THE POST - 1948 DEVELOPMENT OF, AND PROSPECTS FOR, INLAND WATERWAY TRANSPORT IN BRITAIN

by

MARK WALKER BALDWIN

MA MSc MICE DIC

A thesis submitted to the University of London
for the Degree of Doctor of Philosophy
in the Faculty of Engineering

Department of Civil Engineering
Imperial College of Science and Technology

March 1978

ABSTRACT

The post-1948 development of, and prospects for, inland water transport in Britain

Mark Walker Baldwin

Although the Transport Act of 1947 brought a considerable number of British waterways under unified control, this did not provide suitable conditions for the continued development of freight-carrying waterways. The short-comings of the Act, namely its inclusion of many obsolete waterways and simultaneous exclusion of many profitable ones, had repercussions which are still felt today. A survey of the transport use of British waterways shows this clearly; normal estimates of waterway traffics are one order of magnitude too low.

Despite numerous recommendations, the framework in which transport planning and investment takes place does not treat all modes equally. Waterways are especially discriminated against both at national and local level. This is contrary both to the spirit and the letter of EEC legislation, yet there appear to be no moves to correct this.

Experience both at home and in other European countries show that waterways are well suited to trunk-hauling bulk goods, and that long life of craft and structures, large vessel size and low fuel costs more than offset the low speeds involved. Waterways also have significant uses besides transport; these include water transfer, and recreation, neither of which need seriously jeopardize navigation. The reasons for the current restricted extent of waterways in this country are not technical nor topographical; if all transport modes were treated comparably, greater use of waterways would almost certainly result.
Given Britain's needs for freight transport and water supply, there is a strong case for a complete reappraisal of the generally held views on waterways.

CONTENTS

ILLUSTRATIONS

Illustrations	Page Number

TABLES

ABBREVIATIONS

The following is a select list of abbreviated names of organisations etc which have been used in this thesis, with the page number on which the first use occurs.

		page no
AMLBO	Association of Master Lightermen and Barge Owners	109
BACAT	Barge Aboard Catamaran	66
BCN	Birmingham Canal Navigations	207
BCS	Barge - Carrying Ship	172
BTC	British Transport Commission	27
BTDB	British Transport Docks Board	91
BTW	British Transport Waterways	41
BWB	British Waterways Board	55
DIWE	Docks and Inland Waterways Executive	27
ECMT	European Conference of Ministers of Transport	133
ECSC	European Coal and Steel Community	133
HGV	Heavy Goods Vehicle	224
ISG	Inland Shipping Group	82
IWA	Inland Waterways Association	37
LASH	Lighter Aboard Ship	82
NAIWC	National Association of Inland Waterway Carriers	109
NPC	National Ports Council	97
NWTA	National Waterways Transport Association	83
O.N.	Office de la Navigation (Belgium)	124
PLA	Port of London Authority	90
RWA	Regional Water Authority	80
SSYN	Sheffield and South Yorkshire Navigation	114
TOW	Transport On Water	110
TPP	Transport Policy and Programme	111
TSG	Transport Supplementary Grant	111

PREFACE

The last decade has seen a rapid rise in the volume of published material devoted to Britain's waterways. This has largely dealt with the historical and amenity aspects of our canals and rivers, with many writers either noting in passing the possibility of the commercial carriage of freight by waterway or merely regretting its demise. The author was not satisfied by the explanations for the present state of inland shipping given by such writers, but neither did the views of established academics or transport analysts seem convincing. The incompatibility of these ideas suggested a widespread ignorance and misunderstanding of inland waterways in this country. Accordingly, research started tentatively in 1973 and this showed increasingly clearly that the suspected misunderstanding of waterways was a fact, especially amongst many of those who legislate for, plan for and discuss transport. Inland shipping, then, was without doubt a suitable field for serious study.

From the research, a thesis evolved

> The present state of inland waterway transport in Britain is more a result of historical and political factors, than of a balanced technological appraisal. If it were given parity of treatment with other modes, its use would increase, with a resulting benefit to the community.

and the evidence is set out in this volume. Of course, not all the claims which other writers have made for inland shipping turn out to be true, nor does it transpire that inland shipping offers a simple widespread solution to transport problems. Nevertheless there is ample proof that the overlooking of one mode of bulk freight transport is not in our best interest, that this mode is systematically under-valued, and that many of the long-held ideas about the nature of waterway transport are not based on any informed engineering assessment.

As far as the author is aware, a study of this subject in this depth is unique in recent years. Of necessity, therefore, many facets must be dealt with in a brief fashion to enable a single volume to offer the reader a broad and balanced view. Indeed, many of the subjects touched upon, eg coastal shipping, the demand for bulk freight movements, and water transfer, are themselves worthy of prolonged study in their own right. Here, they must each be compressed into a few pages. It is hoped that this will not detract from the merit of the work as whole; better still, it might stimulate further workers to build upon what is merely hinted at here.

Because the subject is effectively a new one, a mere collation of such dispersed material as exists would itself be a worthwhile contribution to the literature. Some part of what follows is indeed a compilation of this sort, but other parts are totally new. The most important of the latter are

(i) the systematic detailed post-war history of commercial inland waterways including professional and political attitudes and containing hitherto unpublished material on non-nationalised waterways,

(ii) the first comprehensive survey of freight movements by waterway carried out in the last thirty years, (possibly ever), and the first recent tabulation of all waterways in commercial use, and

(iii) the analysis of the current position of waterways in transport law both with respect to British legislation and that of the EEC