 and Randolph Churchill introducing a Leasehold Reform Bill in 1884 - the year that an organised pressure group, the Leaseholds Enfranchisement Association, was formed to advocate the right of leaseholders to buy their freeholds.[14] Sidney Webb gave evidence in support of reform to the Select Committee on Town Holdings in 1887.[15]

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[6]Ruskin, 1867 Repr. 1906, 179
[7]McMahon, 1985, 92
[8]Ibid., 93
[9]Watt, 1885, 126; Offer, 1980
[10]Simpson, 1986, 285
[11]McMahon, 1985, 94
[12]Offer, 1981, 152
[13]Ibid.
[14]Ibid., 153-4
[15]Anon., 1888, Vol.III, 281

A series of Parliamentary Commissions and Select Committees - on Land Holdings in 1873, Town Holdings from 1886-9 and Small Holdings in 1889 - examined the extent of monopoly in land supply and the restrictions which Strict Settlement placed on development.[16] McMahon argues that legislation such as the Settled Land Act of 1882 was an intervention by the State to allow the evolution of a market in landed property which was acceptable under capitalism and broke free of the anachronistic relationship between landlord, farmer and agricultural proletariat.[17]

Some contemporaries certainly felt it was a step towards free trade in land and progress from a feudal society to more rational economic relations,[18] although modern historians of land law are more inclined to see the Act as a defensive measure to help the aristocracy defend their wealth by enabling them to convert fixed capital into a shifting fund.[19]

As seen in Chapter 9, the local leasehold reform societies campaigning for change felt the leasehold system was inadequate for a modern industrial economy which needed to transform property rights into tradeable commodities. Members of Parliament supporting the Settled Land Bill in 1882 called for landowners to have the same power of disposal as the owner of a financial stock.[20]

The late 1880s saw a new upsurge in interest in urban land reform.[21] In London, the land reform newspaper The Star promoted taxation of ground rents or the capital values of freeholds.[22] A leasehold enfranchisement Bill was promoted by H.L.W. Lawson in 1886 and a number of others followed before the First World War.[23]

- The Select Committee on Town Holdings

The agenda set by the radicals for the Select Committee on Town Holdings in 1886-7 was based on the propositions that the leasehold system:

  - was not the result of market forces;

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[16]Ward, 1960; Offer, 1980; McMahon, 1985
[17]McMahon, 1985, 92-94
[18]Watt, 1885, 129-32
[19]Simpson, 1986, 286
[20]Ibid., 91
[21]Douglas, 1976, 111
[22]Ibid., 113
[23]Dyke Acland et al, 1914, 415

- enabled the ground landlord without trouble, step or industry to gain an unearned increment from the collective efforts of the community;
- prevented thrift in the working classes and damaged co-operatives and building societies;
- encouraged jerry building, poor maintenance and high rents;
- enabled vexatious restrictions to be imposed which hindered improvements - it was suggested local authorities should enforce non-vexatious and necessary restrictions.

It was proposed that ground rents ought to bear a proportion of land rates and taxes, that rates should be assessed on capital not rental values and that by leasehold enfranchisement or compensation, lessees and tenants should be protected from loss on reversion.[24] The Committee did not recommend total enfranchisement but were sufficiently persuaded to suggest a plan to make it easier to buy freeholds at the end of leases.[25]

On balance, the Committee endorsed the view that the market would prevail, even under the tortuous rules governing tenure in England:

> The terms of every bargain are the result of a contest between two parties each of whom has, in nearly every case, to a greater or lesser extent the power to insist on his own terms and the degree to which one party can dictate to the other varies in nearly every instance with the circumstances of the case. A landowner desiring to develop his estate is practically obliged to dispose of his land on such terms as the public will accept, and though the owner of a large extent of building land often possesses great power to dictate his own terms yet, even in these cases it would, we think, be going much too far to regard the contract contained in the lease as one in which the element of choice or the characteristics of a free bargain are altogether absent.[26]

Even so, and in spite of death duty being introduced on realty by the Rosebery administration in 1894,[27] the subject continued to interest reformers. By the end of the nineteenth century, the amount of settled land was indeed declining,[28] but in 1914 the Land Enquiry Committee could still find that the problems of leasehold tenure were a source of annoyance: appropriation of lessees' property on reversion, prevention of improvements, restrictive covenants and conditions, restrictions on assignment and sub-letting, unreasonable clauses, extortionate

[24]Anon., 1888, Vol.I, 7
[25]Ibid., Vol.III, 15
[26]SCTH, quoted in Dyke Ackland et al, 1914, 404
[27]Douglas, 1976, 115
[28]Offer, 1980, 110

charges for dilapidations, costs and fees were all still prevalent.[29] Although leases of 99 years were now commonplace on settled land, the terms were inconsistent nationally because there had been a tendency in the parts of London where quick returns were possible to shorten the average lease to seventy-five or eighty years, while in Wales 60 years was common. In Huddersfield, Lancashire, Birmingham and some parts of London by contrast, there had been a considerable amount of conversion to 999 year leases.[30]

The majority of the Select Committee on Town Holdings had recommended a form of enfranchisement through local authority purchase of freeholds, while its minority had wanted full enfranchisement for those with a genuine and substantial interest in the property.[31] The Land Enquiry Committee, the last of its kind before the Great War, did not recommend compulsory enfranchisement.[32] It even went so far as to acknowledge 'the wisdom and foresight of such great landlords as the late Duke of Devonshire in Eastbourne and a former Duke of Westminster. Before town planning was thought of by the municipalities they fulfilled many functions of the planning authority'. But lest the landlords should become complacent and believe that threequarters of a century of radical pressure was over, the Committee went on to comment that the great landlords could have achieved as much by selling freeholds and that town planning was now a recognised municipal function.[33]

In towns with estates which had a well structured system of leasehold development there does not seem to be overwhelming evidence that the supply of industrial land was unduly restricted by the kinds of limitations on the market arising from leasehold tenure and Strict Settlement. It was in any case unusual for there to be a complete monopoly of the market in large towns. Kellett, for example, shows that central urban land was often fragmented in ownership,[34] although there tended to be large blocks of estate ownership in what became the suburbs.[35] It may well be true, however, that continuous radical pressure for land reform did modify landlord behaviour. Landowners may well have become more amenable to the sale of land and more lenient on reversion.

Daunton suggests legal impediments to the market were significant in some areas, and that other imperfections such as the relative stickiness of prices in

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[29]Dyke Acland et al, 1914, 365
[30]Ibid., 364
[31]Ibid., 415-6
[32]Ibid.
[33]Ibid., 407-8
[34]Kellett, 1969, 127, 151
[35]Ibid.

different areas, and the relative importance of land values as a proportion of initial building costs as between freehold land and leasehold land subject to ground rents, were other critical factors.[36] Other adaptations of markets to circumstances included the ability of interests such as the railways to appropriate property compulsorily.[37] Rather as in the case of Cannadine's opinion on the impact of landowners on the market, Whitehand considered that these specific factors do not undermine but rather modify the effect of general theories which assert that values are related to accessibility.[38] However, we can safely follow Daunton in accepting the importance of looking at the particular operation of the land market in individual towns.[39]

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[36]Daunton, 1978, 177-80
[37]McMahon, 1985, 96
[38]Whitehand, 1978, 181-91
[39]Ibid.

APPENDIX 3

CENSUS DATA FOR SHEFFIELD WORKERS IN THE COMMUNICATIONS INDUSTRIES, 1841-1901

Occupation	**1841**	**1851**	**1861**	**1871** a	**1881**	**1891**	**1901**
Railway Employees	6	185	316	677	1298	1721	3753
Canal Employees [b]	19	35	82	34	75	78	c.77
Carriers, Carters, Draymen & Women	202	416	924	1189	2063	2884	4749
Warehousemen & Women [c]	330	988	1237	927	656	335	N/A
Porters, Messengers, Errand Boys & Watchmen [d]	91	874	765	177	1873	2811	2618
Domestic Coachmen	N/A	11	46	55			
Coachmen & Grooms Combined					352	N/A	N/A
Grooms	N/A	21	43	45			
Coachmen, Guards, Post Boys (not domestic), Fly and Cabmen	69	59	168	329	312	1322[f]	1023
Telegraph & Telephone Staff	-	-	16	2	73	156	N/A
Coach & Cab Owners	5	20					
Coach & Omnibus Staff Combined			13	41[e]	52[e]	74[e]	N/A
Omnibus Owners, Drivers & Conductors	-	1					
Tramway Service Employees	-	-	-	-	89	116	N/A

Notes:
a. Figures include only those aged 20+
b. May be affected by number of boats in canal basin on census night
c. This category includes a high proportion of women
d. This category includes a high proportion of juveniles
e. Figure includes livery stable owners
f. Figure includes grooms and horsebreakers

Source: UK Censuses

APPENDIX 4

DEVELOPMENT OF FIRTH'S, CAMMELL'S AND BROWN'S WORKS ON THE NORFOLK ESTATE

This Appendix looks at the information in the Applications Registers and Letter Books on the progress of development of some of the larger steel works built on Norfolk land, to see how manufacturers took advantage of the Estate's attitude to industrial schemes. The three firms selected are Firth's, Cammell's and Brown's, not only because they evolved into the largest companies on Norfolk land but also because the Letter Books and Applications Registers contain a lot of information about their land holdings. The evidence is presented in a chronological schedule for each company to show how their sites were assembled. This picture of the accumulation of sites is not necessarily complete. The gaps which exist in the data have already been discussed. Nevertheless, the Agents' correspondence gives a good idea of the progressive growth of the firms' accommodation. Reference has already been made to some of the transactions involved, to illustrate other arguments. Here, each firm's dealings are brought together to build up a sequence of events on a company by company basis.

1. Thomas Firth and Sons

In Chapter 6 the establishment of the Norfolk Works and other Firth factories was described in general terms. Building of the Norfolk Works began in 1849. However, the first details of applications for land appear in the Applications Registers and Letter Books the following year:

- 7 February 1850; Firth's requested a lease of 1a 3r 0p 'on the North Side of Messrs. Spear and Jackson and adjoining to a proposed Street called Savile Street East' at 1.84d per sq.yd. On 15 February Mark Firth called at the Estate Office to request that this allocation be increased to 2 acres. On 18 September he asked for another half acre. This became the site referred to in the next item in this schedule.[1]

- 30 July 1851; 99 year lease of 12,649 sq.yds. in Savile Street East at 1.84d per sq.yd. and lease of Clay Wheel Forge at £21 p.a. (see Chapter 6). Subsequent correspondence took place regarding Firth's failure to pay Tenant Right.[2]

[1]ACM/LB/B/308; ACM/S384, 701
[2]ACM/LB/B/671

- 17 March 1856; Mark Firth inquired about land at Parkin Wood, probably as part of the search that led to the establishment of Firth's works at Whittington near Chesterfield.[3]

- 10 May 1862; Firth's expressed interest in land between Savile Street East and Greystock Street.[4] The fact that this land is shown on Bacon's Plan of Sheffield (1910) as part of the Norfolk Works indicates that a lease was taken.

- 18 December 1862; Firth's expressed interest in land south of the railway on the corner of Savile Street East and Car Wood Lane.[5] Again, Bacon's Plan of Sheffield shows this as Norfolk Works.

- Lady Day 1864; Firth's were paying the Estate a total of £170 for the half year after tax for their various leases, showing that they had added further land to their site (the three leases referred to above having a total annual rental of only £134-10-0d).[6]

- 21 February 1865; Firth's took over the premises of a Mr. Timothy Smith to extend their works.[7]

- March/April 1870; 99 year lease of 1,106 sq.yds. at 5.37d per sq.yd. at the corner of Greystock Street and Fersfield Street and lease of 895 sq.yds. to the east fronting onto Fersfield Street, Greystock Street and Windsor Street at 6.17d per sq.yd.[8] Both sites were opposite the land between Savile Street East and Greystock Street referred to above.

- 10 July 1877; Firth's half year's bill for ground rents was as follows:[9]

	£ s d
Effingham Road	34-18-6
Savile Street East	95- 8-6
Savile Street East	88- 4-0
Savile Street East	9-13-6
Greystock Road/Windsor Street/ Fersfield Road	23-17-6

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[3]ACM/LB/D/346
[4]ACM/LB/F/600
[5]ACM/LB/F/862
[6]ACM/LB/G/554
[7]ACM/LB/G/968
[8]ACM/LB/J/433 & 456
[9]ACM/LB/N/234

Clay Wheel	10-10-0
Land at Clay Wheel	5- 0-0
	267-12-0

- 14 November 1881; Firth's half year's bill for ground rents remained identical to the one above.

- 24 and 27 March 1885; Firth's were negotiating to lease approximately 1,400 sq.yds. of land in Savile Street East. The Estate was seeking 6d per sq.yd. for the land, and would not budge from this rent, claiming that several other applicants would be prepared to take the site at that price, but that it had been reserved for the large manufacturers already in the area.[10]

- July 1886; Firth's leased 1,424 sq.yds. of land in Savile Street East for 99 years at about 6d per sq.yd. - presumably the land referred to above.[11]

- 15 December 1890; Firth's leased 12,150 sq.yds. in Savile Street East for 99 years at 4d per sq.yd. - perhaps the assignment of the Savile Street Foundry Co.'s Lease (see below).[12]

- 31 March 1891; the Estate wrote to Firth's offering to sell the freeholds of the land on which their works were situated.[13]

- 13 April 1891; Firth's agreed the purchase of their freeholds. The terms were not stated in the correspondence.[14]

We know, additionally, that Firth's did not lease and buy land only on the Norfolk Estate in Sheffield. Apart from the Whittington Works, we saw in Chapter 6 that by the mid 1900s the company also had rolling mills at Weedon Street in Tinsley. These were served by sidings on the Sheffield District Railway.[15] They were next to Edgar Allen's works and so were almost certainly on Fitzwilliam land. Firth's also acquired land by purchasing works from other companies. They took over the Savile Street Foundry Co.'s premises in 1888.[16] Records of sidings

[10]ACM/LB/R/359 & 364
[11]ACM/LB/R/942 - list of leases
[12]ACM/LB/V/137 - list of leases
[13]ACM/LB/V/351
[14]ACM/LB/V/365
[15]PRO/MPS/5/274
[16]Marshall and Newbould, 1924, 58

agreements with the Midland Railway on the Wicker Branch show that Firth's took over the Cardigan Works and Wm. Griffith & Sons' works sidings in 1915.[17]

2. John Brown and Co.

According to their own publications, Brown's began by taking over the lease of an existing works beside the Sheffield and Rotherham Railway in 1856 (see Chapter 6). They first appear in the Letter Books in 1854.

- 10 February 1854; terms were set out for Brown's to take 5a 2r 0p between the Sheffield Canal and the MSLR, with a right to build a tramway across the road. A 99 year lease was confirmed on 22 March 1854 with conditions for laying a tramway specified on 27 April 1854. John Brown was invited on 28 July 1854 to explain why he was not allowing the agricultural tenant to cultivate the land when the company had not developed it. It seems probable that this was where Brown's originally intended to locate their Attercliffe works.[18]

- 13 October 1855; a dispute between John Brown and Co. over the land 'proposed to be taken' between the MSLR and the canal was referred to arbitration. It is not clear why, though it seems that Brown may have repudiated his agent Mr. Hewett, and that he considered he had been given incorrect information about the site.[19]

- 29 June 1859; 99 year lease of 15,923 sq.yds. in Carlisle Street East north of the railway at 2d per sq.yd.;[20] 99 year lease of 7,508 sq.yds. of land in Carlisle Street East at 2d per sq.yd.[21]

- 25 September 1860; 99 year lease of 23,350 sq.yds. at the junction of Carlisle Street East and Carr Wood Lane (later Road) was offered at 2.5d per sq.yd.[22] Subsequently the application was reduced to a 99 year lease of 9,870 sq.yds. on Carlisle Street East at 2.5d per sq.yd.[23] This plot had originally been offered to the Midland Railway on 1 February 1860 for an engine shed at 3d per sq.yd. but a cheaper site to the east had been

[17]BRERO/24028 - records of Sheffield Sidings Agreements
[18]ACM/LB/C/497-8, 22 Mar. 1854, 585, 678 & 840
[19]ACM/LB/C936 and D/114
[20]ACM/LB/E/364-6
[21]ACM/LB/E/367-9; ACM/S384
[22]ACM/LB/E/741-4
[23]ACM/LB/F/28-30; ACM/S612, 415 & 626

selected instead.[24] 13,470 sq.yds. on the eastern half of the site was then offered to Cammell's in May 1861 at 3d[25] but not taken. Finally two plots of 9,870 and 13,420 sq.yds. were let to John Brown and Co. on 16 April 1862.[26]

- 30 May 1863; John Brown & Co.'s half yearly land rent bill amounted to:[27]

	£ s d
Savile Street East	60- 0-0
Savile Street East	6- 6-0
Carlisle Street East	31- 5-0
Carlisle Street East	73-15-0
Carlisle Street East/Car Wood Lane	135- 5-0
	306-11-0

- 27 July 1863; the Estate wrote to Brown's with 'a rough sketch showing the plots of ground adjoining Carlisle Street East, near to your works, which are not yet let on building terms'. These comprised sites of 978 and 835 sq.yds. on either corner of an Intended Street (later Atlas Street) and Carlisle Street East at 6d per sq.yd. and another site north of Carlisle Street East and further east of 1,533 sq.yds. at 4.5d per sq.yd.[28]

- 3 August 1863; the Estate sent Brown's a plan showing vacant sites either side of the junction of Harleston Street and Forncett Street at 3.5d per sq.yd. The sites were of 120 ft. depth but no site area was stated. On 7 October, the Estate wrote urging Brown's to make a decision about what land they wanted. A negotiation obviously ensued because the Agents wrote two days later refusing to reduce the price of the land in Harleston Street.[29] It does not seem that Brown's took this land, for White's Plan of Sheffield in 1873 shows the land to the west of Harleston Street as vacant, while the Harleston Iron Works occupies the site to the east.

- 25 June 1865; Brown's took the assignment of J.W. Sales' lease of 4,844 sq.yds. at 6d per sq.yd. at the junction of Carr Wood Lane and Kenninghall Street and a further 9,680 yards at 2d per sq.yd.[30]

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24 ACM/LB/534
25 ACM/LB/E/148 - see below
26 ACM/LB/556-7
27 ACM/LB/G/44
28 ACM/LB/G/27 July 1863
29 ACM/LB/G/133, 217 & 222
30 ACM/LB/H/110

- 21 November 1867; 99 year lease in draft to Sir John Brown of 2,884 sq.yds. beside the canal at the junction of Effingham Road and Tinsley Road next to Atkinson's works for 10d per sq.yd. On 28 November the lease was included in a list sent to Few and Co. for execution, identified as 'John Brown's Wharf'.[31]

- 27 May 1870; 99 year leases of 19,770 sq.yds. of land at the junction of Carlisle Street East and New Hall Road, and 7,700 sq.yds. in Kenninghall Street both at 6d per sq.yd.[32]

- 18 July 1877; John Brown and Co.'s half yearly ground rent account amounted to:[33]

	£ s d	
Brightside	784-10-0	(Atlas Works)
Attercliffe	60- 0-0	(Canal Wharf)
	844-10-0	

- 31 March 1891; Brown's were offered the opportunity to buy their freehold. This was accepted on 21 September 1891.[34]

3. Charles Cammell and Co.

Cammell's, as Messrs. Johnson, Cammell and Johnson were an early migrant to Savile Street, setting up the Cyclops Works in 1844-5, being the first company to locate by the railway.[35] They first appear in the Applications Register in 1844:

- 2 November 1844; application for a lease of 1 acre by Johnson, Cammell and Johnson beside the Sheffield and Rotherham Railway at 1.75d per sq.yd.[36]

- 22 August 1846; application for an additional 9,250 sq.yds. adjoining the above at 2d per sq.yd., giving a total plot size of 15,370 sq.yds.[37]

[31]ACM/LB/I/328 & 347
[32]ACM/LB/J/474-8
[33]ACM/LB/N/260
[34]ACM/LB/V/351 & W/231
[35]Pawson and Brailsford, 1862, 124
[36]ACM/S384, 564
[37]ACM/S384, 630

- 28 June 1847; 'Messrs. Johnson, Cammell and Johnson (owed) To the Duke of Norfolk

	£ s d
For valuation of the tenant right in the land taken from Joseph Glover for the site of the Cyclops Works	9- 0-0
Rent of land from Michaelmas 1844 to Lady Day 1845	7- 2-0
Rent of 6,120 yards from Lady Day 1845 to Michaelmas 1845	22- 6-0
Rent of 6,120 yards from Michaelmas 1845 to Lady Day 1846	22- 6-0
Rent of 6,120 yards from Lady Day 1846 to Michaelmas 1846	22- 6-0
Ditto of 13,351 yards from Michaelmas 1846 to Lady Day 1847	65- 0-0
Contributions to common sewers	32- 8-0
Cost of edge stones and setting along Savile Street and Sutherland Street	21- 7-0

The account was paid on 22 December 1847, and shows that the firm had already expanded their works onto most of their site by the time the Letter Books began (and that signing a lease was no guarantee that the Estate would receive its ground rent income on the due date). It is assumed that the lower initial rent from 1844-45 represents the period before the factory was built (when agricultural rent would have been payable) rather than rent for an initial small site. It is not clear why the site area differs from that which appears in the Applications Register, unless a smaller site was actually taken or part was still in agricultural use.[38]

- 9 June 1848; Cammell's were sent a tracing of land available to the north across the railway opposite the Cyclops Works. In a subsequent letter it was agreed that a lease of 12,500 sq.yds. north of the railway could be granted for seven years at 1d per sq.yd., but the Agent required a higher (though unspecified) rent for a ten year lease. However, on 15th September 1848 it was confirmed that a 10 year lease would be granted at 1d.[39]

[38]ACM/LB/A/394
[39]ACM/LB/B/65, 91 & 114

- 20 December 1850; Cammell's were recorded as paying £205 per half year in ground rents.[40]

- 20 February 1851; 99 year lease of 8,255 sq.yds. in Savile Street/Sutherland Road/Greystock Street and 18,190 sq.yds. in Carlisle Street/Sutherland Street, all at 2.5d per sq.yd.[41]

- November 1851; Cammell's ground rents for the half year were:[42]

	£ s d
Cyclops Works	130-0-0
Carlisle Street	75-0-0
Atlas Works[43] and land bounded by Savile Street, Sutherland Street and Greystock Street	84-0-0

- 23 May 1861; terms of a 99 year lease of 13,470 sq.yds. at the junction of Carlisle Street East and Carr Wood Lane for 3d per sq.yd. were set out.[44] Applications Register B shows that this plot (though measured at 12,900 sq.yds. in the Register) was relinquished by Cammell's.[45] It was occupied within two years by Brown's.[46]

- 29 September 1864; 99 year lease agreed on 48,400 sq.yds. in Carlisle Street East at 3d per sq.yd. This was the large Cammell's site north of the railway and east of New Hall Road[47] known as the Grimesthorpe Works.[48] Half yearly rents due on other properties of £260-0s-0d.[49]

- 25 April 1867; Cammell's owed two years' rents on their properties for 1866 and 1867. The Estate pursued the debt, which seems to have arisen as a result of a dispute about the terms of Cammell's leases, on 4 July and 1 August, finally receiving a cheque on 6 August 1867.[50]

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[40]ACM/LB/B/533
[41]ACM/LB/B/567
[42]ACM/LB/B/800
[43]Although it is not absolutely certain why Cammell's were paying rent on an Atlas Works, which was the name of John Brown's works in later years, the 1863 White's Plan of Sheffield shows an Atlas Works south of Savile Street opposite the Cyclops Works, so it is probable that there were two factories with this name, one of which was occupied by Cammell's and one by Brown's
[44]ACM/LB/F/148
[45]ACM/S612
[46]White's Plan of Sheffield, 1863
[47]PRO/MPS/5/274
[48]Though described incorrectly on OS maps as the Cyclops Works - Lodge 1985
[49]ACM/LB/G/753
[50]ACM/LB/I/69 etc.

- 30 July 1868; the half yearly bill for Cammell's property was, interestingly, divided between land leased personally to Charles Cammell Esq. and leases to Charles Cammell and Company:[51]

Chas. Cammell Esq.	Yards	£ s d
Carlisle St. East with New Hall Road	42,088 }	
Carlisle St. East	4,290 }	368- 7-6
Carlisle St. East	10,540 }	
Carlisle St. East (South East Side)	19,590	122- 7-6
Carlisle St. East (South West Side)	24,480	152-15-0
Carlisle St. with Sutherland Street	18,189	94-10-0
Savile Street	15,351	65- 0-0
Savile S. East with Sutherland Street	6,240	39- 0-0
		842- 0-0

- 31 March 1891; Cammell's were offered their freeholds. On 20th July 1892 the Estate confirmed terms for their purchase at £46,422.[52]

- Early 1900; Cammell's purchased the freehold of 17,190 sq.yds. at the junction of Adsetts Street and Carlisle Street East for £5,770.[53] This appears as part of the eastern part of the Cyclops (more properly called Grimesthorpe) Works in Bacon's Plan of Sheffield (1910).

[51]ACM/LB/I/763
[52]ACM/LB/V/351 and X/95
[53]ACM/LB/AE/476

APPENDIX 5

DEVELOPMENT OF LARGE WORKS ON THE NORFOLK ESTATE*

Date	**Company**	**Location**	**Area**	**Price per sq. yd.**
1836[1]	Chas. Atkinson	Sheffield Canal	5,837 sq. yds.& 1,425 sq. yds.	2d 1d
1837[2]	Nicholsons (Cutlers) - extension of works	Suffolk Road	3,460 sq. yds.	1.5d
1842[3]	John Read of Royd's Mill Silver Refinery - for a wharf	Sheffield Canal	2,776 sq. yds.	2d
1845[4]	Cotton Mill Co.	Uncertain (lease application relinquished)	2a 1r 0p	1d
Jul. 1846[5]	Spear and Jackson	Sheffield and Rotherham Railway (Savile Street East)	7,269 sq. yds.	1.65d
Jul. 1846[6]	Messrs Brookes	Carlisle Street	1,558 sq. yds.	2.5d
May-Jul. 1850[7]	J. Beet & Sons (later Peace, Ward & Co's Aegenoria Works)	Savile Street East, on land originally reserved for Spear and Jackson next to their Aetna Works	1 acre	2.7d
Sept. 1850[8]	Messrs Brookes - extension to existing property	Carlisle Street	1,630 sq. yds.	3.5d

* Excluding Firth's, Brown's and Cammell's, for details of which see Appendix 4
* Excluding Firth's, Brown's and Cammell's, for details of which see Appendix 4
[1]ACM/S384
[2]Ibid.
[3]Ibid.
[4]Ibid.
[5]ACM/S384, 626
[6]ACM/S384, 620
[7]ACM/LB/B/370, 374, 378, 410, 648; Pawson and Brailsford, 1862, 124
[8]ACM LB/B/439-40

Apr. 1853[9]	Moses Eadon & Sons	Brightside, north east of Frankish Bros Works	1a 2r 0p	2d
Jul. 1853[10]	Wilson, Hawksworth & Co, Carlisle Works	Carlisle StreetEast/ Sutherland Street on Midland Railway	2a 2r 27p	2.5d
Jul. 1854[11]	Joseph Peace & Co	Neepsend Lane	4,100 sq. yds. & 1,900 sq. yds.	3d
Jul. 1854[12]	Stephenson, Blake & Co.	Carlisle Street East on Midland Railway	4,340 sq. yds.	?
1857[13]	Illegible Boiler Makers	Leveson Street	1,240 yds as addition to site of 2,772 sq. yds.	1d
1857[14]	Bessemer, Longsden, Galloway, Galloway and Allen	Carlisle Street East	8,070 sq. yds.	2d
Apr. 1859[15]	Benj. Huntsman & Co	Effingham Road near the Sheffield Canal	5,079 sq. yds.	6d
1859[16]	Wilson, Hawksworth & Ellison	Carlisle Street East	12,983 sq. yds. & 4,332 sq. yds.	2d
Jul. 1860[17]	J. Sales Coal Merchant	Savile Street East/Carwood Lane	9,680 sq. yds.	2d
Nov. 1860[18]	Sanderson Bros.	New Hall Road on Midland railway (later maps show this site occupied by a MR engine shed and sidings)	2.5 acres	2d

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[9]ACM/LB/C/209
[10]ACM/LB/C/294
[11]ACM/LB/C/668 & 821
[12]ACM/LB/C/490
[13]ACM/S612
[14]Ibid.
[15]ACM/LB/E/281; ACM/S612
[16]ACM/S612
[17]Ibid. ; ACM/LB/E/685

1860[19]	Burton Weir Brewery - extension	Blackmore Street	5,800 sq. yds.	3d
1860[20]	J.M. Stanley, Sheffield Iron Founders & Co (lease not completed due to 'stoppage' of company)	Savile Street East	2,400 sq. yds.	3d
1860[21]	Sybry Searles & Co	Carlisle Street	2,640 sq. yds.	6d
1860[22]	Charles Camm Steel Manufacturer	Queen's Road	1,996 sq. yds.	1.5d
1860[23]	Illegible Fork Manufacturer	Carlisle Street East	1,680 sq. yds.	3d
1860[24]	Royd's Mill - extension of term of lease	Royd's Mill Street	3,042 sq. yds.	1.5d
Jan. 1864[25]	Chas. Atkinson & Co	Land beside River Don	2,780 sq. yds.	6d
Mar. 1877[26]	Samuel Fox & Co.	Wadsley Bridge	2 acres	1d
Apr. 1884[27]	Shipman & Sons Wire Works	Sutherland Road	4,739 sq. yds.	2d

[18]ACM/LB/E/799-801
[19]ACM/S612
[20]Ibid.
[21]Ibid.
[22]Ibid.
[23]ACM/S613
[24]ACM/S612
[25]ACM/LB/G/374
[26]ACM/LB/N/100
[27]ACM/LB/R/21

APPENDIX 6

PREMISES LEASED FROM THE NORFOLK ESTATE FOR COMMERCIAL/INDUSTRIAL USES CORRELATED AGAINST SUBSEQUENT EDITIONS OF WHITE'S DIRECTORY

A random selection of properties was checked to see if the head lessee subsequently gave the property as their commercial address. All 16 proved to be owner occupiers.

Trade of Lessee:	Address:	Area (sq.yds. or acres/roods /perches)	Date
T. & J. Langley (Joiners & Builders)	St. Mary's Road, Highfield	2008	Apr. 1877[1]
John Jowett (Edge Tool Manufacturer)	Countess Road, Highfield		1881[2]
W. & G. Sissons (Electro-platers)	St. Mary's Road, Highfield		1881[3]
J. Sivil (Builder)	Brittain Street, Highfield		1881[4]
Shipman and Son (Attercliffe Steel & Wire Works)	Sutherland Road, Brightside	4739	Apr. 1884[5]
Confectioner	Petre St. Brightside - Pitsmoor	178	Apr. 1884[6]
Public House or Grocer	Duke St./School La., Park	1476	Apr. 1884[7]
Sheffield Varnish Co. Ltd.	Green Head, Nr. Oughtibridge	2300	Feb. 1887[8]
Victoria Corn Mills	Carlisle St., Brightside	5256	Feb. 1887[9]
B. Cartledge (Veterinary Surgeon)	Norfolk Road., Park	6684	Oct. 1888[10]

[1]ACM/LB/N/149
[2]ACM/LB/P/535
[3]Ibid.
[4]Ibid.
[5]ACM/LB/R/21
[6]Ibid.
[7]Ibid.
[8]ACM/LB/S/249
[9]Ibid.
[10]ACM/LB/T/222

Trade of Lessee:	Address:	Area (sq.yds. or acres/roods /perches)	Date
Frederick Ward (Merchant and Manufacturer)	East Bank Road., Park	6a Or 29p	Mar. 1890[11]
Henry Bessemer (Steel Manufacturer)	Atlas St./Forncett St., Brightside	2772	Mar. 1890[12]
Alfred Smith (Doctor) (Freehold)	Danville St., Pitsmoor	304	Mar. 1890[13]
Winder Bros. (Engineers and Ironfounders, Royd's Works)	Tinsley Rd./Warren St., Attercliffe	4279	Sept.1890[14]
J Clarke (Niagara Recreation Grounds)	Wadsley Bridge	12a Or 29p	Dec. 1890[15]
Conservative Club	Ditchingham Road, Pitsmoor	2824	Dec. 1892[16]

[11]ACM/LB/V/155
[12]Ibid.
[13]Ibid.
[14]ACM/LB/V/44
[15]ACM/LB/V/137
[16]ACM/LB/X/332

APPENDIX 7 - SHEFFIELD'S POPULATION BY TOWNSHIP, 1801-1911

Township	**1801**	**1811**	**1821**	**1831**	**1841**	**1851**	**1861**	**1871**	**1881***	**1891**	**1901**	**1911**
Sheffield	31314	35840	42157	59011	68186	83447	87703	91613	91801	91416	90398 }	
Attercliffe-cum-Darnall	2281	2673	3172	3741	4156	4873	7464	17447	26968	35881	51807	} 252239
Brightside Bierlow	4030	4899	6615	8968	10089	12042	29816	50269	56721	67083	73088 }	
Ecclesall Bierlow	5363	6569	9113	14279	19984	24562	38771	50709	58790	68987	82422]	
Nether Hallam	1974	2384	3200	4658	7275	8897	18760	32403	38868	46328	64599]	
Upper Hallam	794	866	1018	1035	1401	1499	1643	2021	2513	2709	3657	] 201698
Heeley	-	-	-	-	-	-	-	-	8747	11837	14822]	
Norton Within	-	-	-	-	-	-	-	-	-	-	10828]	
Total	**45755**	**53231**	**65275**	**91692**	**111091**	**135310**	**185157**	**244462**	**286289**	**324241**	**391621**	**454637**
								Without	**'Norton Within'**		**380793**	
% Change												
Sheffield Township		**14.45**	**17.63**	**39.98**	**15.55**	**22.38**	**5.10**	**4.46**	**0.21**	**-0.42**	**-1.11** }	**17.16**
Attercliffe & Brightside		**19.98**	**29.25**	**29.86**	**12.09**	**18.74**	**120.40**	**81.64**	**23.59**	**23.03**	**21.30** }	
Ecclesall		**22.49**	**38.73**	**56.69**	**39.95**	**22.91**	**57.85**	**30.79**	**15.94**	**17.34**	**19.47**]	
Upper Hallam		**9.07**	**17.55**	**1.67**	**35.36**	**7.00**	**9.61**	**23.01**	**24.34**	**7.80**	**34.99**	] **14.39**
Nether Hallam & Heeley		**20.77**	**34.23**	**45.56**	**56.18**	**22.30**	**110.86**	**72.72**	**46.95**	**22.16**	**36.54**]	
Total		**16.34**	**22.63**	**40.47**	**21.16**	**21.80**	**36.84**	**32.03**	**17.11**	**13.26**	**17.44**	**16.09**

* Creation of Heeley Township by division of Nether Hallam in 1881 affected statistical distribution of population

Source: Census data reported in the Sheffield Red Books

APPENDIX 8

ACCOUNTS OF DEVELOPMENT OF J. EDGAR ALLEN'S IMPERIAL STEEL WORKS (1)

The account begins in a letter of 19 January 1891:

Particulars of Foundry Capital Debts to 31 Dec 1890

	£	s	d
Buildings	3,650	7	7
General Services A/c (relaying sidings etc.)	126	5	2
Gas Pot Furnace and (indec)[a]	905	17	4
Producer and Flues	356	15	0
Store	203	12	0
F.P and M. Engine A/c	390	1	10
F.P and M. Machine Shop	592	4	9
" " " Pattern (?) Shop	169	14	7
" " " Smith's Shop	195	4	9
" " " Moulding Shop	376	15	7
" " " Gas Pot Furnace	119	12	6
" " " Fettling Shop	138	19	10
Hydraulic Service A/c	273	2	11
Loose Tools General Service	117	16	2
" " Pattern Shop	13	1	7
" " Engine A/c	1	3	2
" " Moulding Shop	259	4	5
" " Smith's Shop	22	2	2
" " (indec)	8	4	10
" " Gas (indec) Furnace	55	11	10
" " Machine Shop	10	15	10
Stores	11	1	2
Bricks and Mortar	255	18	9

Contd. from previous page	£	s	d
(Indec. - possibly Exhibiting) A/c	37	19	10
Partners (?) A/c	7	15	8
Sub-Total	8,279	9	3
Less Ps - on A/c Tinsley Purchase	3,000		
Total	5,279		

[a] £50 to be recovered in royalties and debited to Mr. Siemen's Account.

B. Dept.

Approximate statement of Plant bought and ordered to: 31 Dec. 1891

	£	s	d
Blowing Engine	225	0	0
Converter	100	0	0
Cupola	80	0	0
Roof	363	0	0
Receivers	45	0	0
Hydraulic Lift	22	10	0
Plates and girders for do.	65	14	5
Italiano*	110	11	7
Wages digging well for lift, foundations etc.	139	5	1
Sundries	65	15	3
Total	1,217	6	4
2 Hydraulic Cranes	225	0	0

Other expenditure expected on Galvanized sheets for walls, etc. and erection.

* Italiano was the servant of the Robert Company sent over to supervise erection and operation of the new blast furnace.

APPENDIX 9

ACCOUNT OF DEVELOPMENT OF J. EDGAR ALLEN'S IMPERIAL STEEL WORKS (2)

Mem. as to further Expenditure

Estimate C. Dept. i.e. Gas Crucible Foundry

	£
Furnace in Smith's Shop for heating Wheels to pass on to Axles	40
Vertical Boiler to supply Steam to producer instead of taking Steam from present boiler	45
Cart Weighing machine and fixing	50
One 6" or 8" Lathe say	50
One 10" slotting machine "	70
Machine for centring axles "	20
Hollow Spindle Lathes "	45
Fittings A/c for Laboratory "	50
	370
Another 6" Lathe may be required	50
Increased Trade may require more Moulding Boxes	50
	470

Est. for B. Dept. In addition to previous

1 Drying Stove, 1 Annealing Stove	250
Fixing to 2 Boilers and Shed over it	100
3 Stove Carriages	45
"Shanks" for carrying Steel to moulds	20
2 Hydraulic Cranes and Fixing	240
Galvd. sheets for Sides and Ends of Building and fixing	60
C.I. Connecting pipe for Steam and Air	25
5 ft. Brick Wall on E. side of Building	
Erecting and lining of Cupola Converter	150
	890
Moulding Boxes for 6 mths.	250
	£1,140

Estimate Expenditure in Connexion with B. and C. Depts. and also in connexion with Coke Furnace

	£
Extension of Sidings to Coke Furnace	50
Fixing Truck Weighing Machine	30
Fixing Turntable in space between Fettling Shop and Pattern Shop	30
Sidings to Cupola, to Pot-shed and to Fettling Shop and 2'6" Tramway from present moulding shop thro' B Shop and Yard to Fettling Shop	60
4 Trams for 2'6" Way	20
Large Sign Edgar Allen Co. Ltd. to be used with Present large sign Imperial Steel Works: taking that sign down and re-fixing it at Tinsley	50
	£240

Note:We have the rails for the sidings and Tramway. Sleepers and fixing only required and some Switches.

Estimate to accommodate Cross George St. at Tinsley. The File Dept. is left out of consideration.

12 Cokeholes @ £50 p. hole	600
Shed for Coke and Pot making and fittings for Bar Steel, Scrap etc.	250
Altering Building for Warehouse and offices for Everitt, properly constructed floor of Concrete, Wood and Stone. Offices - Not more than	£1500
	£2600

Electric lighting for Works and Offices would cost £500 but may be left over. It is a luxury more than a necessity.

Summary			£
C. Dept.	£ 470	say	500
B. Dept.	£1,140	say	1,200
B. and C. Dept.	£ 240	say	250
Sundries			5
			£2,000
Coke hole, Offices etc.	£2,600	say	3,000
Expend to 31 Dec. not included above			2,300
Working Capital, B. and C. Dept.			3,000
			£10,300
Sale of Cross George St.			£5,000?
File Plant, Fixed			£ 609
" " , Loose			£ 246
Weight Machine say			£ 50
			£5,905?

APPENDIX 10

CHRONOLOGY OF URBAN AND INDUSTRIAL DEVELOPMENT IN SHEFFIELD, 1750-1920

(Relevant developments outside Sheffield shown in italics)

Transport and Urban Development	Year	Industrial and Commercial Development
	1750	
River Don Navigation extended to Tinsley	51	Huntsman Crucible Process reaches commercial output levels - works in Attercliffe
	52	
	53	
	54	
	55	
Turnpike to Chesterfield	56	
	57	
Turnpikes to Chapel, Buxton & Wakefield	58	
Turnpike to Tinsley	59	
Stagecoaches to London, Leeds, Wakefield, Chesterf'ld & Nottingham begin	1760	Change to coke smelting in 1760s
	61	
Lady's Bridge widened to 38'	62	
	63	
Turnpike Attercliffe to Worksop	64	
	65	
	66	
	67	
	68	
	69	
	1770	Britannia Metal production begins
Building Paradise Sq. begins	71	
	72	Hadfield's founded
	73	Sheffield Assay Office opened

Transport and Urban Development	Year	Industrial and Commercial Development
	1774	Jessop's established in Jessop St.; First Trade Directory
	75	
Building Alsop Fields begins	76	
Turnpike to Penistone	77	
	78	
Turnpike to Eckington; Sheffield Moor enclosed and allotted for building	79	
	1780	
	81	
	82	
	83	
	84	
	85	
New market building	86	First use of steam power (Grinding)
	87	
	88	
Attercliffe Bridge built in stone	89	Thos. Firth starts steel melting
Park Hill developed in 1790s	1790	
	91	
	92	Sheffield & Rotherham Bank started
Laying out of Alsop Fields complete; First Hackney Carriage	93	
	94	
Wicker layed out	95	Green Lane Stove & Grate Works Established
	96	
	97	
	98	
	99	
	1800	
	01	
	02	
Turnpike to Baslow	03	
	04	
Turnpike Wadsley to Langsett	05	

Transport and Urban Development	Year	Industrial and Commercial Development
	1806	
	07	Fire Insurance Office opens
New town hall	08	
	09	
	1810	
	11	
	12	
	13	
	14	Act limits Cutlers' Company powers to grant of trademarks only
	15	
	16	
	17	
Improvement Act sets up Police (later Improvement) Commissioners to watch, light & cleanse streets;	18	
Sheffield Canal opens; First gas street lighting	19	Sheffield & Hallamshire Savings Bank opens
	1820	
Turnpike to Glossop	21	
	22	
	23	First cutlery factory - Sheaf Works
	24	*Needham patents method of producing steel castings*
	25	
	26	
Broom Hill sold for housing	27	
	28	
Building Leases sold on Broom Hall estate	29	
Endcliffe Cres. layed out; First co-operative building society; Duke of Norfolk opens New Corn Exchange, Haymarket and Cattle Market	1830	'German Silver' production begins
	31	Daniel Doncaster builds his first cementation furnace; Sheffield Banking Co. formed

Transport and Urban Development	Year	Industrial and Commercial Development
First cab stand (in High St.); New Cutlers Hall; Cholera epidemic	1832	
	33	
	34	
Streets layed out in Sharrow	35	Approx. date of Jessop's move to Brightside
	36	
	37	Spear & Jackson move to Brightside
Sheffield & Rotherham Railway opens; First horse bus routes from Wicker Station to the Moor & Glossop Rd.	38	
	39	
NMR opens - rail to London via Rotherham	1840	Firth & Sons start business in town centre site; *During 1840s German companies patent practical steel casting methods; Electro-Plating patented*
Cabs allowed to ply for hire	41	Sam'l Fox locates in Stocksbridge
	42	*Nasmyth Steam Hammer invented*
Sheffield incorporated as a Borough	43	
Sheffield's two gas companies merge	44	John Brown begins steel making (Orchard St.)
MSLR (SAMR) opens to Manchester	45	Cammell's open works in Brightside; Davy Bros. found Park Iron Works
Council appoints Health Committee but street improvements remain with Town Trustees & Improvement Commissioners	46	
	47	

Transport and Urban Development	Year	Industrial and Commercial Development
MSLR takes over Sheffield Canal; Highways Board laying new sewers pursuant to Public Health Act, 1848	1848	
MSLR to Lincolnshire opens; First freehold land societies; Highways Board promulgates main sewerage plan	49	
New barracks open	50	Sheffield firms begin to produce steel castings - seven involved by 1880
MSLR Victoria Station opens - original Bridgehouses terminus becomes goods depot; Norfolk Market Hall opens	51	Firth's begin to build Norfolk Works; Cocker Bros. take over Navigation Works from Marsh Bros.
	52	Firth's begin ordnance production
	53	By-Law on smoke nuisance
SYR opens Barnsley to Tinsley (Blackburn Valley Line)	54	Brown's buy works in Brightside
MSLR Park Goods branch built	55	Vickers buy patent for steel bells; First use of Nasmyth hammer in Sheffield at Sheaf Works; Crinoline wire production begins
	56	Bessemer announces his steel conversion process
	57	Brown's lay down puddling furnaces, leave Furnival St. works and concentrate production in Brightside, roll rails
	58	Knife blades begin to be stamped from sheet metal

Transport and Urban Development	Year	Industrial and Commercial Development
First pillar boxes for mail	1859	Bessemer builds works in Brightside
Borough Bridge at end of Corporation St. opens (begun 1853)	1860	Brown's lay down four Bessemer converters
Lady's Bridge widened	61	Brown's roll armour plate; Cammell's roll rails;
	62	Sam'l. Fox & Co. install crucibles at Stocksbridge
	63	Vickers River Don Works opens; Cammell's roll armour plate
SYR opens Tinsley to Darnall; Broughton La. Goods Depot opens; Introduction of building bye-laws - back-to-back housing prohibited; Collapse of Dale Dyke Dam; Council adopts Local Government Act, 1858 and abolishes Highway Boards & Improvement Commission	64	Brown's & Cammell's become public companies; Cammell's take lease of site for Grimesthorpe Works
MSLR Park Goods Depot opens	65	Firth's new gun factory complete; *Siemens-Martin Open Hearth process used in Birmingham*
Council Weights & Measures Dept. established	66	
	67	Hadfield's establish works in Attercliffe
MSLR opens Tinsley to Rotherham	68	Edgar Allen starts prduction in Joiner St.; *Mushet discovers Titanium high speed steel*
Police take over fire service from insurance companies	69	

Transport and Urban Development	Year	Industrial and Commercial Development
MR opens Brightside to Chesterfield; Pond St. Goods Station opens; Wicker Station becomes goods only	1870	Samuel Osborn begins to produce Titanium steel in partnership with Mushet; Sam'l Fox installs Bessemer converters; Crinoline wire production ends
	71	Brown, Bayley & Dixon erect works in Attercliffe; Brown's Atlas Works expands; Cammell's Cyclops Works expands; Sanderson Bros. erect new furnaces; Andrews Toledo Works erected; New rolling mills at River Don Works; New furnaces at Scotia works; New foundry at Craven's Wagon Works; Rodgers (cutlers) become private limited company
Medical Officer of Health appointed	72	Hadfield's move to Hecla Works, Newhall Rd., Attercliffe
First horse tram route - Lady's Bridge to Attercliffe	73	
	74	Brown's close rail mill
Removal of toll bars begins; first sanitary inspectors; Leopold, Pinstone & Surrey Sts. built by Council	75	Jessop's and Wostenholm's (cutlers) become limited liability companies
	76	
	77	
Experiments with steam tramway traction	78	Introduction of steel-iron compound armour plate; Hadfield's install Bessemer converter; *Siemens demonstrates practical electric furnace in Birmingham; Gilchrist Thomas process for converting phosphoric ores first demonstrated*

Transport and Urban Development	Year	Industrial and Commercial Development
	1879	Approximate date of introduction of Open Hearth furnaces in Sheffield by Vickers and Brown's
	1880	
Corn Exchange replaced	81	
	82	*Cammell's relocate rail mill from Dronfield to Workington*
	83	Hadfield's first patents for Manganese steels
Last turnpike road 'disturnpiked'	84	Hadfield's first patents for Silicone steels
	85	Machine cutting of files had become established
	86	
Council buys Water Company	87	
Fargate widened	88	Vickers roll armour plate & begin to make equipment for warships
	89	Brown's & Sam'l. Fox dismantle Bessemer converters
	1890	Edgar Allen's move to Tinsley & introduce Tropenas process
	91	
MR Queens Rd. Goods Depot opens; Electric Light & Power Company set up; High Street widened	92	'Flying' grinding method for scissors introduced
Sheffield is made a City; MR opens Dore to Manchester & Blackburn Valley Lines	93	W.T. Flather produces first drawn steel bar
	94	
LNWR Goods Depot in Bernard Rd. opens; High St. widened by Council	95	

Transport and Urban Development	Year	Industrial and Commercial Development
Municipalisation of tramways	1896	
New town hall opens (begun 1891)	97	
Electric Light & Power Company municipalised; clearance of Crofts area by Council begins to make way for Townhead Flats	98	Hadfield's East Hecla Works opens
First electric trams; Duke of Norfolk sells market rights to Council	99	
SDR opens Attercliffe Goods Depot; City boundaries extended to include 172 acres in Tinsley	1900	
	01	
	02	
LNWR Goods Depot in Broad St. opens	03	Firth's & Brown's amalgamate
	04	
Through trams run between Sheffield & Rotherham via Tinsley & Templebo'	05	
	06	
	07	
	08	Firth's open crucible steel & rolling mills in Weedon Rd., Tinsley
	09	First Sheffield Simplex motor car produced at Tinsley
	1910	81 Town Gas furnaces installed during year; Edgar Allen & Co. install Héroult electric furnace

Transport and Urban Development	Year	Industrial and Commercial Development
Sheffield's population is fifth largest in Great Britain & largest in Yorkshire	1911	Firth's & Jessop's install electric furnaces;
	12	Harry Brearley of Firth's develops Stainless Steel
	13	
	14	
	15	
	16	Vickers using electric furnaces; Construction of Steel, Peach & Tozer's Templeboro' Works begins
	17	Kayser Ellison using electric furnaces
	18	
	19	Templeboro' Works fully operational
	1920	

APPENDIX 11

DATBASE OF NORFOLK LAND DISPOSALS

Sources: ACM Registers of Applications for Land and Land Agents' Letter Books

Sites Within Sheffield

Abbreviations:
A = Attercliffe
AF = Alsop Fields
AF/CENT = Alsop Fields/Town Centre
B = Brightside
B/G = Brightside/Grimesthorpe
BRID = Bridgehouses
BRID/P = Bridgehouses/Pitsmoor
C/W = Crookes/Walkley
CENT = Town Centre
CENT/A = Town Centre/Attercliffe
ESTBNK = East Bank, Park
G = Grimesthorpe
H = Highfield
LOWF = Lowfield
MANPK = Manor Park, Park
N = Neepsend
NFKPK = Norfolk Park, Park
NORWD = Norwood
P = Pitsmoor
P/B = Pitsmoor/Brightside
P/WDSD = Pitsmoor/Woodside
PK = Park
PK/A = Park/Attercliffe
PK/PND = Park/Ponds
PND = Ponds
PS/N = Parkwood Springs/Neepsend
SHFDTN = Sheffield Township

rict	Date	Street/Location	Area Sq. Yds.	Price d per Sq. Yd.	Comments
A	1820	Attercliffe	1500	2.24	Malthouse
A	1826	Attercliffe	800	0.95	Brickyard
A	1829	Attercliffe	2420	1.88	
A	1829	Attercliffe		2.00	Adjoining Attercliffe Malthouses
A	1834	Attercliffe	1000	1.50	Farm
A	1836	Attercliffe	1425	1.00	Chas. Atkinson - across Intended St from plot of 5837 sq. yds.
A	1840	Attercliffe	384	1.00	
A	1877	Attercliffe	2963	4.50	Carting contractor and coal-merchant
A	1885	Attercliffe	16594	2.89	Mayor & Burgesses of Sheffield - 21 years
A	1844	Attercliffe Forge	31127	0.15	Dam Field for Attercliffe Forge - Both leases to Sanderson
A	1844	Attercliffe Forge	127806	0.71	42 year lease of Tilts,Rolling Mill, Workshops,Warehouses
A	1832	Attercliffe Rd (aka Tinsley Rd)	1000	1.25	Between 12 O'Clock St & Royd's Mill
A	1833	Attercliffe Rd (aka Tinsley Rd)	737	1.50	
A	1834	Attercliffe Rd (aka Tinsley Rd)	582	1.50	
A	1834	Attercliffe Rd (aka Tinsley Rd)	1029	1.50	
A	1835	Attercliffe Rd (aka Tinsley Rd)	473	1.50	
A	1835	Attercliffe Rd (aka Tinsley Rd)	764	1.50	
A	1835	Attercliffe Rd (aka Tinsley Rd)	1644	1.50	Near Royd's Mill
A	1836	Attercliffe Rd (aka Tinsley Rd)	623	1.50	
A	1836	Attercliffe Rd (aka Tinsley Rd)	721	1.50	
A	1838	Attercliffe Rd (aka Tinsley Rd)	294	1.75	
A	1846	Attercliffe Rd (aka Tinsley Rd)	1336	2.00	Extension of Royd's Works - 2.5 years at 1d until leases could be merged on expiry of Royd's Works Lease
A	1846	Attercliffe Rd (aka Tinsley Rd)	1557	2.00	Adjoining Royd's Works - Needle Manufacturer
A	1846	Attercliffe Rd (aka Tinsley Rd)	297	4.00	Optician
A	1846	Attercliffe Rd (aka Tinsley Rd)	500	6.00	c/o Saville St - Publican
A	1850	Attercliffe Rd (aka Tinsley Rd)	182	2.00	Near the 12 O'Clock
A	1850	Attercliffe Rd (aka Tinsley Rd)	244	2.00	Near the 12 O'Clock
A	1850	Attercliffe Rd (aka Tinsley Rd)		2.00	Near Royd's Mill
A	1850	Attercliffe Rd (aka Tinsley Rd)	708	5.00	Near the 12 O'Clock - butcher
A	1857	Attercliffe Rd (aka Tinsley Rd)	1530	1.00	
A	1857	Attercliffe Rd (aka Tinsley Rd)	298	3.50	
A	1859	Attercliffe Rd (aka Tinsley Rd)		3.00	Near Attercliffe Forge Goit
A	1860	Attercliffe Rd (aka Tinsley Rd)	500	3.00	By Head Goit
A	1860	Attercliffe Rd (aka Tinsley Rd)	645	4.00	
A	1860	Attercliffe Rd (aka Tinsley Rd)	825	4.00	
A	1867	Attercliffe Rd (aka Tinsley Rd)	202	3.56	
A	1867	Attercliffe Rd (aka Tinsley Rd)	650	2.21	Next to canal - Malthouse & ground
A	1867	Attercliffe Rd (aka Tinsley Rd)	231	2.29	Next to canal - 3 houses part built
A	1867	Attercliffe Rd (aka Tinsley Rd)	619	2.50	Next to canal - Cottages
A	1867	Attercliffe Rd (aka Tinsley Rd)	171	3.16	Next to canal - 1 house part built
A	1890	Attercliffe Rd (aka Tinsley Rd)	4279	3.25	
A	1898	Attercliffe Rd (aka Tinsley Rd)	815	9.00	

A	1849	Bacon La	1961	0.92	Land for houses, gardens and yard
A	1846	Bernard La	240	1.00	
A	1846	Bernard La	300	1.00	
A	1847	Bernard La	300	1.00	46
A	1868	Bernard Rd	5079	6.62	
A	1877	Bernard Rd	643	7.00	
A	1825	Beside Canal, Attercliffe		2.50	For a glass house
A	1825	Beside Canal, Attercliffe		2.50	Manufacturing furnaces for Hy. Cadman, Wm. Jessop & Saml. Fox (probably Park Works)
A	1825	Beside Canal, Attercliffe		2.50	Shops and a steam engine
A	1831	Beside Canal, Attercliffe	480	5.00	Between Canal Bridge and New Bridge
A	1833	Beside Canal, Attercliffe	712	2.50	Next to Canal by Oblique Bridge
A	1833	Beside Canal, Attercliffe	1068	3.00	Next to Canal by Oblique Bridge
A	1836	Beside Canal, Attercliffe	5837	2.00	Chas. Atkinson
A	1836	Beside Canal, Attercliffe	774	2.50	By Canal, near the Oblique Bridge
A	1842	Beside Canal, Attercliffe	2776	2.00	John Read, The Mills for a wharf (owner of Royd's Silver Mill)
A	1844	Beside Canal, Attercliffe		1.75	
A	1844	Beside Canal, Attercliffe	1102	1.63	
A	1826	Blast Furnace La		2.00	
A	1834	Blast Furnace La	1000	1.50	
A	1836	Blast Furnace La	411	2.50	
A	1853	Blast Furnace La	1014	18.00	Benjamin Huntsman - record may be unreliable because part faded
A	1855	Canal St		6.00	Land beside canal
A	1826	Canal Wharf St		2.00	Adjoining Messrs. Eadon Jessop
A	1859	Effingham Rd	1428	6.00	c/o Canal St but not beside canal
A	1859	Effingham Rd	5079	6.00	Benj. Huntsman and Co. - adjoining canal
A	1860	Effingham Rd	461	4.00	To a file forger - beside canal
A	1864	Effingham Rd	564	6.00	
A	1867	Effingham Rd	2884	9.99	J.Brown & Co - c/o Tinsley Rd
A	1877	Effingham Rd	312	7.23	
A	1877	Effingham Rd	1112	9.00	
A	1891	Effingham Rd	1288	9.00	
A	1899	Effingham Rd	746	2.99	Cocker Bros
A	1899	Effingham Rd	636	3.00	Beardshaw & Son
A	1805	Effingham St	11679	2.57	Davy Bros 63 yr lease - Park Iron Works by R. Don
A	1825	Effingham St		2.00	Near Gas Works
A	1835	Effingham St	481	2.75	
A	1835	Effingham St	1356	3.00	
A	1835	Effingham St	502	4.00	
A	1835	Effingham St	2026	4.50	
A	1836	Effingham St	486	3.00	
A	1836	Effingham St	867	3.00	
A	1840	Effingham St	200	4.00	
A	1840	Effingham St	515	4.00	
A	1840	Effingham St	582	4.00	
A	1840	Effingham St	960	4.00	

A	1841	Effingham St	1206	4.00	
A	1846	Effingham St	950	4.00	
A	1850	Effingham St	613	3.00	Davy Bros 63 yr lease - Park Iron Works land for wharf
A	1852	Effingham St	22385	0.12	Unclear if this is new lease or record of rent payable
A	1852	Effingham St	5023	0.13	Unclear if this is new lease or record of rent payable
A	1852	Effingham St	3811	0.19	Garden - unclear if this is new lease or record of rent payable
A	1852	Effingham St	220	0.47	Garden - unclear if this is new lease or record of rent payable
A	1891	Effingham St	1031	9.00	
A	1892	Effingham St	883	9.00	
A	1898	Effingham St	1033	7.00	
A	1843	Matilda St	810	3.00	
A	1828	Near Sheaf Works		2.00	
A	1831	Near Sheaf Works		3.00	
A	1832	Near Sheaf Works	401	3.00	
A	1832	Near Sheaf Works	1327	3.00	
A	1832	Near the12 O'Clock PH	803	1.50	
A	1832	Near the12 O'Clock PH	682	1.75	
A	1833	Near the12 O'Clock PH		1.50	
A	1834	Near the12 O'Clock PH	959	2.00	
A	1836	Near the12 O'Clock PH		1.75	
A	1850	Near the12 O'Clock PH	629	4.00	
A	1847	Park Works		4.00	Land 86 yds depth between works and canal
A	1858	Pinfold Canal Bridge, Attercliffe	28556	0.12	Not clear if this is new lease or record of rent receivable
A	1858	Pinfold Canal Bridge, Attercliffe	18480	0.17	From plan of gardens - probably not new lease
A	1859	Proposed SYR Station nr canal bsn.		60.00	- quote for price of 5 yard wide strip by canal
A	1859	Proposed SYR Station nr canal bsn.	14127	120.00	Presumably freehold
A	1845	Royd's Mill	16819	0.19	Land near Mill on yearly tenancy
A	1845	Royd's Mill	15851	2.65	Renewal of lease - Corn mill,brewery,etc.
A	1860	Royd's Mill	3042	1.50	Extension of term of Royd's Mill lease
A	1861	Royd's Mill St	412	2.50	
A	1864	Royd's Mill St	2780	6.00	Chas. Atkinson, Fitzalan Wks c/o Windsor St
A	1880	Royd's Mill St		3.00	Sheffield Smelting Co - offer of land
A	1837	Sheffield Gas Works Co.	884	2.75	
A	1837	Sheffield Gas Works Co.	2343	2.75	
A	1837	Sheffield Gas Works Co.	7960	2.75	
A	1881	Woodbourn Junction	4840	0.12	Leased from MSLR to Duke of Norfolk
A	1858	Woodburn Rd	105270	0.10	Either side of MSLR
AF	1887	Earl St	230	10.50	37 years
AF	1837	Matilda St	769	2.00	
AF	1837	Matilda St	440	2.50	
AF	1838	Matilda St	248	2.50	
AF	1838	Matilda St		2.50	
AF	1838	Matilda St	540	3.00	
AF	1838	Matilda St		3.00	
AF	1840	Matilda St	296	3.00	

AF	1840	Matilda St		3.00	
AF	1841	Matilda St	540	3.00	
AF	1842	Matilda St	900	3.00	
AF	1842	Matilda St		3.00	
AF	1843	Matilda St	788	3.00	
AF	1868	Matilda St	1880	2.49	71 years
AF	1832	Norwich St	494	1.50	
AF	1832	Norwich St		1.50	
AF	1835	Norwich St	526	2.00	
AF	1838	Norwich St		2.00	
AF	1840	Norwich St	158	1.00	Same lessee as plot of 345 Sq. Yds
AF	1840	Norwich St	1173	1.50	
AF	1840	Norwich St	345	2.00	Same lessee as plot of 158 Sq. Yds
AF	1853	Norwich St	300	1.60	Not new lease
AF	1838	Norwich St West		2.00	
AF	1839	Norwich St West	439	2.50	
AF/CENT	1845	Sycamore St	437	1.65	Adjoining E.Ingall's plot
AF/CENT	1845	Sycamore St	110	16.33	Lease to E.Ingall
B	1898	Alliance St	339	4.00	
B	1899	Alliance St	678	4.00	
B	1850	Atkinson St	4500	2.88	Next to canal
B	1890	Atlas St	2772	4.00	Hy. Bessemer & Co
B	1897	Atlas St	300	4.00	c/o Alliance St
B	1897	Atlas St	306	4.00	c/o Alliance St
B	1857	Beside River Don		1.00	
B	1870	Beside River Don	1830	8.00	J.Murray of Rotherham - Land by Ches'f'ld & Sh'f'ld Rly
B	1870	Beside River Don	2392	8.00	J.Murray of Rotherham - Land by Ches'f'ld & Sh'f'ld Rly
B	1843	Beside S&R Rly	9559	0.15	North of rly.
B	1849	Beside S&R Rly	840	1.50	North of rly.
B	1854	Beside S&R Rly	90598	0.13	Joseph Ibbotson - agricultural
B	1860	Blackmore St	225	3.00	
B	1860	Blackmore St	316	3.00	
B	1860	Blackmore St	412	3.00	
B	1860	Blackmore St	5800	3.00	Extension of Burton Weir Brewery
B	1860	Blackmore St		3.00	
B	1861	Blackmore St	225	2.99	
B	1827	Brightside	1935	0.46	
B	1827	Brightside	3815	0.57	Carriage house, stable and gardens
B	1836	Brightside Bierlow	437	1.25	
B	1858	Brightside Bierlow	1510	1.00	
B	1854	Brightside La	69091	0.11	Joseph Ibbotson
B	1854	Brightside La	32004	0.12	Joseph Ibbotson
B	1859	Brightside La	293	3.00	
B	1860	Brightside La	8100	2.00	Sanderson Bros, next to railway
B	1860	Brightside La	66187	2.00	MR - Straddled railway, developed as sidings

B	1860	Brightside La	1670	2.00	To a builder - beside railway
B	1860	Brightside La	3500	2.00	To a builder - beside railway
B	1860	Brightside La	12100	2.00	Sanderson Bros - beside Midland Railway
B	1860	Brightside La	40717	2.00	Midland Railway sidings
B	1860	Brightside La	2410	2.50	Hawksley & Wild - beside Midland Railway
B	1868	Brightside La	212	1.50	39 years
B	1868	Brightside La	2830	1.50	39 years
B	1871	Brightside La	56855	6.00	Lease to MR - asking price
B	1871	Brightside La	26880	6.18	Lease to MR - asking price
B	1851	Brightside Station		1.00	Land for an inn
B	1837	Brightside Warehouse		1.25	
B	1843	Carlisle St		3.00	c/o Hall Carr St
B	1846	Carlisle St	1558	2.50	Brooks and Co. (sketch plan seems to show this was not a railwayside site)
B	1848	Carlisle St	12500	1.00	Johnson, Cammell & Co - 10 year lease opposite Cyclops Wks
B	1849	Carlisle St		6.00	Next to Midland Station
B	1850	Carlisle St	665	3.00	Stonemason
B	1850	Carlisle St	1630	3.50	Extension to Howard Works - Messrs Brookes & Co
B	1851	Carlisle St	18190	2.50	Johnson, Cammell & Co
B	1853	Carlisle St	2290	1.50	C/o Hall Car St for reservoir
B	1853	Carlisle St	750	4.96	C/o Hall Car St
B	1857	Carlisle St		6.00	
B	1858	Carlisle St	273	6.00	
B	1858	Carlisle St	311	6.00	
B	1859	Carlisle St	1583	6.00	c/o Hall Carr St
B	1860	Carlisle St	40	6.00	Extensinon to existing leasehold at same rent
B	1860	Carlisle St	356	6.00	To a mason - beside Midland Railway next to Sybry, Searles & Co
B	1860	Carlisle St	2640	6.00	Next to Midland Railway beside Sybry, Searles & Co
B	1887	Carlisle St	5256	5.70	Victoria Corn Mills
B	1849	Carlisle St	864	6.00	c/o Hall Carr St beside railway - Jas. Sykes, Railway Contractor
B	1850	Carlisle St	665	3.00	c/o Hall Carr St
B	1857	Carlisle St		6.00	To W.F.Hoyle, Gentleman next to Jas. Sykes plot east of Carr Wood La
B	1849	Carlisle Street East		2.50	Next to railway
B	1850	Carlisle Street East	1135	1.25	Housing land
B	1850	Carlisle Street East	1446	1.25	Housing land
B	1853	Carlisle Street East	12917	2.50	Wilson, Hawksworth and Co. c/o Sutherland St.
B	1857	Carlisle Street East	334	2.00	
B	1857	Carlisle Street East	621	2.00	
B	1857	Carlisle Street East	8070	2.00	Bessemer & Co - next to S&R Railway
B	1858	Carlisle Street East	1840	1.50	
B	1858	Carlisle Street East	478	2.00	
B	1858	Carlisle Street East	910	2.00	
B	1859	Carlisle Street East	4332	2.00	c/o Sutherland St-Wilson Hawksworth and Co. - beside Midland Railway
B	1859	Carlisle Street East	12983	2.00	c/o Sutherland St-Wilson Hawksworth and Co. - beside Midland Railway
B	1859	Carlisle Street East	7508	2.00	John Brown and Co. - beside Midland Railway
B	1859	Carlisle Street East	15923	2.00	John Brown and Co. - beside Midland Railway

B	1859	Carlisle Street East	456	2.50	
B	1859	Carlisle Street East	525	2.50	
B	1859	Carlisle Street East	774	2.50	
B	1859	Carlisle Street East	455	3.00	
B	1859	Carlisle Street East	624	3.00	
B	1859	Carlisle Street East	650	3.00	
B	1859	Carlisle Street East	652	3.00	
B	1860	Carlisle Street East	25471	2.00	Midland Railway sidings
B	1860	Carlisle Street East		2.00	Alternative engine shed site for MR well to east of Carr Wood Rd
B	1860	Carlisle Street East	9870	2.50	John Brown & Co - beside Midland Railway
B	1860	Carlisle Street East	23350	2.50	John Brown & Co, c/o of Carr Wood La next to existing premises
B	1860	Carlisle Street East	930	3.00	
B	1860	Carlisle Street East	1680	3.00	
B	1860	Carlisle Street East	12900	3.00	Chas. Cammell Co - beside Midland Railway
B	1860	Carlisle Street East		3.00	
B	1860	Carlisle Street East	22990	3.00	Alternative engine shed site for MR next to John Brown's
B	1861	Carlisle Street East	930	2.99	
B	1861	Carlisle Street East	1680	3.00	
B	1861	Carlisle Street East	13470	3.00	Chas. Cammell & Co - c/o Carr Wood Rd
B	1862	Carlisle Street East	423	2.99	
B	1862	Carlisle Street East	537	2.99	
B	1862	Carlisle Street East	628	3.00	
B	1862	Carlisle Street East	629	3.00	
B	1862	Carlisle Street East	630	3.00	
B	1862	Carlisle Street East	9870	3.00	Plan seems to show land prevoiusly allocated to J.Brown & Co
B	1862	Carlisle Street East	13420	3.00	Plan shows land c/o Carr Wood La previously allocated to Cammells
B	1863	Carlisle Street East	1533	4.50	Between Carlisle Street East and Forncett St
B	1863	Carlisle Street East	835	6.00	Between Carlisle Street East and Forncett St
B	1863	Carlisle Street East	978	6.00	Between Carlisle Street East and Forncett St
B	1865	Carlisle Street East	4844	5.95	From J.Sales to John Brown & Co
B	1871	Carlisle Street East	19770	6.00	John Brown & Co - c/o New Hall Rd
B	1880	Carlisle Street East		4.00	G.Carr - Brick Maker & Builder, 65,Carlisle St. E.
B	1860	Carr Wood La	9680	2.00	J.H.Sales, Coal Merchant
B	1864	Carr Wood La	48400	3.00	Chas. Cammell and Co
B	1865	Carr Wood La	9680	1.98	J.Brown & Co - c/o Keninghall St - assignment of J.H.Sales's lease
B	1881	Carr Wood Rd	376	4.00	
B	1868	Church Rd	631	3.88	
B	1878	Church Rd	486	2.99	
B	1857	Clun St	435	3.00	
B	1857	Clun St	515	3.00	
B	1859	Clun St	968	3.00	
B	1860	Clun St	413	2.50	
B	1860	Clun St	340	3.00	
B	1860	Clun St		3.00	
B	1889	Cook St	262	3.00	

B	1889	Cook St	268	3.00	
B	1889	Cook St	271	3.00	
B	1889	Cook St	276	3.00	
B	1889	Cook St	288	3.00	
B	1889	Cook St	326	3.00	
B	1889	Cook St	353	3.00	
B	1855	Corby St	137	2.23	
B	1855	Corby St	76	2.29	
B	1860	Corby St	397	3.00	
B	1860	Corby St	840	3.00	To Messrs Norman
B	1860	Corby St	200	4.00	To Messrs Norman
B	1860	Corby St	286	4.00	To Messrs Norman
B	1860	Corby St	405	4.00	To Messrs Norman
B	1861	Corby St	218	2.97	
B	1861	Corby St	397	2.99	
B	1861	Corby St	546	2.99	
B	1861	Corby St	260	3.00	
B	1886	Corby St	604	4.99	
B	1861	Dorking St	166	4.00	
B	1878	Earl Marshal Rd	1224	1.50	
B	1888	Earl Marshal St	432	3.00	
B	1857	Earsham St		3.00	
B	1858	Earsham St	270	2.50	
B	1860	Earsham st	190	3.00	
B	1860	Earsham St	583	4.00	
B	1861	Earsham St	413	2.49	
B	1861	Earsham St		3.00	
B	1862	Earsham St	190	2.97	
B	1862	Earsham St	490	3.99	
B	1862	Earsham St	536	3.99	
B	1870	Earsham St	1107	4.60	
B	1882	Earsham St	297	3.50	
B	1884	Earsham St	351	4.00	
B	1885	Earsham St		4.00	
B	1885	Earsham St		4.00	
B	1885	Earsham St		4.00	
B	1885	Earsham St		4.00	
B	1889	Earsham St	326	4.00	
B	1889	Earsham St	368	4.00	
B	1889	Earsham St	372	4.00	
B	1890	Earsham St	398	3.50	
B	1890	Earsham St	1347	3.50	
B	1890	Earsham St	284	4.00	
B	1890	Earsham St	286	4.00	
B	1890	Earsham St	296	4.00	

B	1891	Earsham St	383	3.98	
B	1891	Earsham St	357	4.00	
B	1892	Earsham St	374	3.98	
B	1892	Earsham St	371	4.00	
B	1893	Earsham St	488	4.00	
B	1860	Fersfield Rd		3.00	
B	1860	Fersfield St	416	3.00	
B	1860	Forncett St	700	3.00	
B	1861	Forncett St	7260	0.06	G.Noble's holding - not new lease
B	1861	Forncett St	7260	0.08	Nether High Field - G.Noble's holding - not new lease
B	1863	Forncett St		3.50	C/o Harleston St
B	1863	Forncett St		3.50	C/o Harleston St
B	1868	Forncett St	4428	3.00	
B	1860	Garter St		3.00	
B	1862	Garter St	393	2.99	
B	1881	Garter St	598	5.00	c/o Carlisle St E.
B	1838	Greystock St		1.50	
B	1841	Greystock St		1.50	
B	1847	Greystock St	544	2.50	
B	1853	Greystock St	304	2.25	
B	1855	Greystock St	172	2.23	
B	1857	Greystock St	350	2.00	
B	1857	Greystock St	1511	2.00	
B	1859	Greystock St	806	3.00	
B	1860	Greystock St	218	3.00	
B	1861	Greystock St		3.00	
B	1862	Greystock St	388	3.99	
B	1862	Greystock St	273	4.00	
B	1862	Greystock St	288	4.00	
B	1870	Greystock St	1106	5.37	Firths - c/o Fersfield St
B	1871	Greystock St	895	5.73	Firths - c/o Windsor St
B	1871	Greystock St	1106	5.73	
B	1886	Greystock St	607	5.00	
B	1844	Hall Carr	904	1.50	
B	1845	Hall Carr	904	1.50	Site of house and buildings
B	1832	Hall Carr Grange	1212	0.79	Near Hall Carr Grange
B	1848	Hall Carr Grange	296	1.00	
B	1831	Hall Carr House		1.50	North of Hall Carr House
B	1833	Hall Carr House		1.50	North of Hall Carr House
B	1850	Hall Carr St	780	3.00	Near Carlisle St
B	1837	Hall Carr Wood	2420	1.00	
B	1858	Handley St	228	3.00	
B	1860	Handley St	240	3.50	
B	1860	Handley St	200	3.00	
B	1857	Harleston St	790	2.00	

B	1871	Kenninghall St	7700	6.00	John Brown & Co
B	1857	Leveson St	1240	1.00	Extension of existing 2772 sq yd boilermakers near Norfolk Bridge
B	1858	Lovell St	585	3.50	
B	1860	Lovell St	257	3.00	
B	1860	Lovell St	307	3.00	
B	1860	Lovell St	366	3.00	
B	1860	Lovell St	447	3.00	
B	1860	Lovell St	488	3.00	
B	1861	Lovell St	447	2.98	
B	1861	Lovell St	257	2.99	
B	1861	Lovell St	488	3.00	
B	1859	Lovell St	324	3.00	
B	1855	Lovetot Rd	1516	1.25	c/o Lumley St
B	1854	Lumley St	26620	1.50	Offer of land on newly laid out plots
B	1889	Manners St	286	3.00	
B	1890	Manners St	506	3.00	
B	1890	Manners St	628	3.00	
B	1891	Manners St	248	3.00	
B	1891	Manners St	249	3.00	
B	1891	Manners St	358	3.00	
B	1843	Meadow Hall	457380	0.08	Farm
B	1853	Midland Railway Station	2391	12.00	Messrs Singleton, timber merchants
B	1853	Midland Railway Station	5857	252.00	Freehold sale of land next to Spear & Jackson to MR Co
B	1857	Norroy St	780	2.00	
B	1861	Princes St	422	2.99	
B	1861	Princes St	684	3.00	
B	1853	Princess St	600	4.00	
B	1856	Princess St	2000	3.50	c/o Tinsley Rd - offer of land
B	1857	Princess St	801	3.00	
B	1859	Princess St	224	3.00	
B	1859	Princess St	445	3.00	
B	1860	Princess St	312	3.00	
B	1860	Princess St	255	3.00	To Messrs Norman
B	1860	Princess St	422	3.00	
B	1860	Princess St	431	3.00	
B	1860	Princess St	622	3.00	
B	1860	Princess St	643	3.00	
B	1860	Princess St	684	3.00	
B	1860	Princess St	416	4.00	
B	1860	Princess St	590	4.00	
B	1861	Princess St	212	3.00	
B	1861	Princess St	416	3.00	
B	1861	Princess St	431	3.00	
B	1861	Princess St	840	3.00	
B	1861	Princess St	255	3.01	

B	1861	Princess St	286	3.99	
B	1861	Princess St	590	3.99	
B	1861	Princess St	405	4.00	
B	1861	Princess St	200	4.02	
B	1841	Roper St	423	3.00	Ammonia Works
B	1852	Roper St	409	0.47	Yard - unclear if this is new lease or record of rent payable
B	1830	Savile St		1.75	Adjoining Hall Carr Works
B	1844	Savile St	4840	1.75	Johnson, Cammell and Johnson on S. & R. Railway
B	1845	Savile St	6120	1.75	Messrs Johnson Cammell & Co
B	1846	Savile St	15370	2.03	Johnson, Cammell and Johnson - area includes previous site of 1 acre (1844)
B	1846	Savile St	13351	2.34	Messrs Johnson Cammell & Co
B	1846	Savile St	524	2.50	
B	1849	Savile St	5800	6.00	Next to Midland Station
B	1850	Savile St	9922	2.70	
B	1850	Savile St	364	3.00	Dealer in Fireclay
B	1851	Savile St	8225	2.50	Johnson, Cammell & Co - c/o Sutherland St
B	1860	Savile St		3.00	
B	1860	Savile St	2392	12.00	To Midland railway Co - next to Wicker Stn - formerly Singleton & Co
B	1881	Savile St	19570	6.13	Savile St Foundry & Engineering Co - 82 yr lease on surrender of old
B	1881	Savile St		9.00	Savile St Foundry & Engineering Co - offer of land
B	1849	Savile St East	11200	3.00	Next to railway
B	1850	Savile St East	779	2.00	
B	1850	Savile St East	1172	2.00	Builder
B	1850	Savile St East	4840	2.72	Beet & Sons next to railway and Spear and Jackson
B	1850	Savile St East		2.00	I.N. Mappin
B	1851	Savile St East	12649	1.84	Firths - Norfolk Wks - original application 1851
B	1853	Savile St East	7260	1.98	Moses, Eadon and Sons
B	1854	Savile St East	26620	1.49	John Brown and Co.
B	1857	Savile St East	2837	2.00	c/o Greystock St - Firth's
B	1859	Savile St East	500	3.00	c/o Princess St & Carr Wood Rd
B	1859	Savile St East	495	3.00	
B	1859	Savile St East	593	3.00	
B	1859	Savile St East	956	3.00	
B	1860	Savile St East	386	3.00	
B	1860	Savile St East	670	3.00	
B	1860	Savile St East	2400	4.00	Sheffield Iron Founders & Co - beside Midland Railway
B	1860	Savile St East	622	3.00	
B	1861	Savile St East	386	2.98	
B	1861	Savile St East	622	2.99	
B	1861	Savile St East	670	2.99	
B	1868	Savile St East	122	12.00	84 years - c/o Windsor St
B	1885	Savile St East	1400	6.00	Firths - offer of land
B	1886	Savile St East	1424	5.90	Firths
B	1890	Savile St East	12150	4.00	Firths
B	1846	Savile Street East	7269	1.65	Spear and Jackson adjoining railway

B	1845	Sheaf Works		1.00	Greaves & Co - Land between works and canal
B	1860	Sorby St	267	3.00	
B	1860	Sorby St	334	3.00	
B	1860	Sorby St		3.00	
B	1860	Sorby St		3.00	
B	1861	Sorby St	267	3.00	
B	1862	Sorby St	334	2.98	
B	1836	Sussex St	611	3.00	
B	1844	Sussex St	370	3.50	
B	1847	Sussex St	5085	3.00	
B	1850	Sussex St	606	2.50	
B	1850	Sussex St	788	2.50	
B	1850	Sussex St	1725	2.92	House and land
B	1854	Sussex St	776	3.45	Hockton Works
B	1857	Sussex St	145	2.40	c/o Effingham Rd
B	1860	Sussex St	248	4.80	
B	1868	Warren St	5688	6.18	Willey & Sons - Rollers,Tilters & Forgers
B	1885	Wincobank Wood La	900	1.00	
B	1860	Windsor St	212	3.00	To Messrs Norman
B	1860	Windsor St	362	3.00	To Messrs Norman
B	1860	Windsor St	823	3.00	
B	1861	Windsor St	362	2.98	
B	1864	Windsor St	1836	4.00	
B	1878	Windsor St	554	6.00	
B/G	1870	Petre St	330	5.35	
B/G	1870	Petre St	434	8.30	
B/G	1881	Petre St	295	5.00	c/o Canada St
B/G	1881	Petre St	312	5.00	
B/G	1881	Petre St	317	5.00	
B/G	1881	Petre St	335	5.00	c/o Jamaica St
B/G	1881	Petre St	373	5.00	c/o Petre St
B/G	1881	Petre St	656	5.00	
B/G	1881	Petre St	278	5.50	
B/G	1881	Petre St	487	5.50	
B/G	1882	Petre St	178	5.00	
B/G	1882	Petre St	613	5.00	
B/G	1882	Petre St	157	6.00	Confectioner
B/G	1882	Petre St	333	6.00	
B/G	1884	Petre St	236	5.00	c/o Kingston St
B/G	1884	Petre St	309	5.00	c/o Kingston St
B/G	1885	Petre St	338	4.50	
B/G	1885	Petre St	340	4.50	
B/G	1886	Petre St	387	3.47	
B/G	1886	Petre St	341	3.98	
B/G	1890	Petre St	230	4.00	

B/G	1890	Petre St	432	4.00	
B/G	1892	Petre St	472	4.14	
B/G	1893	Petre St	61	2.00	
B/G	1893	Petre St	345	3.00	
BRID	1826	Bridgehouses	300	1.00	
BRID	1826	Bridgehouses	480	1.00	
BRID	1830	Bridgehouses	320	0.75	
BRID	1831	Bridgehouses	1322	0.45	
BRID	1836	Bridgehouses		1.75	
BRID	1838	Bridgehouses		1.00	
BRID	1845	Bridgehouses	1209	1.00	Old Turnpike Road
BRID	1855	Bridgehouses		1.50	
BRID	1830	Edward St		0.75	
BRID	1830	Edward St		0.75	
BRID	1835	Edward St		0.75	
BRID	1837	Edward St		1.00	
BRID	1840	Edward St	509	1.00	
BRID	1844	Edward St	569	1.50	
BRID	1845	Edward St	693	1.25	
BRID	1853	Edward St	633	6.00	Across road from MSLR Works - extension of property for housing
BRID	1860	Edward St	572	3.00	
BRID	1861	Edward St	572	3.00	
BRID	1859	Edward St		2.50	
BRID	1857	Handley St	321	3.00	
BRID	1857	Handley St	646	3.50	
BRID	1844	Harvest La	525	1.00	
BRID	1847	Harvest La	2438	2.25	Silver Refinery
BRID	1831	Marcus St	456	0.75	
BRID	1832	Marcus St	545	1.00	
BRID	1835	Marcus St	434	1.00	
BRID	1845	Marcus St	373	2.00	
BRID	1857	Marcus St	533	2.00	
BRID	1858	Marcus St	265	2.00	
BRID	1858	Marcus St	520	2.75	
BRID	1859	Marcus St	580	2.75	
BRID	1859	Marcus St		2.75	
BRID	1860	Marcus St	893	3.00	
BRID	1888	Marcus St	151	3.00	
BRID	1897	Marcus St	431	3.50	
BRID	1857	Spital St		2.00	
BRID	1858	Spital St	533	2.00	
BRID	1858	Spital St	823	2.00	
BRID	1858	Spital St	362	3.00	
BRID	1858	Spital St	910	3.00	
BRID	1859	Spital St	552	2.00	

BRID	1859	Spital St	786	2.00	
BRID	1859	Spital St	954	3.25	
BRID/P	1840	Andover St	975	1.50	
BRID/P	1845	Andover St	796	2.00	
BRID/P	1846	Andover St	262	1.50	
BRID/P	1850	Andover St	2938	2.00	
BRID/P	1857	Andover St	330	2.00	
BRID/P	1857	Andover St	396	2.00	
BRID/P	1857	Andover St	698	2.00	
BRID/P	1857	Andover St	966	2.00	
BRID/P	1858	Andover St	434	2.00	
BRID/P	1858	Andover St	974	2.00	
BRID/P	1859	Andover St	411	2.00	
BRID/P	1859	Andover St	562	2.00	
BRID/P	1859	Andover St	622	2.50	
BRID/P	1861	Andover St	1174	2.49	
BRID/P	1886	Andover St	1132	2.50	
BRID/P	1859	Andover St West		2.50	
BRID/P	1860	Andover St West	504	2.50	
BRID/P	1860	Andover St West	812	2.50	
BRID/P	1878	Andover Street West	377	4.49	c/o Fox St
BRID/P	1881	Andover Street West	1167	4.00	c/o Rock St
BRID/P	1827	Fitzalan St		1.00	
BRID/P	1828	Rock St		1.00	
BRID/P	1839	Rock St	1452	1.25	
BRID/P	1839	Rock St	1402	1.50	
BRID/P	1839	Rock St		1.50	
BRID/P	1840	Rock St	1153	1.50	
BRID/P	1840	Rock St	1681	1.50	
BRID/P	1845	Rock St	861	1.50	
BRID/P	1847	Rock St	791	2.00	
BRID/P	1850	Rock St	486	1.50	
BRID/P	1850	Rock St	696	1.50	
BRID/P	1850	Rock St	1000	1.50	
BRID/P	1850	Rock St		1.50	
BRID/P	1857	Rock St	331	2.00	
BRID/P	1857	Rock St	660	2.00	
BRID/P	1858	Rock St	620	2.00	
BRID/P	1858	Rock St		2.00	
BRID/P	1860	Rock St	1218	2.00	
BRID/P	1860	Rock St		2.00	
BRID/P	1870	Rock St	820	4.28	
BRID/P	1877	Rock St	529	4.49	
BRID/P	1880	Rock St	384	4.00	
BRID/P	1880	Rock St	462	4.00	

BRID/P	1884	Rock St	386	3.00	
BRID/P	1885	Rock St	1995	1.80	53 years
BRID/P	1885	Rock St	1382	3.99	
BRID/P	1886	Rock St	908	2.40	
BRID/P	1886	Rock St	692	3.09	
BRID/P	1891	Rock St	1995	1.81	
BRID/P	1898	Rock St	629	3.50	
BRID/P	1841	Rock St	980	1.50	
C/W	1893	Back La	576	2.00	
C/W	1892	Bole Hill	651	1.00	
C/W	1894	Bole Hill	290	1.00	
CENT	1894	Blonk St	402	54.00	18 years - note: rent quoted at 4/6d
CENT	1839	By Sheaf Bridge	159	6.00	
CENT	1832	Exchange Inn La	239	6.00	
CENT	1845	Exchange Inn La	228	9.50	
CENT	1835	Exchange St	278	8.00	
CENT	1835	Exchange St	525	10.00	
CENT	1836	Exchange St	296	8.00	
CENT	1831	Fronting Canal Warehouse	321	8.50	2 houses and workshop
CENT	1832	Fronting Cattle Market	328	3.00	
CENT	1835	Fronting Cattle Market	2026	4.00	
CENT	1830	Fronting New Cattle Market		3.50	
CENT	1830	Fronting New Cattle Market		6.00	Between Corn Exchange and New Bridge
CENT	1831	Fronting New Cattle Market	281	8.00	
CENT	1831	Fronting New Cattle Market	589	8.00	
CENT	1832	Fronting New Cattle Market	868	4.00	
CENT	1833	Fronting New Cattle Market		4.00	
CENT	1830	Furnace Hill	303	8.00	
CENT	1830	Furnival Rd	480	8.00	
CENT	1830	Furnival Rd	303	9.00	
CENT	1831	Furnival Rd	781	6.50	
CENT	1832	Furnival Rd	199	6.50	Adjoins an existing leasehold to same party
CENT	1832	Furnival Rd	199	7.00	Adjoins an existing leasehold to same party
CENT	1833	Furnival Rd	297	8.00	
CENT	1835	Furnival Rd	885	8.00	
CENT	1828	Near Lady's Bridge		4.00	
CENT	1845	Norfolk St	400	1.50	
CENT/A	1837	Effingham La	357	4.00	
ESTBNK	1860	Belle Vue Rd	2000	1.00	
ESTBNK	1868	Belle Vue Rd	2000	1.00	
ESTBNK	1831	Clay Wood	728	1.00	
ESTBNK	1834	Clay Wood	465	1.50	
ESTBNK	1837	East Bank	5184	0.50	
ESTBNK	1840	East Bank	5575	0.62	
ESTBNK	1843	East Bank	5627	0.35	

ESTBNK	1844	East Bank	1240	0.58	
ESTBNK	1845	East Bank House	5596	0.62	T. Nicholson
ESTBNK	1845	East Bank House	19360	3.39	T. Nicholson
ESTBNK	1845	East Bank House		3.47	T. Nicholson
ESTBNK	1890	East Bank Rd	29917	0.19	F.Ward - Merchant & Manufacturer
ESTBNK	1890	East Hill	8940	1.24	
ESTBNK	1833	Farm Bank	2625	1.25	
ESTBNK	1840	Farm Bank	1127	1.50	
ESTBNK	1881	Norfolk Cottage	370	0.97	
ESTBNK	1839	The Farm	5230	0.62	
G	1893	Carlisle Rd	1338	4.00	
G	1860	Corby Rd	480	1.00	
G	1833	Grimesthorpe	412	0.87	
G	1833	Grimesthorpe	913	0.87	
G	1836	Grimesthorpe	990	1.00	
G	1837	Grimesthorpe	2420	0.50	
G	1849	Grimesthorpe	82099	0.12	
G	1856	Grimesthorpe	206	1.00	
G	1859	Grimesthorpe	805	1.00	
G	1860	Grimesthorpe	463	1.00	
G	1860	Grimesthorpe	488	1.00	
G	1861	Grimesthorpe	488	0.98	
G	1890	Grimesthorpe Highway	890	0.50	
G	1891	Grimesthorpe Highway	1750	1.37	
G	1861	Winco Rd	480	1.00	
G	1849	Wincobank	600	0.48	
G	1861	Worthing Rd	795	2.50	
H	1877	Alderson Rd	300	4.00	
H	1888	Alderson Rd	272	4.00	
H	1889	Alderson Rd	542	4.00	
H	1881	Baron St	654	5.00	
H	1881	Baron St	498	6.00	c/o John St
H	1857	Bramall La	544	3.00	
H	1877	Bramall La	506	3.98	
H	1877	Bramall La	357	4.00	
H	1878	Bramall La	996	6.00	c/o John St
H	1889	Bramall La	2875	1.75	c/o Cherry St
H	1898	Bramall La	1080	6.00	
H	1881	Brittain St	226	7.00	
H	1881	Brittain St	226	7.00	
H	1881	Brittain St	298	7.00	J.Sivil, Builder
H	1880	Charlotte Rd		5.00	c/o Lancing Rd
H	1881	Charlotte Rd	1736	5.00	
H	1881	Charlotte Rd	1736	5.00	
H	1887	Charlotte Rd	3272	2.20	

H	1878	Cherry St	460	4.49	
H	1882	Cherry St	1930	1.87	Next to Cricket Ground
H	1889	Cherry St	350	2.00	Back
H	1889	Cherry St	1690	4.00	Front
H	1841	Clough Bank	1912	0.75	
H	1885	Clough Rd	196	4.96	
H	1885	Clough Rd	373	4.99	
H	1885	Colver Rd		5.00	
H	1886	Colver Rd	211	5.00	
H	1880	Countess Rd	200	6.00	
H	1880	Countess Rd	456	6.00	
H	1880	Countess Rd	490	6.00	c/o John St
H	1881	Countess Rd	907	6.00	John Jowett, Edge Tool Mfr.
H	1888	Countess Road South	284	4.00	
H	1889	Countess Road South	527	4.00	
H	1885	Duchess Rd	393	4.98	
H	1897	Duchess St	1190	3.50	
H	1876	Edmund Rd	535	5.99	
H	1877	Edmund Rd	746	6.00	
H	1884	Edmund Rd	250	4.00	
H	1884	Edmund Rd	251	4.00	
H	1884	Edmund Rd	251	4.00	
H	1884	Edmund Rd	252	4.00	
H	1884	Edmund Rd	252	4.00	
H	1884	Edmund Rd	466	4.00	
H	1884	Edmund Rd	507	4.00	
H	1885	Edmund Rd	413	3.98	
H	1885	Edmund Rd	362	4.97	
H	1885	Edmund Rd	171	5.00	
H	1885	Edmund Rd	288	5.00	
H	1831	Fornham St		1.50	
H	1886	Guernsey Rd	288	3.00	
H	1877	Harrington Rd	429	4.98	
H	1877	Harrington Rd	370	6.00	
H	1878	Harrington Rd	721	4.99	
H	1857	Hereford St	358	3.00	
H	1858	Hereford St	285	3.50	
H	1858	Hereford St	169	4.00	
H	1858	Hereford St	295	4.00	
H	1859	Hereford St	346	4.00	
H	1860	Hereford St	216	4.00	
H	1860	Hereford St	279	4.00	
H	1861	Hereford St	216	4.00	
H	1876	Hereford St	279	3.87	82 year lease
H	1876	Hereford St	511	8.99	

H	1885	Jersey Rd	205	4.98	
H	1885	Jersey Rd		5.00	
H	1881	John St	286	6.00	
H	1881	John St	287	6.00	
H	1899	Leadmill Rd	1565	6.44	90 years
H	1848	Manton St	96	1.50	
H	1890	Manton St	270	4.00	
H	1891	Manton St	200	3.96	
H	1893	Manton St	468	4.00	
H	1877	Margaret St	428	6.98	
H	1888	Margaret St	535	5.00	
H	1860	Mary St	170	4.00	
H	1860	Mary St	270	4.00	
H	1861	Mary St	170	3.95	
H	1877	Mary St	357	6.99	
H	1880	Mary St		8.00	
H	1836	Near Clough Wheel		0.50	
H	1841	Queens Rd	2472	0.84	
H	1841	Queens Rd	1564	0.92	
H	1860	Queens Rd	1996	1.50	
H	1877	Queens Rd	435	4.99	
H	1877	Queens Rd	497	5.99	
H	1877	Queens Rd	426	6.00	
H	1878	Queens Rd	1996	1.50	c/o Duchess Rd
H	1878	Queens Rd	728	5.00	
H	1884	Queens Rd	372	6.00	
H	1885	Queens Rd		6.00	
H	1857	Rodley La	555	2.00	Near Suffolk La
H	1831	Sheaf Gardens		1.50	
H	1844	Sheaf Gardens	260	1.50	
H	1844	Sheaf Gardens	376	1.50	
H	1844	Sheaf Gardens	401	1.50	
H	1847	Sheaf Gardens	267	1.50	
H	1847	Sheaf Gardens		1.50	
H	1848	Sheaf Gardens	334	1.50	
H	1848	Sheaf Gardens	370	1.50	
H	1848	Sheaf Gardens	520	1.50	
H	1848	Sheaf Gardens	606	1.50	
H	1848	Sheaf Gardens	664	1.50	
H	1849	Sheaf Gardens	575	1.50	
H	1849	Sheaf Gardens	321	2.00	
H	1849	Sheaf Gardens	384	2.00	
H	1849	Sheaf Gardens	385	2.00	
H	1850	Sheaf Gardens		1.50	
H	1858	Sheaf Gardens	1835	2.00	

H	1887	Sheaf Gardens	385	4.00	
H	1889	Sheaf Gardens	2490	4.00	
H	1857	Sheaf Terrace	572	2.00	
H	1857	Sheaf Terrace		2.00	
H	1857	Sheaf Terrace		2.00	
H	1840	Shoreham St	825	3.00	
H	1846	Shoreham St	1129	3.00	
H	1848	Shoreham St		0.50	Non-building land on yearly tenancy
H	1848	Shoreham St		3.00	Building land
H	1850	Shoreham St		2.00	Timber yard c/o Matilda St
H	1876	Shoreham St	484	3.99	
H	1877	Shoreham St	236	3.97	
H	1877	Shoreham St	308	3.97	
H	1877	Shoreham St	852	4.00	
H	1877	Shoreham St	241	4.48	
H	1877	Shoreham St	762	4.49	
H	1877	Shoreham st	483	4.50	
H	1877	Shoreham St	747	4.50	
H	1877	Shoreham St	759	5.00	Lease to Edmund Winder, the Duke's Chief Clerk & Land Surveyor
H	1878	Shoreham St	491	3.98	
H	1878	Shoreham St	743	4.49	
H	1878	Shoreham St	325	4.99	
H	1878	Shoreham St	414	4.99	
H	1878	Shoreham St	985	5.00	
H	1878	Shoreham St	398	7.00	Brittain St
H	1880	Shoreham St		5.00	
H	1881	Shoreham St	292	7.00	
H	1881	Shoreham St	273	8.00	
H	1886	Shoreham St	260	3.83	
H	1887	Shoreham St	261	3.82	
H	1888	Shoreham St	700	4.00	
H	1890	Shoreham St	2490	3.25	c/o Lead Mill St
H	1893	Shoreham St	7100	2.50	
H	1840	St Mary's Rd	320	2.00	
H	1840	St Mary's Rd	1252	2.00	
H	1841	St Mary's Rd	206	2.00	
H	1841	St Mary's Rd	220	2.00	
H	1841	St Mary's Rd	360	2.00	
H	1841	St Mary's Rd	1950	2.00	
H	1841	St Mary's Rd		2.00	
H	1850	St Mary's Rd	208	2.00	
H	1850	St Mary's Rd	1118	2.00	
H	1850	St Mary's Rd	236	2.50	
H	1850	St Mary's Rd	256	2.50	
H	1857	St Mary's Rd	240	2.50	

H	1857	St Mary's Rd	523	2.50	
H	1857	St Mary's Rd		2.50	
H	1857	St Mary's Rd		2.50	
H	1858	St Mary's Rd		2.00	
H	1858	St Mary's Rd	489	2.50	
H	1858	St Mary's Rd		2.50	
H	1858	St Mary's Rd		2.50	
H	1858	St Mary's Rd	382	4.00	
H	1859	St Mary's Rd	280	2.00	
H	1859	St Mary's Rd	463	2.00	
H	1859	St Mary's Rd	724	2.00	
H	1859	St Mary's Rd	321	3.00	
H	1860	St Mary's Rd	1252	1.92	Land already built on
H	1861	St Mary's Rd	724	1.99	
H	1877	St Mary's Rd	275	6.98	
H	1877	St Mary's Rd	352	6.99	
H	1877	St Mary's Rd	393	6.99	
H	1877	St Mary's Rd	493	6.99	
H	1877	St Mary's Rd	520	6.99	
H	1877	St Mary's Rd	2008	7.00	T.&J.Langley - Steam Joinery Works
H	1878	St Mary's Rd	485	6.98	
H	1878	St Mary's Rd	699	6.99	
H	1878	St Mary's Rd	752	6.99	
H	1878	St Mary's Rd	720	7.00	
H	1880	St Mary's Rd		7.00	
H	1881	St Mary's Rd	556	7.00	c/oShoreham St
H	1881	St Mary's Rd	722	7.00	
H	1881	St Mary's Rd	722	7.00	
H	1881	St Mary's Rd	924	7.00	
H	1881	St Mary's Rd	1084	7.00	W.&G.Sissons, Electro Platers
H	1844	St Marys Rd	1175	2.00	
H	1859	St. Mary's Rd		3.00	
H	1898	Suffolk La	950	2.75	
H/PND	1844	Turner St		1.50	Extension of Thos. Turner's Suffolk Works (confluence of Sheaf and Porter)
H/PND	1860	Turner St		3.00	
H/PND	1865	Turner St	2230	2.58	
LOWF	1893	Heeley Bank Rd	50306	40.00	Mayor & Burgesses of Sheffield - next to MR as far as Brammall La
LOWF	1884	Myrtle Rd	376	3.00	
LOWF	1884	Myrtle Rd	745	3.00	
LOWF	1885	Myrtle Rd	264	3.00	c/o Anne's Rd
LOWF	1885	Myrtle Rd		3.00	
LOWF	1885	Myrtle Rd		3.00	
LOWF	1885	Myrtle Rd		3.50	
LOWF	1886	Myrtle Rd	307	2.97	
LOWF	1886	Myrtle Rd	313	2.99	

LOWF	1886	Myrtle Rd	319	4.48	
LOWF	1887	Myrtle Rd	400	2.50	
LOWF	1887	Myrtle Rd	404	2.50	
LOWF	1887	Myrtle Rd	610	2.50	
LOWF	1893	Myrtle Rd	404	2.00	
LOWF	1899	Myrtle Rd	763	3.50	
LOWF	1884	Olive Grove Rd	2870	1.30	38.5years
MANPK	1836	Manor	595	1.00	
MANPK	1839	Manor	557	0.75	
MANPK	1839	Manor		0.75	
MANPK	1841	Manor	970	0.75	
MANPK	1842	Manor	425	0.75	
MANPK	1847	Manor	603	0.75	
MANPK	1850	Manor	400	0.75	
MANPK	1850	Manor	513	0.75	
MANPK	1891	Manor La	346	0.69	58 years
MANPK	1850	Sky Edge		1.00	
N	1857	Mowbray St	395	1.00	
N	1868	Mowbray St	1310	2.49	
N	1898	Mowbray St	2449	82.42	T.W.Sorby Esq - Freehold purchase
N	1898	Mowbray St	6463	83.59	John Bedford & Sons - Offer of Freehold
N	1898	Mowbray St	1612	132.50	W.H.Thackray - Offer of Freehold
N	1898	Mowbray St	345	141.22	Worksop & Retford Brewery Co - Offer of Freehold
N	1898	Mowbray St	2026	151.04	Oxley Bros Ltd - Offer of Freehold
N	1898	Mowbray St	1392	214.14	W.Turner & Sons - Offer of Freehold
N	1881	Neepsend	8598	3.75	MSLR for station freehold (price reflects value of stn to estate)
N	1854	Neepsend La	3877	2.97	Joseph Peace
N	1854	Neepsend La	1900	3.03	Joseph Peace
N	1857	Neepsend La	752	4.00	
N	1858	Neepsend La	419	4.00	
N	1860	Neepsend La	558	3.00	
N	1881	Old Park Wood	12540	3.75	MSLR for station freehold (price reflects value of stn to estate)
N	1891	Rutland Rd	368	4.99	
NFKPK	1839	Intake Bar	939	0.75	
NFKPK	1855	Intake Bar	4230	1.00	
NFKPK	1877	Intake Rd	814	2.49	
NFKPK	1877	Intake Rd	1510	2.50	
NFKPK	1878	Intake Rd	802	2.50	
NFKPK	1878	Intake Rd	1985	2.50	
NFKPK	1881	Intake Rd	234	2.50	
NFKPK	1881	Intake Rd	1113	2.50	
NFKPK	1881	Intake Rd	1137	2.50	
NFKPK	1887	Intake Rd	314	2.50	
NFKPK	1887	Intake Rd	450	2.50	
NFKPK	1887	Intake Rd	467	2.50	

NFKPK	1888	Intake Rd	353	4.00	
NFKPK	1890	Intake Rd	696	1.45	
NFKPK	1890	Intake Rd	294	4.00	
NFKPK	1890	Intake Rd	364	4.00	
NFKPK	1891	Intake Rd	416	1.50	
NFKPK	1891	Intake Rd	666	4.00	
NFKPK	1892	Intake Rd	620	2.50	
NFKPK	1894	Intake Rd	393	1.50	
NFKPK	1894	Intake Rd	564	1.50	
NORWD	1881	Norwood Rd		1.50	99 year lease - 1200 sq yd minimum plot size - not grant of lease
NORWD	1881	Norwood Rd		2.00	200 year lease - 1200 sq yd minimum plot size - not grant of lease
NORWD	1899	Norwood Rd	1230	1.50	
NORWD	1885	Roe Wood		2.00	
NORWD	1885	Roe Wood		2.00	
NORWD	1881	Roe Wood La	800	1.50	
NORWD	1885	Roe Wood Rd	618	1.50	
P	1868	Abbey Field Rd	1210	2.48	
P	1878	Abbeyfield Rd	1356	1.50	
P	1878	Abbeyfield Rd	1725	1.50	
P	1880	Abbeyfield Rd		1.75	Henry Cadman - c/o Barnsley St
P	1881	Abbeyfield Rd	1250	1.50	
P	1887	Abbeyfield Rd	1358	1.50	
P	1838	Barnsley New Rd		2.00	
P	1839	Barnsley New Rd		1.50	
P	1839	Barnsley New Rd	728	2.00	
P	1839	Barnsley New Rd		2.00	
P	1839	Barnsley New Rd	220	3.00	
P	1839	Barnsley New Rd	393	3.00	
P	1839	Barnsley New Rd	1478	3.00	
P	1840	Barnsley New Rd	188	1.00	
P	1841	Barnsley New Rd		3.00	
P	1842	Barnsley New Rd	1115	3.50	
P	1836	Barnsley Rd		1.50	
P	1838	Barnsley Rd	1864	1.50	
P	1838	Barnsley Rd		1.50	
P	1839	Barnsley Rd	1500	1.50	
P	1854	Barnsley Rd	11041	0.16	Not new lease
P	1854	Barnsley Rd	6170	0.78	
P	1891	Barnsley Rd	1210	2.00	Offer price for building land
P	1859	Brackley St	1174	2.50	
P	1858	Bramber Pl		3.00	
P	1860	Bramber Pl	394	3.00	
P	1857	Bramber St	611	2.00	
P	1857	Bramber St		2.00	
P	1857	Bramber St	227	2.00	

P	1857	Bramber St	672	3.00	
P	1858	Bramber St	910	2.00	
P	1854	Burngreave	50608	0.11	Fields & woods
P	1888	Burngreave Bank	720	2.50	
P	1888	Burngreave Bank	436	3.75	
P	1888	Burngreave Bank	384	4.00	
P	1888	Burngreave Bank	533	4.50	
P	1892	Burngreave Bank	411	4.00	
P	1897	Burngreave Bank	334	4.00	
P	1887	Burngreave St	179	5.00	
P	1892	Burngreave St	471	4.00	
P	1897	Burngreave St	308	4.00	
P	1897	Burngreave St	404	4.00	
P	1826	Burngreave Wood	4840	0.25	
P	1835	Burngreave Wood	1250	1.00	
P	1835	Burngreave Wood	1011	1.50	
P	1881	Canada St	812	3.99	
P	1881	Canada St	295	4.00	
P	1881	Canada St	334	4.00	
P	1867	Catherine Rd	598	6.64	
P	1889	Catherine Rd	477	3.50	
P	1889	Catherine Rd	490	3.50	
P	1890	Catherine Rd	364	4.00	
P	1890	Catherine Rd	382	4.00	
P	1891	Catherine Rd	748	3.99	
P	1850	Catherine St	1080	1.50	
P	1858	Catherine St	397	2.00	
P	1859	Catherine St		2.50	
P	1860	Catherine St	58	2.50	
P	1860	Catherine St	164	2.50	
P	1860	Catherine St	396	2.50	
P	1860	Catherine St	915	2.50	
P	1860	Catherine St	80	3.00	
P	1861	Catherine St	752	0.73	
P	1861	Catherine St	396	2.49	
P	1861	Catherine St	915	2.49	
P	1861	Catherine St	80	3.00	
P	1877	Crabtree Rd	2495	2.00	
P	1890	Ditchingham Rd	456	4.00	
P	1892	Ditchingham Rd	2824	3.57	Conservative Club
P	1858	Ditchingham St	554	3.00	
P	1860	Ditchingham St	259	3.00	
P	1860	Ditchingham St	680	3.00	
P	1868	Ditchingham St	336	5.04	
P	1880	Ditchingham St		5.00	

P	1881	Ditchingham St	109	5.00	
P	1885	Ditchingham St	230	3.97	
P	1881	Firs Hill Rd	598	3.00	
P	1884	Firs Hill Rd	300	3.00	
P	1885	Firs Hill Rd		3.00	
P	1898	Firs Hill Rd	424	2.25	
P	1898	Firs Hill Rd	655	2.25	
P	1827	Fitzalan St		1.00	
P	1827	Fitzalan St		1.00	
P	1829	Fitzalan St		1.00	
P	1830	Fitzalan St		1.00	
P	1837	Fitzalan St		1.25	
P	1860	Fitzalan St	310	2.50	
P	1860	Fitzalan St	526	3.00	
P	1860	Fitzalan St	663	3.00	
P	1861	Fitzalan St	526	2.99	
P	1861	Fitzalan St	663	2.99	
P	1864	Fitzalan St	357	5.98	
P	1864	Fitzalan St	164	6.00	
P	1864	Fitzalan St	184	6.00	
P	1864	Fitzalan St	184	6.00	
P	1864	Fitzalan St	272	6.00	
P	1864	Fitzalan St	274	6.00	
P	1864	Fitzalan St	472	6.00	
P	1877	Fox St	307	4.50	
P	1878	Fox St	297	4.48	
P	1881	Fox St	350	4.00	
P	1881	Fox St	350	4.00	
P	1889	Fox St	210	2.00	c/o Rising St
P	1889	Fox St	218	2.00	
P	1835	Gray St	945	1.00	
P	1839	Gray St	1131	1.25	
P	1839	Gray St		1.50	
P	1841	Gray St	840	1.25	
P	1842	Gray St	379	1.25	
P	1825	Grimesthorpe Rd		0.40	
P	1890	Grimesthorpe Rd	395	3.98	
P	1890	Grimesthorpe Rd	401	3.98	
P	1891	Grimesthorpe Rd	222	4.00	
P	1877	Melrose Rd	511	2.98	
P	1877	Melrose Rd	622	2.99	
P	1877	Melrose Rd	504	3.00	
P	1877	Melrose Rd	604	3.00	
P	1878	Melrose Rd	594	2.99	
P	1878	Melrose Rd	679	2.99	

P	1878	Melrose Rd	502	3.00	
P	1878	Melrose Rd	503	3.00	
P	1878	Melrose Rd	560	3.00	
P	1878	Minna Rd	619	2.99	
P	1882	Minna Rd	946	2.00	
P	1882	Minna Rd	570	5.00	
P	1864	Montfort Rd	276	6.00	
P	1857	Montfort St	399	2.00	
P	1857	Montfort St	472	2.00	
P	1857	Montfort St	990	2.00	
P	1858	Montfort St	957	2.00	
P	1858	Montfort St	712	2.50	
P	1859	Montfort St	160	3.00	
P	1860	Montfort St	712	2.50	
P	1860	Montfort St	807	2.50	
P	1860	Montfort St	866	2.50	
P	1860	Montfort St	236	3.00	
P	1860	Montfort St	374	3.00	
P	1860	Montfort St		3.00	
P	1859	Neville St	520	2.00	
P	1861	Neville St	520	3.00	
P	1864	Neville St	310	3.99	
P	1849	New Park	4098	0.60	
P	1877	Nottingham Cliff	200	3.96	
P	1891	Nottingham Cliff	260	3.00	
P	1857	Nottingham St	331	2.00	
P	1857	Nottingham St	380	2.00	
P	1857	Nottingham St	391	2.00	
P	1857	Nottingham St	451	2.00	
P	1857	Nottingham St	624	2.00	
P	1857	Nottingham St	631	2.00	
P	1857	Nottingham St	996	2.00	
P	1857	Nottingham St		2.00	
P	1858	Nottingham St	191	2.00	
P	1858	Nottingham St	225	2.00	
P	1858	Nottingham St	336	2.00	
P	1858	Nottingham St	336	2.00	
P	1858	Nottingham St	389	2.00	
P	1858	Nottingham St	485	2.00	
P	1858	Nottingham St	624	2.00	
P	1858	Nottingham St	730	2.00	
P	1858	Nottingham St	830	2.00	
P	1858	Nottingham St	396	2.50	
P	1858	Nottingham St	430	2.50	
P	1858	Nottingham St	754	2.50	

P	1859	Nottingham St	754	1.43	
P	1859	Nottingham St	178	2.50	
P	1859	Nottingham St	200	2.50	
P	1859	Nottingham St	266	2.50	
P	1859	Nottingham St	297	2.50	
P	1859	Nottingham St	326	2.50	
P	1859	Nottingham St	389	2.50	
P	1859	Nottingham St	420	2.50	
P	1859	Nottingham St	435	2.50	
P	1859	Nottingham St	723	2.50	
P	1859	Nottingham St	971	3.00	
P	1859	Nottingham St	1367	3.00	
P	1860	Nottingham St	679	2.50	
P	1860	Nottingham St	672	3.00	
P	1877	Nottingham St	334	2.98	
P	1877	Nottingham St	442	3.99	
P	1877	Nottingham St	570	4.00	
P	1881	Nottingham St	226	4.00	
P	1881	Nottingham St	295	4.00	
P	1887	Nottingham St	363	4.00	
P	1889	Nottingham St	250	4.00	
P	1889	Nottingham St	438	4.00	
P	1881	Pilgrim St	421	4.00	
P	1881	Pilgrim St	464	4.00	
P	1884	Pilgrim St	246	4.00	
P	1893	Pinfold La	890	2.00	
P	1826	Pitsmoor	4840	0.50	
P	1831	Pitsmoor	1650	0.58	
P	1832	Pitsmoor	1287	0.79	Adjoins plot of 1780 sq yds
P	1832	Pitsmoor	1393	0.79	
P	1832	Pitsmoor	1296	1.00	
P	1832	Pitsmoor	1780	1.00	Adjoins plot of 1287 sq yds
P	1833	Pitsmoor	2320	0.72	
P	1835	Pitsmoor	1326	1.25	
P	1835	Pitsmoor	1773	1.25	
P	1836	Pitsmoor	1952	0.75	
P	1836	Pitsmoor	560	1.00	
P	1837	Pitsmoor	2148	0.78	
P	1838	Pitsmoor	1090	0.75	
P	1842	Pitsmoor	1210	0.79	
P	1842	Pitsmoor	1443	0.79	
P	1844	Pitsmoor	1678	0.75	
P	1845	Pitsmoor	580	1.00	
P	1846	Pitsmoor		0.16	
P	1846	Pitsmoor		0.69	

P	1846	Pitsmoor	8258	0.69	
P	1846	Pitsmoor		0.70	
P	1848	Pitsmoor	641	1.25	
P	1850	Pitsmoor	4931	0.20	
P	1850	Pitsmoor	4540	0.74	Builder
P	1850	Pitsmoor		0.75	
P	1876	Pitsmoor	1197	1.49	87 year lease
P	1876	Pitsmoor	2104	1.50	82 year lease
P	1878	Pitsmoor	772	3.00	
P	1878	Pitsmoor	1057	3.07	
P	1881	Pitsmoor	4272	1.57	
P	1881	Pitsmoor	618	5.44	
P	1836	Pitsmoor Bar	1980	0.75	
P	1837	Pitsmoor Occupation Rd	240	3.00	
P	1833	Pitsmoor Occupation Road	331	1.50	
P	1833	Pitsmoor Occupation Road	483	1.50	
P	1833	Pitsmoor Occupation Road	500	1.50	
P	1834	Pitsmoor Occupation Road	275	1.50	
P	1834	Pitsmoor Occupation Road	280	1.50	
P	1834	Pitsmoor Occupation Road	288	1.50	
P	1834	Pitsmoor Occupation Road	921	1.50	
P	1834	Pitsmoor Occupation Road	1000	1.50	
P	1845	Pitsmoor Rd	566	0.75	
P	1845	Pitsmoor Rd	673	1.50	
P	1887	Pitsmoor Rd	2315	1.87	
P	1887	Pitsmoor Rd	1056	3.00	
P	1898	Pitsmoor Rd	973	2.50	39 years
P	1833	Pitsmoor Toll Bar		0.75	
P	1838	Pitsmoor Toll Bar	456	1.50	
P	1854	Pitsmoor Turnpike Rd	16300	0.50	14 year lease
P	1854	Pitsmoor Turnpike Rd	6170	0.78	
P	1846	Pye Bank		1.25	
P	1890	Pye Bank	2000	1.50	c/o Fox St - 15 years
P	1870	Pye Bank Rd	2185	3	
P	1881	Pye Bank Rd	714	3.00	
P	1859	Richmond St	240	2.50	
P	1893	Rising St	237	3.00	
P	1894	Rising St	197	3.00	
P	1897	Scott Rd	190	3.00	
P	1897	Scott Rd	378	3.00	c/o Pass House La
P	1877	Sedan St	421	3.99	
P	1877	Sedan St	285	4.00	
P	1842	Shirecliffe Hall La	1585	0.79	
P	1842	Shirecliffe Hall La	2318	0.79	
P	1847	Shirecliffe Hall La	2339	0.82	

P	1850	Shirecliffe Hall La	913	92.00	Fork Manufacturer - presumably premises
P	1850	Shirecliffe Hall La	350	1.00	
P	1868	Shirecliffe Hall La	986	2.00	
P	1868	Shirecliffe Hall La	604	2.62	
P	1894	Shirecliffe La	484	4.00	26 years
P	1858	Somerset St	122	2.00	
P	1859	Somerset St	626	2.50	
P	1857	Stockton St	271	2.00	
P	1857	Stockton St	278	2.00	
P	1857	Stockton St	386	2.00	
P	1857	Stockton St	389	2.00	
P	1857	Stockton St	497	2.00	
P	1857	Stockton St	593	2.00	
P	1857	Stockton St		2.00	
P	1858	Stockton St	600	2.00	
P	1858	Stockton St	660	2.00	
P	1859	Verdon St	253	2.00	
P	1859	Verdon St	440	2.00	
P	1859	Verdon St	491	2.00	
P	1859	Verdon St	520	2.00	
P	1859	Verdon St	560	2.00	
P	1859	Verdon St	1246	2.00	
P	1859	Verdon St	1251	2.00	
P	1859	Verdon St	1257	2.00	
P	1859	Verdon St	282	2.50	
P	1859	Verdon St	556	2.50	
P	1859	Verdon St	558	2.50	
P	1859	Verdon St	655	2.50	
P	1860	Verdon St	841	2.50	
P	1861	Verdon St	841	2.50	
P	1861	Verdon St	374	3.01	
P	1871	Verdon St	266	5.28	
P	1888	Worksop St	1976	2.00	
P/B	1877	Bressingham Rd	749	4.49	
P/B	1878	Bressingham Rd	346	3.99	86 years
P/B	1878	Bressingham Rd	302	4.49	
P/B	1878	Bressingham Rd	296	4.50	
P/B	1878	Bressingham Rd	328	4.50	c/o Catherine St
P/B	1891	Bressingham Rd	255	4.00	
P/B	1891	Bressingham Rd	369	4.00	
P/B	1867	Brunswick Road North	570	8.21	
P/B	1864	Buckenham Rd	576	4.00	
P/B	1858	Buckenham St	409	3.00	
P/B	1857	Burngreave Rd	712	2.00	
P/B	1858	Burngreave Rd	400	2.00	

P/B	1859	Burngreave Rd	1497	0.25	10 year lease of land r/o J.Frith's house
P/B	1859	Burngreave Rd	1780	0.25	10 year lease of land r/o M.Hunter's house
P/B	1859	Burngreave Rd	160	2.00	
P/B	1860	Burngreave Rd		1.75	
P/B	1860	Burngreave Rd		2.00	
P/B	1861	Burngreave Rd	1218	2.00	
P/B	1864	Burngreave Rd	687	4.00	
P/B	1876	Burngreave Rd	749	5.00	
P/B	1877	Burngreave Rd	876	2.49	
P/B	1877	Burngreave Rd	3370	2.50	
P/B	1877	Burngreave Rd	645	4.99	
P/B	1877	Burngreave Rd	765	4.99	
P/B	1878	Burngreave Rd	647	4.99	
P/B	1891	Burngreave Rd	574	3.99	
P/B	1891	Burngreave Rd	1202	3.99	
P/B	1891	Burngreave Rd	642	4.00	
P/B	1891	Burngreave Rd	643	4.01	
P/B	1893	Burngreave Rd	2195	1.25	
P/B	1897	Burngreave Rd	519	1.00	
P/B	1898	Burngreave Rd		120.00	Tramway Company - strip for road widening, probably Freehold
P/B	1849	Carr Wood La		1.50	
P/B	1891	Clun Rd	223	3.98	
P/B	1891	Clun Rd	387	4.00	
P/B	1891	Earldom Rd	309	4.00	
P/B	1893	Earldom Rd	273	4.00	
P/B	1893	Earldom Rd	310	4.00	
P/B	1878	Earldom St	455	4.99	
P/B	1880	Earldom St	387	6.00	
P/B	1870	Edgar St	440	5.07	
P/B	1871	Edgar St	296	5.07	
P/B	1877	Edgar St	190	3.98	
P/B	1881	Edgar St	186	4.00	
P/B	1888	Edgar St	185	4.50	
P/B	1890	Edgar St	328	3.99	
P/B	1891	Edgar St	313	3.99	
P/B	1891	Edgar St	312	4.00	
P/B	1891	Edgar St	315	4.00	
P/B	1891	Edgar St	321	4.00	
P/B	1891	Edgar St	314	4.01	
P/B	1891	Edgar St	316	4.03	
P/B	1892	Edgar St	154	4.00	
P/B	1857	Ellesmere Rd	387	3.00	
P/B	1858	Ellesmere Rd	489	3.00	
P/B	1858	Ellesmere Rd	590	3.00	
P/B	1858	Ellesmere Rd	948	3.00	

P/B	1858	Ellesmere Rd	1117	3.00	
P/B	1860	Ellesmere Rd		3.00	
P/B	1860	Ellesmere Rd	228	6.00	
P/B	1864	Ellesmere Rd	385	3.24	
P/B	1864	Ellesmere Rd	1174	6.13	
P/B	1867	Ellesmere Rd	409	7.10	
P/B	1871	Ellesmere Rd	545	5.64	
P/B	1876	Ellesmere Rd	406	3.99	
P/B	1878	Ellesmere Rd	503	4.99	
P/B	1857	Gower St		4.00	
P/B	1858	Gower St	766	3.00	
P/B	1860	Gower St		3.00	
P/B	1861	Gower St	276	3.00	
P/B	1861	Gower St	320	3.00	
P/B	1861	Gower St		3.00	
P/B	1861	Gower St	583	3.99	
P/B	1861	Gower St		4.00	
P/B	1864	Gower St	370	3.99	
P/B	1878	Gower St	646	6.00	
P/B	1893	Harleston Rd	286	4.00	
P/B	1863	Harleston St		3.50	
P/B	1864	Harleston St	1030	3.50	
P/B	1877	Harleston St	1178	3.99	
P/B	1885	Harleston St	576	4.00	
P/B	1890	Harleston St	269	3.48	
P/B	1893	Harleston St	379	4.00	
P/B	1881	Jamaica St	448	4.00	
P/B	1880	Kingston St		4.00	
P/B	1881	Kingston St	342	4.00	
P/B	1881	Kingston St	346	4.00	
P/B	1881	Kingston St	346	4.00	
P/B	1882	Kingston St	192	4.00	
P/B	1884	Kingston St	184	4.00	
P/B	1878	Lyons St	650	3.99	
P/B	1878	Lyons St	741	4.99	
P/B	1881	Lyons St	268	4.97	
P/B	1881	Lyons St	320	4.99	
P/B	1891	Lyons St	454	3.99	
P/B	1891	Lyons St	315	4.99	
P/B	1891	Lyons St	169	5.00	
P/B	1891	Lyons St	173	5.00	
P/B	1892	Lyons St	378	4.00	c/o Edgar St
P/B	1892	Lyons St	419	4.00	
P/B	1892	Lyons St	460	4.00	
P/B	1893	Lyons St	460	5.00	

P/B	1894	Lyons St	178	5.00	
P/B	1894	Lyons St	284	5.00	
P/B	1897	Lyons St	340	4.00	
P/B	1835	Spital Hill	1142	1.50	
P/B	1837	Spital Hill	2.5		
P/B	1839	Spital Hill		4.00	
P/B	1840	Spital Hill	380	3.00	
P/B	1840	Spital Hill	764	3.00	
P/B	1840	Spital Hill		3.00	
P/B	1842	Spital Hill	756	3.00	
P/B	1847	Spital Hill	188	1.00	
P/B	1891	Spital Hill	764	4.50	
P/B	1861	Spital La	566	3.00	
P/B	1877	Spital La	478	3.99	
P/B	1860	Sutherland Rd	150	3.00	
P/B	1860	Sutherland Rd	1287	3.00	
P/B	1861	Sutherland Rd	14308	0.17	Upper High Field - G.Noble's holding - not new lease
P/B	1876	Sutherland Rd	604	3.99	
P/B	1876	Sutherland Rd	310	4.99	
P/B	1880	Sutherland Rd	270	6.00	
P/B	1880	Sutherland Rd		6.00	
P/B	1884	Sutherland Rd	4739	2.00	Shipman & Son - Attercliffe Steel & Wire Works
P/B	1884	Sutherland Rd	270	5.50	
P/B	1888	Sutherland Rd	550	5.00	
P/B	1847	Sutherland St	942	2.50	
P/B	1884	Thorndon Rd	356	4.00	
P/B	1885	Thorndon Rd		4.00	
P/B	1893	Thorndon Rd	375	3.00	
P/B	1893	Thorndon Rd	381	3.00	
P/B	1894	Thorndon Rd	376	3.00	
P/B	1894	Thorndon Rd	379	3.00	
P/B	1894	Thorndon Rd	381	3.00	
P/B	1894	Thorndon Rd	382	3.00	
P/B	1894	Thorndon Rd	384	3.00	
P/B	1894	Thorndon Rd		3.00	
P/B	1898	Thorndon Rd	616	3.00	
P/B	1831	Tom Cross La	380	1.00	
P/B	1831	Tom Cross La		1.25	
P/B	1836	Tom Cross La	186	1.25	
P/B	1837	Tom Cross La	388	1.50	
P/B	1839	Tom Cross La	4245	0.79	
P/B	1839	Tom Cross La	622	1.50	
P/B	1839	Tom Cross La	1917	1.50	
P/B	1839	Tom Cross La	891	2.00	
P/B	1845	Tom Cross La	707	1.50	

P/B	1845	Tom Cross La		1.50	
P/B	1846	Tom Cross La		2.00	
P/B	1850	Tom Cross La	306	2.00	
P/B	1850	Tom Cross La	322	2.00	
P/B	1850	Tom Cross La		2.00	
P/B	1850	Tom Cross La	360	2.50	
P/B	1859	Tom Cross La	1208	1.00	
P/B	1859	Tom Cross La	400	3.00	
P/B	1860	Tom Cross La	1335	1.00	
P/B	1860	Tom Cross La	1384	1.00	
P/B	1860	Tom Cross La	1385	1.00	
P/B	1860	Tom Cross La		1.00	
P/B	1860	Tom Cross La	183	3.00	
P/B	1861	Tom Cross La	1335	1.00	
P/B	1861	Tom Cross La	1384	1.00	
P/B	1861	Tom Cross La	1385	1.00	
P/B	1861	Tom Cross La	233	2.99	
P/B	1861	Tom Cross La		3.00	
P/B	1861	Tom Cross La	183	3.02	
P/WDSD	1853	Woodside	12100	0.27	Field
PK	1886	Bard St	840	4.86	21 years
PK	1889	Bard St	260	13.00	19.5 years
PK	1889	Bard St	283	19.00	
PK	1891	Bard St	258	3.72	32 years
PK	1825	Bernard St		1.00	
PK	1826	Bernard St		1.00	
PK	1827	Bernard St		1.00	
PK	1827	Bernard St		1.00	
PK	1829	Bernard St		1.00	
PK	1829	Bernard St		1.00	
PK	1831	Bernard St	495	1.00	
PK	1832	Bernard St	308	1.00	
PK	1832	Bernard St	400	1.00	
PK	1834	Bernard St	147	1.50	
PK	1835	Bernard St	290	1.25	
PK	1836	Bernard St	705	1.25	
PK	1836	Bernard St	232	1.50	
PK	1836	Bernard St	283	1.50	
PK	1836	Bernard St	833	1.50	
PK	1836	Bernard St		1.50	
PK	1837	Bernard St	391	1.50	
PK	1837	Bernard St	405	1.50	
PK	1837	Bernard St	272	2.00	
PK	1837	Bernard St		2.00	
PK	1841	Bernard St	471	1.00	

PK	1841	Bernard St	336	1.50	
PK	1847	Bernard St	617	1.25	
PK	1849	Bernard St	197	2.00	
PK	1889	Bernard St	512	2.00	Back - c/o StaniforthLa
PK	1889	Bernard St	435	2.75	c/o School La
PK	1890	Bernard St	396	0.60	
PK	1891	Bernard St	312	1.50	20 years
PK	1893	Bernard St	312	1.50	
PK	1848	Blagdon St	300	1.00	
PK	1885	Blagdon St		3.00	
PK	1825	Broad St		2.00	
PK	1826	Broad St	696	1.50	
PK	1831	Broad St	373	1.00	
PK	1831	Broad St		1.00	
PK	1853	Broad St	1034	4.00	Next to MSLR
PK	1881	Broad St	641	11.25	Sandersons
PK	1886	Broad St	490	4.90	21 years
PK	1887	Broad St	1595	16.00	
PK	1889	Broad St	1350	7.00	
PK	1890	Broad St	1302	26.73	c/o Wharf St
PK	1891	Broad St	890	27.00	11 years - c/o Sheaf St
PK	1835	Broad Street La	400	1.50	
PK	1838	Bungay St	567	2.00	c\o South St
PK	1839	Bungay St	395	3.00	
PK	1846	Bungay St	354	1.50	
PK	1860	Bungay St	426	1.69	
PK	1860	Bungay St	650	3.00	
PK	1862	Bungay St	426	1.69	
PK	1899	City Rd	464	4.99	
PK	1899	City Rd	252	5.00	
PK	1899	City Rd	252	5.00	200 years
PK	1899	City Rd	464	5.00	200 years
PK	1899	City Rd	465	5.00	200 years
PK	1899	City Rd	465	5.01	
PK	1828	Colliers Row	399	1.00	
PK	1829	Colliers Row		1.00	
PK	1832	Colliers Row	376	1.00	
PK	1836	Colliers Row	292	1.50	
PK	1843	Colliers Row	480	0.50	
PK	1847	Colliers Row		2.00	
PK	1861	Cricket Inn Rd	690	2.49	
PK	1829	Cricket Ground Gdns		1.00	
PK	1833	Cricket Ground Gdns		1.00	
PK	1839	Cricket Ground Gdns	1080	1.50	
PK	1840	Cricket Ground Gdns	450	1.25	

PK	1831	Cricket Inn Rd		1.00	
PK	1832	Cricket Inn Rd	681	1.00	
PK	1834	Cricket Inn Rd	80	1.50	
PK	1839	Cricket Inn Rd	582	1.00	
PK	1845	Cricket Inn Rd		1.00	
PK	1845	Cricket Inn Rd	294	1.50	
PK	1848	Cricket Inn Rd	892	1.50	
PK	1858	Cricket Inn Rd	306	3.00	
PK	1860	Cricket Inn Rd	690	2.50	
PK	1860	Cricket Inn Rd		3.00	
PK	1891	Cricket Inn Rd	640	3.00	
PK	1893	Cricket Inn Rd	446	3.00	
PK	1893	Cricket Inn Rd	510	4.00	
PK	1878	Derwent St	440	4.99	
PK	1878	Derwent St	1112	5.00	
PK	1826	Duke St		1.00	
PK	1826	Duke St		1.00	
PK	1828	Duke St		1.50	
PK	1828	Duke St		1.50	
PK	1828	Duke St		1.50	
PK	1828	Duke St		1.50	
PK	1831	Duke St	387	1.50	
PK	1831	Duke St	409	1.50	Adjoining Thomas Firth's leasehold
PK	1831	Duke St	557	1.50	
PK	1833	Duke St	192	1.50	
PK	1833	Duke St		1.50	
PK	1834	Duke St	161	1.50	
PK	1835	Duke St	1086	1.50	
PK	1837	Duke St	597	2.00	
PK	1839	Duke St	673	1.50	
PK	1845	Duke St		1.50	
PK	1848	Duke St	139	0.86	Yearly tenancy - rent of 3d for 99 yr lease offered
PK	1850	Duke St	1091	0.99	c/o Talbot St - for erection of a chapel & school only
PK	1850	Duke St	1091	1.30	c/o Talbot St - for erection of a chapel & school only
PK	1850	Duke St	194	2.00	
PK	1860	Duke St	1097	3.00	
PK	1882	Duke St	1475	8.00	38 years c/o School La - either pub or grocers
PK	1885	Duke St	586	8.19	20 years
PK	1885	Duke St	560	18.00	Furniture Broker & Bedding Manufacturer
PK	1886	Duke St	330	18.18	
PK	1887	Duke St	483	8.00	Sanderson Bros
PK	1887	Duke St	543	13.25	21 years
PK	1889	Duke St	228	5.79	
PK	1889	Duke St	439	16.00	
PK	1889	Duke St	582	16.00	

PK	1890	Duke St	560	8.50	
PK	1893	Duke St	254	24.00	61 years
PK	1891	Duke Street La	480	0.50	8 years
PK	1891	East St	336	4.00	2 years - c/o Bard St
PK	1858	Fitzwalter Rd	1280	1.50	
PK	1860	Fitzwalter Rd	166	1.50	
PK	1871	Fitzwalter Rd	660	2.84	
PK	1881	Fitzwalter Rd	753	2.50	c/o Stafford Rd
PK	1845	Gilbert St	186	2.00	
PK	1864	Grafton St	587	3.00	
PK	1867	Grafton St	608	3.34	
PK	1891	Granville Hill	150	36.00	
PK	1855	Granville St	202	2.50	
PK	1834	Hague La	390	1.50	
PK	1838	Hague La	636	1.25	
PK	1853	Hague La	500	1.63	Not new lease
PK	1864	Hampton St	398	1.99	
PK	1892	Hampton St	766	3.99	
PK	1835	Henry St	746	1.50	
PK	1838	Henry St	528	2.00	
PK	1889	High La	402	3.00	
PK	1833	High St	275	2.00	
PK	1836	High St	236	1.50	
PK	1839	High St	250	1.50	
PK	1845	High St	496	1.50	
PK	1857	High St	624	4.00	
PK	1889	High Street La	127	18.50	
PK	1830	Lord St		1.25	
PK	1830	Lord St	726	1.50	
PK	1830	Lord St		1.50	
PK	1831	Lord St	294	1.50	
PK	1831	Lord St	608	1.50	
PK	1832	Lord St	359	1.50	
PK	1832	Lord St		1.50	
PK	1834	Lord St	151	1.50	
PK	1834	Lord St	633	1.50	
PK	1836	Lord St	286	1.75	
PK	1836	Lord St	374	1.75	
PK	1837	Lord St	496	1.75	
PK	1837	Lord St	277	2.50	
PK	1838	Lord St	264	2.00	
PK	1838	Lord St	1218	2.00	
PK	1840	Lord St	622	1.75	
PK	1840	Lord St	910	1.75	
PK	1840	Lord St		2.00	

PK	1840	Lord St	244	2.50	
PK	1840	Lord St	336	2.50	
PK	1843	Lord St	217	2.00	
PK	1845	Lord St	350	1.75	
PK	1845	Lord St	361	1.75	
PK	1846	Lord St	230	2.00	
PK	1847	Lord St	215	1.75	
PK	1847	Lord St	330	1.75	
PK	1847	Lord St	517	1.97	
PK	1850	Lord St		3.00	
PK	1858	Lord St	272	3.00	
PK	1889	Lord St	257	6.00	
PK	1889	Low St	109	3.50	
PK	1877	Maltravers Rd	326	4.99	
PK	1878	Maltravers Rd	321	4.97	
PK	1892	Maltravers Rd	425	4.00	
PK	1892	Maltravers Rd	428	4.00	
PK	1892	Maltravers Rd	429	4.00	
PK	1834	Maltravers St	489	3.00	c/o Effingham St
PK	1837	Maltravers St	377	3.00	
PK	1831	Near Machon's Quarry	804	1.50	
PK	1830	Near New Shrewsbury Hospital		1.25	
PK	1830	Near Park Grange		0.50	
PK	1839	Near St John's Church	496	1.50	
PK	1839	Near St John's Church	572	1.50	
PK	1826	New St		1.00	
PK	1829	New St		1.25	
PK	1885	New St	437	5.99	
PK	1841	Norfolk Rd	1820	0.79	
PK	1841	Norfolk Rd	1821	0.79	
PK	1848	Norfolk Rd	2870	1.00	
PK	1850	Norfolk Rd	2810	1.00	
PK	1855	Norfolk Rd	1397	1.00	
PK	1857	Norfolk Rd	1395	1.00	
PK	1858	Norfolk Rd	1393	1.50	
PK	1859	Norfolk Rd	1085	1.50	
PK	1859	Norfolk Rd	1426	1.50	
PK	1868	Norfolk Rd	1701	3.00	
PK	1881	Norfolk Rd	1170	2.49	
PK	1888	Norfolk Rd	6684	1.25	Veterinarian
PK	1894	Norfolk Rd	935	3.00	
PK	1860	Norfolk Rd North	602	3.00	In Old Park Wood
PK	1861	Norfolk Road North	602	2.99	
PK	1889	Old St	975	4.00	
PK	1897	Old St	331	6.00	17 years

PK	1825	Park		0.75	For a garden
PK	1825	Park		1.00	
PK	1825	Park		1.00	
PK	1825	Park		1.00	
PK	1825	Park		1.50	
PK	1825	Park		1.50	
PK	1826	Park		1.00	
PK	1833	Park	4840	0.62	Land for a gentleman's house
PK	1833	Park		1.00	Conversion of yearly tenancy on sundry cottages into a lease
PK	1850	Park	2404	0.50	To a farmer for building
PK	1876	Park	12000	120.00	MR - freehold
PK	1887	Park	13600	1.00	39 years
PK	1825	Park Grange	10890	0.15	69 years
PK	1886	Park Grange	10800	1.11	49 years
PK	1832	Park Hill La	530	1.00	
PK	1840	Park Hill La	268	1.25	
PK	1841	Park Hill La	1204	0.75	
PK	1843	Park Hill La	501	1.25	
PK	1851	Park Hill La	287	0.84	c/o Bigood st - not new leases
PK	1851	Park Hill La	426	1.32	c/o Bigood st - not new leases - plans show buildings in situ
PK	1851	Park Hill La	654	1.62	c/o Bigood st - not new leases
PK	1859	Park Hill La	597	1.25	
PK	1877	Park Hill La	539	2.98	
PK	1838	Park Rd	552	1.00	
PK	1847	Park Spring	1524	0.50	
PK	1855	Park Spring	6920	0.52	House and land
PK	1838	Rhodes St	530	1.50	
PK	1839	Rhodes St	528	1.50	
PK	1841	Rhodes St	126	1.75	
PK	1868	Rhodes St	147	1.80	72 years
PK	1888	Rough Bank	1041	2.00	
PK	1888	Rough Bank	1060	2.00	
PK	1865	School La	754	3.66	60 year lease of existing buildings
PK	1832	School St	481	1.50	
PK	1832	Shrewsbury Rd	582	1.00	
PK	1832	Shrewsbury Rd	1125	1.00	
PK	1832	Shrewsbury Rd	1342	1.00	
PK	1833	Shrewsbury Rd	600	1.80	
PK	1834	Shrewsbury Rd	80	1.50	
PK	1834	Shrewsbury Rd	535	1.50	
PK	1836	Shrewsbury Rd		2.00	
PK	1841	Shrewsbury Rd	2408	1.50	
PK	1843	Shrewsbury Rd	234	2.00	
PK	1832	Snow Hill La	359	1.50	
PK	1825	South St		1.00	

PK	1826	South St		1.00	
PK	1826	South St		1.25	
PK	1826	South St		1.25	
PK	1826	South St		1.25	
PK	1826	South St		1.25	
PK	1827	South St		1.25	
PK	1827	South St		1.50	
PK	1827	South St	197	3.00	Adjoins existing plot
PK	1828	South St		1.25	
PK	1828	South St		1.25	
PK	1828	South St		1.50	
PK	1828	South St		1.50	
PK	1828	South St		1.50	
PK	1828	South St		1.50	
PK	1828	South St		2.00	
PK	1828	South St		2.00	
PK	1828	South St		2.00	
PK	1829	South St		1.50	
PK	1829	South St		1.50	
PK	1829	South St		1.50	
PK	1829	South St		1.50	
PK	1829	South St		1.50	
PK	1829	South St		2.00	
PK	1829	South St		2.00	Chapel and school
PK	1830	South St		1.00	
PK	1830	South St		1.25	
PK	1830	South St		1.50	
PK	1830	South St	140	2.00	
PK	1830	South St	170	2.00	
PK	1830	South St	345	2.00	
PK	1830	South St		2.00	
PK	1830	South St		2.00	
PK	1830	South St		2.00	
PK	1831	South St		1.25	
PK	1832	South St	251	1.25	
PK	1832	South St	588	1.50	
PK	1832	South St		1.50	
PK	1833	South St	726	1.25	
PK	1833	South St	588	1.84	
PK	1835	South St	261	1.50	
PK	1835	South St	401	1.50	
PK	1835	South St	647	1.50	
PK	1835	South St	830	1.50	
PK	1835	South St	920	1.50	
PK	1836	South St	520	1.50	

PK	1836	South St	695	1.50	
PK	1836	South St	733	1.50	
PK	1836	South St	1057	1.50	
PK	1836	South St	500	1.75	
PK	1836	South St	600	3.00	
PK	1838	South St	610	2.00	
PK	1838	South St	918	2.00	
PK	1838	South St		2.00	
PK	1839	South St	610	2.00	
PK	1841	South St	296	2.00	
PK	1860	South St	1296	2.00	
PK	1890	South St	1275	0.38	
PK	1890	South St	310	1.47	
PK	1890	South St	1500	11.20	
PK	1827	South St		2.00	
PK	1836	South St	722	1.50	
PK	1842	St John's Rd	1062	1.50	
PK	1857	St John's Rd	683	2.00	
PK	1858	St John's Rd	299	2.00	
PK	1859	St John's Rd	218	2.00	
PK	1859	St John's Rd		2.00	
PK	1860	St John's Rd	220	2.00	
PK	1881	St John's Rd	1170	2.00	
PK	1860	Stafford Rd	988	1.50	
PK	1880	Stafford Rd		2.50	c/o Intake Rd
PK	1880	Stafford Rd	362	2.50	
PK	1880	Stafford Rd	485	2.50	
PK	1881	Stafford Rd	363	2.50	
PK	1881	Stafford Rd	1238	2.50	
PK	1884	Stafford Rd	592	2.50	
PK	1884	Stafford Rd	615	2.50	
PK	1885	Stafford Rd	535	2.24	
PK	1885	Stafford Rd	447	2.50	
PK	1899	Stafford Rd	717	3.13	200 years
PK	1899	Stafford Rd	845	3.13	200 years
PK	1837	Stafford St	780	2.00	
PK	1855	Stafford St	370	2.01	
PK	1857	Stafford St		2.00	
PK	1858	Stafford St	651	2.00	
PK	1858	Stafford St	206	2.50	
PK	1858	Stafford St	600	2.50	
PK	1859	Stafford St	1894	1.00	
PK	1884	Stafford St	623	2.50	
PK	1886	Stafford St	562	2.50	
PK	1893	Stafford St	1535	6.00	

PK	1894	Stafford St	907	2.50	
PK	1894	Stafford St	915	2.50	
PK	1894	Stafford St	924	2.50	
PK	1894	Stafford St	944	2.50	
PK	1829	Staniforth Croft		1.00	
PK	1859	Staniforth La	902	2.00	
PK	1888	Staniforth La	354	3.00	
PK	1888	Stepney St	535	2.25	
PK	1888	Stepney St	663	7.50	
PK	1890	Stepney St	444	8.50	19 years
PK	1891	Stepney St	1018	7.00	3.5 years
PK	1897	Stepney St	238	6.00	
PK	1835	Suffolk Rd	2000	1.50	John Brown, Merchant - mortgaged
PK	1836	Suffolk Rd		1.50	
PK	1836	Suffolk Rd	1463	1.50	
PK	1837	Suffolk Rd	3460	1.50	Nicholson's Cutlery Works extension
PK	1837	Suffolk Rd	380	2.00	
PK	1837	Suffolk Rd	966	2.00	Adjoining Nicholson's Cutlery Works
PK	1838	Suffolk Rd	366	2.00	
PK	1838	Suffolk Rd	380	2.00	
PK	1838	Suffolk Rd	401	2.00	
PK	1838	Suffolk Rd	543	2.00	
PK	1838	Suffolk Rd	544	2.00	
PK	1838	Suffolk Rd	668	2.00	
PK	1838	Suffolk Rd	1020	2.00	
PK	1838	Suffolk Rd		2.00	
PK	1839	Suffolk Rd	3362	1.50	By Farm Bridge
PK	1839	Suffolk Rd	397	2.00	
PK	1839	Suffolk Rd	313	2.50	c/o Pond Mill La (Four shops with room over)
PK	1839	Suffolk Rd	450	2.50	
PK	1839	Suffolk Rd		3.00	
PK	1840	Suffolk Rd	396	2.00	
PK	1846	Suffolk Rd	717	2.50	
PK	1850	Suffolk Rd	717	2.50	
PK	1859	Suffolk Rd	408	2.00	
PK	1858	Talbot Close	474	2.50	
PK	1859	Talbot Gdns	820	1.75	
PK	1859	Talbot Gdns		1.75	
PK	1861	Talbot Gdns	508	2.00	
PK	1857	Talbot Pl	502	2.50	
PK	1858	Talbot Pl	577	2.00	
PK	1858	Talbot Place	500	2.00	
PK	1858	Talbot Place		2.50	
PK	1850	Talbot Rd	428	2.50	
PK	1857	Talbot Rd	286	2.50	

PK	1858	Talbot Rd	227	3.00	
PK	1837	Talbot St	476	2.00	
PK	1838	Talbot St	540	1.50	
PK	1838	Talbot St	438	1.75	
PK	1838	Talbot St	554	2.00	
PK	1838	Talbot St	750	2.00	
PK	1838	Talbot St	1034	2.00	
PK	1838	Talbot St		2.00	
PK	1839	Talbot St	469	2.00	
PK	1840	Talbot St		2.00	
PK	1840	Talbot St		2.00	
PK	1850	Talbot St	1091	1.30	Chapel Trust
PK	1850	Talbot St	1357	1.30	Chapel Trust
PK	1857	Talbot St	249	3.00	
PK	1858	Talbot St	192	2.50	
PK	1860	Talbot St	80	3.00	
PK	1835	Weigh La	346	1.00	
PK	1836	Weigh La	433	1.25	
PK	1841	Weigh La	1055	1.25	
PK	1859	Weigh La	353	1.50	
PK	1888	Weigh La	375	3.00	
PK	1891	Weigh La	307	15.50	88 years - c/o Duke St
PK/A	1868	Aston St	568	6.97	
PK/A	1891	Aston St	350	3.98	
PK/A	1891	Aston St	350	3.98	
PK/A	1891	Aston St	529	3.99	
PK/A	1891	Aston St	354	4.00	
PK/A	1898	Aston St	367	5.00	
PK/A	1898	Aston St	369	5.00	
PK/A	1898	Aston St	370	5.00	
PK/A	1898	Aston St	372	5.00	
PK/A	1899	Aston St	371	4.98	
PK/A	1899	Aston St	371	5.00	
PK/A	1899	Aston St	372	5.00	
PK/A	1899	Aston St	372	5.00	
PK/A	1899	Aston St	374	5.00	
PK/A	1899	Aston St	375	5.00	
PK/A	1899	Aston St	374	5.01	
PK/A	1899	Aston St	375	5.02	
PK/A	1862	Conway St	518	2.99	
PK/A	1829	Near Park Foundry	500	1.92	
PK/A	1830	Near Park Foundry	318	2.37	
PK/A	1828	Near Park Works	400	1.89	
PK/A	1829	Near Park Works		1.50	
PK/A	1830	Near Park Works		1.00	

PK/A	1825	Road from canal to the Manor		1.00	
PK/PND	1835	Granville St	491	1.75	
PK/PND	1835	Granville St		2.00	
PK/PND	1836	Granville St	582	1.00	
PK/PND	1836	Granville St	474	1.50	
PK/PND	1836	Granville St	338	2.00	
PK/PND	1836	Granville St	400	2.00	
PK/PND	1836	Granville St	810	2.00	
PK/PND	1836	Granville St	810	2.00	
PK/PND	1836	Granville St		2.50	
PK/PND	1837	Granville St	273	2.50	
PK/PND	1837	Granville St	431	2.50	
PK/PND	1837	Granville St	706	2.50	
PK/PND	1837	Granville St	876	2.50	
PK/PND	1837	Granville St		2.50	
PK/PND	1837	Granville St		2.50	
PK/PND	1837	Granville St	328	3.50	
PK/PND	1837	Granville St	348	3.50	
PK/PND	1838	Granville St	392	2.00	
PK/PND	1838	Granville St	258	2.50	
PK/PND	1838	Granville St	767	2.50	
PK/PND	1838	Granville St	271	3.00	
PK/PND	1838	Granville St	332	3.00	
PK/PND	1838	Granville St	496	3.00	
PK/PND	1839	Granville St	404	2.50	
PK/PND	1839	Granville St	964	2.50	
PK/PND	1843	Granville St	265	2.00	
PK/PND	1846	Granville St	259	2.50	
PK/PND	1846	Granville St	152	3.00	
PK/PND	1857	Granville St	202	2.50	Beside River Sheaf
PK/PND	1857	Granville St	280	2.50	By River Sheaf
PK/PND	1857	Granville St	294	2.50	Beside River Sheaf
PK/PND	1857	Granville St	360	2.50	By River Sheaf
PK/PND	1857	Granville St	422	2.50	By River Sheaf
PK/PND	1857	Granville St	683	2.50	By River Sheaf
PK/PND	1857	Granville St	763	2.50	c/o Bungay St
PK/PND	1857	Granville St	1073	2.50	c/o Bungay St
PK/PND	1857	Granville St		3.00	
PK/PND	1857	Granville St	320	4.00	c/o Gilbert St
PK/PND	1857	Granville St	755	4.00	c/o Gilbert St
PK/PND	1858	Granville St	167	2.50	
PK/PND	1859	Granville St	330	2.50	Near River Sheaf
PK/PND	1859	Granville St	441	4.00	Near Gilbert St
PK/PND	1861	Granville St	412	3.00	Next to River Sheaf
PK/PND	1862	Granville St	287	2.51	

PK/PND	1891	Granville St	786	2.49	
PK/PND	1898	Granville St	698	14.00	c/o Granville Hill
PK/PND	1840	Granville St	368	2.00	
PND	1881	Granville Rd	655	2.50	c/o Intake Rd
PND	1887	Granville Rd	782	2.49	
PND	1897	Granville Rd	388	2.50	
PND	1897	Granville Rd	392	2.50	
PND	1897	Granville Rd	414	2.50	
PND	1897	Granville Rd	494	2.50	
PND	1898	Granville Rd	267	2.50	
PND	1898	Granville Rd	416	2.50	
PND	1898	Granville Rd	1120	2.50	
PND	1899	Granville Rd	289	3.75	
PND	1899	Granville Rd	532	3.75	
PND	1899	Granville Rd	650	3.75	
PND	1831	Pond La		1.50	
PND	1834	Pond La	239	1.50	
PND	1831	Pond Mill La	617	1.50	
PND	1832	Pond Mill La	679	1.50	
PND	1834	Pond Mill La		1.50	
PND	1835	Pond Mill La	376	1.50	
PND	1836	Pond Mill La	279	1.50	
PND	1836	Pond Mill La	285	1.50	
PND	1836	Pond Mill La	837	1.50	
PND	1836	Pond Mill La		1.50	
PND	1837	Pond Mill La	632	0.13	
PND	1837	Pond Mill La	150	1.50	
PND	1837	Pond Mill La	180	1.50	
PND	1837	Pond Mill La	418	1.50	
PND	1837	Pond Mill La		1.50	
PND	1838	Pond Mill La	275	1.50	
PND	1838	Pond Mill La	742	1.50	
PND	1841	Pond Mill La	466	1.75	
PND	1841	Pond Mill La		1.75	
PS/N	1889	Boylands Pl	409	3.00	
PS/N	1858	Boylands St		4.00	
PS/N	1865	Boylands St	5473	192.00	Compulsory purchase freehold by MSLR for widening lines
PS/N	1865	Boylands St	1420	240.00	Compulsory purchase freehold by MSLR for widening lines
PS/N	1865	Boylands St	3130	375.00	Compulsory purchase freehold by MSLR for widening lines
PS/N	1865	Boylands St	5960	375.00	Compulsory purchase freehold by MSLR for widening lines
PS/N	1865	Boylands St	4920	468.00	Compulsory purchase freehold by MSLR for widening lines
PS/N	1865	Boylands St	2970	750.00	Compulsory purchase freehold by MSLR for widening lines
PS/N	1889	Boylands St	272	3.00	
PS/N	1891	Hicks St	512	4.99	
SHFDTN	1840	Bigod St	279	1.75	Precise location not found

SHFDTN	1867	Bigod St	310	4.41	Precise location not found
SHFDTN	1870	Bigod St	276	2.83	Precise location not found

Sites Outside Sheffield

Abbreviations:
CHAP = Chapeltown
DARN = Darnall
ECCL = Ecclesfield
GLEA = Gleadless
GREN = Grenoside
HAND = Handsworth
MALBR = Malin Bridge
MIDLWD = Middlewood
OUGH = Oughtibridge
OWL =Owlerton
RING = Ringinglow
RIVVAL = Rivelin Valley
SHRGRN = Shire Green
STOCK = Stocksbridge
TREE = Treeton
WADSB = Wadsley/Wadsley Br.
WHIS = Whiston

BRAD	1893	Bradfield Highway	1394	0.50	
BRAD	1842	Hollow Meadows	2420	0.10	
BRAD	1868	Hollow Meadows	3630	0.10	77 years - Bradfield
BRAD	1889	Hollow Meadows	933	7.50	84.5 years
BRAD	1890	Hollow Meadows	8863	0.25	Bradfield
CHAP	1848	Chapeltown	2415	0.50	
CHAP	1848	Chapeltown	1470	0.75	
CHAP	1850	Chapeltown	3650	0.50	
CHAP	1850	Chapeltown	3650	0.50	
CHAP	1850	Chapeltown	1210	0.75	
CHAP	1857	Chapeltown	1170	0.50	
CHAP	1857	Chapeltown	862	0.75	
CHAP	1858	Chapeltown	398	1.00	
CHAP	1859	Chapeltown		0.50	
CHAP	1860	Chapeltown	860	0.50	
CHAP	1860	Chapeltown	400	1.00	
CHAP	1861	Chapeltown	860	0.50	
CHAP	1878	Chapeltown	609	0.99	
CHAP	1881	Chapeltown	594	1.00	
CHAP	1894	Chapeltown	465	1.50	

CHAP	1894	Chapeltown	677	1.50	
CHAP	1894	Chapeltown	756	1.50	
CHAP	1894	Chapeltown	842	1.50	
CHAP	1898	Chapeltown	936	1.00	
CHAP	1881	Chapeltown Station	601	1.00	
CHAP	1881	Near Chapeltown	594	1.00	
CHAP	1859	Sussex Rd, Chapeltown	819	0.50	Next to Newton Chambers and Co.
DARN	1881	Near Darnall Railway Tunnel	2727	1.50	
ECCL	1845	Busk Houses	1090	0.50	
ECCL	1845	Busk Houses	1090	0.50	
ECCL	1846	Busk Houses	400	0.50	
ECCL	1846	Busk Houses	400	0.50	
ECCL	1847	Busk Houses	543	0.50	
ECCL	1847	Busk Houses		0.50	
ECCL	1848	Busk Houses	938	0.50	
ECCL	1849	Busk Houses	1753	0.43	
ECCL	1849	Busk Houses	832	0.50	
ECCL	1850	Busk Houses	858	0.45	
ECCL	1857	Busk Houses	1252	1.00	
ECCL	1858	Busk Houses	640	0.50	
ECCL	1859	Busk Houses	480	0.50	
ECCL	1859	Busk Houses	796	0.50	
ECCL	1859	Busk Houses	1000	0.50	
ECCL	1861	Busk Houses	480	0.50	Ecclesfield
ECCL	1861	Busk Houses	1000	0.50	Ecclesfield
ECCL	1864	Busk Houses	1040	0.75	
ECCL	1877	Busk Houses	1618	0.99	
ECCL	1878	Busk Houses	818	0.99	
ECCL	1878	Busk Houses	850	0.99	
ECCL	1878	Busk Houses	1063	0.99	
ECCL	1878	Busk Houses	527	1.00	
ECCL	1881	Busk Houses	276	1.00	
ECCL	1881	Busk Houses	1023	1.00	
ECCL	1893	Busk Houses	618	1.00	
ECCL	1893	Busk Houses	1265	1.25	
ECCL	1892	Church La	1370	1.25	
ECCL	1894	Church La	644	1.25	
ECCL	1827	Ecclesfield	300	0.80	
ECCL	1827	Ecclesfield	300	0.80	
ECCL	1830	Ecclesfield	380	0.69	
ECCL	1837	Ecclesfield		0.75	
ECCL	1845	Ecclesfield	880	0.50	
ECCL	1850	Ecclesfield		1.00	
ECCL	1857	Ecclesfield	1131	0.50	
ECCL	1857	Ecclesfield	1256	0.50	

ECCL	1857	Ecclesfield	1266	0.50	
ECCL	1857	Ecclesfield	1483	0.69	
ECCL	1857	Ecclesfield	915	0.75	
ECCL	1858	Ecclesfield	1246	0.71	
ECCL	1859	Ecclesfield	597	0.50	
ECCL	1859	Ecclesfield	602	0.50	
ECCL	1859	Ecclesfield	846	0.50	
ECCL	1859	Ecclesfield	1496	0.50	
ECCL	1859	Ecclesfield	3060	0.75	
ECCL	1860	Ecclesfield	3148	0.50	
ECCL	1860	Ecclesfield	535	1.00	
ECCL	1859	Ecclesfield		0.50	
ECCL	1853	Ecclesfield Common	115888	0.08	
ECCL	1849	Hesley Bar	1500	0.50	
ECCL	1888	Hesley Bar	1200	1.25	
ECCL	1841	Hesley La		0.50	
ECCL	1842	Hesley La	1194	0.50	
ECCL	1842	Hesley La	1400	0.50	
ECCL	1843	Hesley La	1184	0.50	
ECCL	1844	Hesley La	967	0.50	
ECCL	1845	Hesley La	1474	0.50	
ECCL	1846	Hesley La		0.50	
ECCL	1847	Hesley La		0.50	
ECCL	1850	Hesley La	1356	0.50	
ECCL	1858	Hesley La	575	0.50	
ECCL	1858	Hesley La	1200	0.50	
ECCL	1858	Hesley La	1326	0.50	
ECCL	1858	Hesley La	2050	0.50	
ECCL	1859	Hesley La	797	0.50	
ECCL	1861	Hesley La	846	0.50	
ECCL	1881	Hesley La	816	1.00	
ECCL	1881	Hesley La	816	1.00	
ECCL	1850	High Green		0.75	
ECCL	1858	High Green	1205	0.50	
ECCL	1860	High Green	605	0.50	
ECCL	1860	High Green	645	0.50	
ECCL	1861	High Green	605	0.50	
ECCL	1861	High Green	645	0.50	
ECCL	1861	High Green	663	0.50	
ECCL	1878	High Green	268	0.99	
ECCL	1887	High Green	738	1.00	
ECCL	1887	High Green	842	1.00	
ECCL	1892	High Green	980	0.99	
ECCL	1892	High Green	336	1.00	
ECCL	1892	High Green	322	1.01	

ECCL	1893	High Green	658	1.00	
ECCL	1893	High Green	1025	1.00	
ECCL	1893	High Green	700	1.50	
ECCL	1894	High Green	718	1.00	
ECCL	1898	High Green	665	0.50	
ECCL	1898	High Green	900	0.50	62 years
ECCL	1898	High Green	240	1.00	
ECCL	1859	High Green	668	0.50	
ECCL	1877	High Green House	290	0.99	
ECCL	1898	Land near Ecclesfield Station	12100	9.92	T.Chambers, Architect & Surveyor - offer of land, probably Freehold
ECCL	1843	Parkin Wood	423	0.50	
ECCL	1843	Parkin Wood		0.50	
ECCL	1843	Parkin Wood		0.50	
ECCL	1843	Parkin Wood		0.50	
ECCL	1843	Parkin Wood		0.50	
ECCL	1877	White La	883	0.99	
ECCL	1894	White La	1307	1.00	
GLEAD	1893	White Lane Head	452	1.00	
GREAS	1845	Far Potter Hill	1219	0.50	
GREAS	1870	Potter Hill	1500	0.75	Greaseborough - already built on
GREN	1888	Greno Wood La	970	1.00	
GREN	1850	Grenoside	1210	0.50	
GREN	1860	Grenoside		0.50	
GREN	1878	Grenoside	986	1.00	
GREN	1891	Grenoside	1920	2.50	
GREN	1850	Grenowood Gate	585	1.00	
GREN	1848	Woodseats/Greno Wood	664	0.50	
HAND	1897	Bernard Rd	266	1.50	Handsworth
HAND	1897	Bernard Rd	280	1.50	
HAND	1894	Catcliffe Rd	478	1.00	
HAND	1878	Finch Well La	1519	1.00	
HAND	1892	Finch Well La	1050	1.00	Handsworth
HAND	1893	Finch Well La	440	0.50	Handsworth
HAND	1831	Handsworth	578	0.79	
HAND	1831	Handsworth		0.79	
HAND	1833	Handsworth		0.79	
HAND	1834	Handsworth	591	0.81	
HAND	1838	Handsworth	1526	0.79	
HAND	1838	Handsworth	1526	0.79	
HAND	1841	Handsworth	601	0.79	
HAND	1858	Handsworth	612	0.78	
HAND	1858	Handsworth	1505	0.79	
HAND	1858	Handsworth	666	0.79	
HAND	1858	Handsworth	670	0.79	
HAND	1858	Handsworth	1044	0.79	

HAND	1858	Handsworth	1826	0.79	
HAND	1858	Handsworth		0.79	
HAND	1859	Handsworth	1816	0.79	
HAND	1861	Handsworth	1816	0.79	
HAND	1870	Handsworth	984	1	
HAND	1870	Handsworth	1132	1.5	
HAND	1871	Handsworth	986	2.00	
HAND	1878	Handsworth	1685	1.50	
HAND	1894	Handsworth	1200	1.00	
HAND	1894	Handsworth Hall Rd	668	1.00	
HAND	1892	St Joseph's Rd	1164	1.00	Handsworth
HAND	1898	St Joseph's Rd	1260	1.50	
MALBR	1849	Holme Wheel	12282	11.73	Probably freehold
MALBR	1886	Wood La	180	1.33	65 years
MIDLWD	1855	Clay Wheel	4477	0.25	21 years
MIDLWD	1855	Clay Wheel	2420	0.69	
OUGH	1877	Cowley Manor	430	0.98	
OUGH	1857	Oughtibridge	1210	1.00	
OUGH	1857	Oughtibridge	1400	1.00	
OUGH	1858	Oughtibridge	656	1.00	
OUGH	1858	Oughtibridge	1410	1.00	
OUGH	1887	Oughtibridge	2300	1.00	Sheffield Varnish Co- Green Head
OUGH	1860	Oughtibridge Turnpike Road	230747	0.08	At crossing of MSLR - agricultural holding
OWL	1850	Owlerton	191	1.50	
OWL	1831	Owlerton Toll Bar	500	0.96	
OWL	1832	Owlerton Toll Bar	1025	0.75	
OWL	1834	Owlerton Toll Bar		1.00	
OWL	1837	Owlerton Toll Bar		0.75	
OWL	1837	Owlerton Toll Bar		0.75	
OWL	1846	Owlerton Toll Bar		1.00	
OWL	1847	Owlerton Toll Bar	491	1.50	
OWL	1859	Owlerton Turnpike Rd	1258	0.10	
OWL	1842	Penistone Rd	100430	0.24	Land for new barracks
OWL	1857	Penistone Rd	501	0.59	Chapel site
OWL	1894	Sheffield Wednesday F.C.	19269	0.37	5 years
RING	1845	Ringing Low	8077	0.22	
RIVVAL	1846	Rivelin Paper Mill	9226	0.31	63 year lease
RIVVAL	1846	Rivelin Side	1223	0.25	
SHRGRN	1831	Sheffield Lane Top	400	0.75	
SHRGRN	1831	Sheffield Lane Top	507	0.75	
SHRGRN	1843	Sheffield Lane Top	1438	0.75	
SHRGRN	1844	Sheffield Lane Top	425	0.50	
SHRGRN	1860	Sheffield Lane Top	287	1.00	
SHRGRN	1861	Sheffield Lane Top	287	1.00	
SHRGRN	1836	Shire Green	294	0.50	

SHRGRN	1847	Shire Green	664	0.75	
SHRGRN	1867	Shire Green	488	0.98	
SHRGRN	1892	Shire Green	519	2.78	92 years
STOCK	1829	Mortomley		0.75	
STOCK	1829	Mortomley		0.75	
STOCK	1829	Mortomley		0.75	
STOCK	1839	Mortomley		0.75	
STOCK	1843	Mortomley	600	0.50	
STOCK	1857	Mortomley	880	0.79	
STOCK	1878	Mortomley	677	0.99	
STOCK	1878	Mortomley	785	0.99	
TREE	1881	Near Treeton Mill	3280	1.00	
TREE	1850	Treeton	645	0.50	
TREE	1857	Treeton	1094	0.50	
TREE	1881	Treeton	1020	0.50	
TREE	1881	Treeton	1116	0.50	
TREE	1881	Treeton	1436	0.50	Rother Vale Colliery
TREE	1881	Treeton	3280	1.00	Rother Vale Colliery
TREE	1884	Treeton	963	1.00	
TREE	1886	Treeton	663	0.50	
TREE	1886	Treeton	2290	0.50	
TREE	1886	Treeton	3372	0.50	
TREE	1889	Treeton	20	2.93	
TREE	1892	Treeton	692	1.00	
TREE	1894	Treeton	20060	0.50	
TREE	1894	Treeton	322	1.50	
TREE	1894	Treeton	486	1.50	
TREE	1893	Treeton Highway	142	1.00	
WADSB	1881	Carlton Rd	432	5.49	
WADSB	1881	Carlton Rd	1731	5.49	
WADSB	1844	Wadsley & Langsett Turnpike	8772	11.16	Freehold to Lady Burgoyne
WADSB	1850	Wadsley Bridge	1287	1.00	
WADSB	1857	Wadsley Bridge	980	1.00	
WADSB	1858	Wadsley Bridge		1.00	
WADSB	1877	Wadsley Bridge	33880	0.74	Offered to Sam'l Fox and Co as an alternative
WADSB	1877	Wadsley Bridge	9680	1.00	Offered to Sam'l Fox and Co as an alternative
WADSB	1885	Wadsley Bridge	29524	0.60	A.S.Denton , Surveyor - Raisen Hall
WADSB	1887	Wadsley Bridge	42108	0.50	Samuel Fox & Co
WADSB	1888	Wadsley Bridge	1070	1.00	
WADSB	1890	Wadsley Bridge	58957	0.15	J.Clarke - Niagara Recreation Grounds
WDSND	1842	Wardsend	14520	0.25	House & farm - required to give up land to MSLR
WDSND	1845	Wardsend	18157	0.22	
WHIS	1892	Canklow Rd	564	1.50	
WHIS	1892	Canklow Rd	591	1.50	
WHIS	1892	Canklow Rd	592	1.50	

WHIS	1892	Canklow Rd	593	1.50	
WHIS	1893	Canklow Rd	594	1.00	
WHIS	1893	Canklow Rd	596	1.25	
WHIS	1893	Canklow Rd	530	1.50	
WHIS	1893	Canklow Rd	531	1.50	
WHIS	1893	Canklow Rd	597	1.50	
WHIS	1893	Canklow Rd	598	1.50	
WHIS	1893	Canklow Rd	612	1.50	
WHIS	1893	Canklow Rd	613	1.50	
WHIS	1893	Canklow Rd	614	1.50	
WHIS	1893	Canklow Rd	616	1.50	
WHIS	1893	Canklow Rd	630	1.50	

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2. Documentary Sources and Contemporary Newspapers

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SC	Attercliffe-cum-Darnall Poor Rate Book No. 1, 1875
SC Aurora 490-508	Bundles of title deeds for a number of works latterly in the ownership of Aurora Holdings, including the Toledo Steel Works (Aurora 494)
SC Aurora 54/a	J. Edgar Allen & Co. General Letter Book, 1899
SC Aurora 54/b	J. Edgar Allen & Co. bundle of loose letters dating from 1907 onwards

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SC Bram 47	Chas. Brammall's Carting Book, Nov. 1882 - Jan. 1885
SC CR 135-40; 142-4; 149-51	Bills of Lading and boatmens' orders from R.C. Clarke's Silkstone Colliery near Barnsley, 1833-46
SC LD 369	Letter book of Daniel Doncaster & Sons Ltd., 1869-71, including SC Marsh 28(4) Carriers' Notes, 1840
SC LZ/1	City and County Borough of Sheffield Register of Motor Cars, 1903
SC Marsh 16-30	Trading letters and papers of Marsh Bros., 1819-94
SC Marsh 32-4	Papers relating to production and costs for Marsh Bros.
SC Marsh 40	Steel and Engine Wage Book of Marsh Bros., 1900-6
SC Marsh 64	Transcript of Arbitration Proceedings, Marsh and Others v The Midland Railway Co., June 1870
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SC SJC 47-50	Wages ledger of Spear & Jackson Ltd. clerks and managers, 1883-1906
SC SJC 67	Letter book of Spear & Jackson Ltd., 1812-16

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SC SYRO S60 Cocker Brothers Limited 3/3	Letter and draft agreement between Messrs. Cocker Bros. and the Sheffield and South Yorkshire Navigation Co. relating to industrial water supply, dated 4 March 1911. Documents retained by the company at the time of cataloguing (copy in author's possession)

3. Maps

OS 1:2500	Sheet CCXCIV.4, Sheffield (North) 1905; Repr. 1985 by Alan Godfrey, Gateshead as Yorkshire Sheet 294.04
OS 1:2500	Sheet CCLXXXIX.14, Templeborough and Tinsley 1921; Repr. 1985 by Alan Godfrey, Gateshead as Yorkshire Sheet 289.14
OS 1:2500	Sheet CCXCV.5, Darnall, 1903; Repr. 1988 by Alan Godfrey, Gateshead as Yorkshire Sheet 295.05
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OS 1:2500	Sheet CCLXXXIX.13, Wincobank & Meadowhall 1902; Repr. 1986 by Alan Godfrey, Gateshead as Yorkshire Sheet 289.13
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OS 1:2500	Sheet CCXCIV.11, Ecclesall & Sharrow 1903; Repr. 1990 by Alan Godfrey, Gateshead as Yorkshire Sheet 294.11
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OS 1:2500	Sheet CCXCIV.15; Nether Edge 1903; Repr. 1989 by Alan Godfrey, Gateshead as Yorkshire Sheet 294.15
OS 1:2500	Sheet CCXCIV.12, Sheffield Park; Repr. 1987 by Alan Godfrey, Gateshead as Yorkshire Sheet 294.12
	Kelly's Directory Map of Sheffield, c.1930, London
OS 1"=1 Mile	Sheet LXXXII.82, Chesterfield (Sheffield) 1838, Repr. by David & Charles, Newton Abbott as Sheet 28
	Bacon's Large Scale Plan of Sheffield with Street Index 1910 (6"=1Mile), London
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OS 6"=1 Mile	Sheet 294, Sheffield 1850, SC 5598 E(294) IL
OS 6"=1 Mile (1:25000)	Sheets CCXCIV S.E. & N.E., Sheffield 1906
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ACM She 56	The Estate of His Grace the Duke of Norfolk [and] of the Trustees of the Late Charles Dukes of Norfolk c.1819, Arundel Castle MS, Sheffield Archives
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	R.Gosling's A Plan of Sheffield from an Actual Survey 1736
PRO/MPS 5/274	Sheffield District Railway, Plan of Stations and Sidings, date uncertain but before 1923, based on 1906 OS 6'=1Mile map
BRERO	Plan of MSLR, Sheffield, Tinsley & Aldam Junction Section, Surveyed 1887
BRERO	Plan of London & North Eastern Railway, GCR Section - Woodhead Station to Woodbourne Junction, 1884-1920, Engineer's Office, Marylebone
BRERO	Plan of MSLR, Sheffield Station - Gainsborough Section, Henry Fowler, Surveyor, 1884
BRERO	Plan of MR, Chesterfield & Sheffield Branch, Land Plan, Surveved by P.S.M.McCallum, Estate Agent, Derby, 1906-6
BRERO	Plan of MR, Sheffield & Rotherham Line, Land Plan, Surveyed by W.H.Clay, Estate Agent, Derby, 1916
	J.Leather's Plan of Sheffield in 1823, Sheffield
	Pawson & Brailsford's Smaller Map of the City of Sheffield, appended to the Sheffield Council Minutes for 8th July 1896 to show the routes of existing and proposed tramways and suggested continuations
SC CA 5(9)	General Plan Showing Proposed Tramways, Session 1872

4. Parliamentary Papers

	Minutes of Evidence of the Committee on the Midland Railway (Chesterfield to Sheffield) Bill, HL 1864, Vol. 19
	Select Committee on the Act for the Regulation of Mills and Factories, Minutes of Evidence and Report, 1840, PP Vol. X, Cmnd. 203
HLRO Local and Personal Acts	7 Will IV & I VICT, Vol. I, Cap xxi, Manchester, Sheffield and Lincolnshire Railway Act, 1837
PRO/RAIL 1016/5	Sheffield and Manchester Railway Bill - Case in Support of the Bill in Parliament, Session 1830-31
PRO/RAIL 1067/10; SCS&RR	Minutes of Evidence taken before the Lord's Committee to whom the Bill Intituled "An Act for making a Railway from Sheffield to Rotherham both in the West Riding of the County of York" was committed, 8th July, 1835
PRO/RAIL 1075/69	'Sheffield, Ashton-under-Lyne and Manchester Railway - Report of the present Traffic on the different lines of road between Sheffield and Manchester and an estimate of the increased and additional Traffic which may be expected to pass upon the Railway between those towns - taken from actual observation in the months of November 1836 and February 1837 - and founded on the opinions and experience of individuals living upon and engaged in business on the line and neighbourhood of the Railway, presented to, and accepted by, Committees of both houses of Parliament, by B. Sidmore, Commercial Agent, Sheffield'
SCSDR	Minutes of Evidence taken before the Select Committee of the House of Commons on the Sheffield District Railway Bill (Group 4), HL 1896
SCTH	Select Committee on Town Holdings, Minutes of Evidence, 1886, PP Vol. XII
SCTH	Select Committee on Town Holdings, Minutes of Evidence, 1888, PP Vol. XXII
SCTH	Select Committee on Town Holdings, Report, 1889, PP Vol. XV
45 & 46 Vict., Ch. 38, IV	Settled Land Act, 1882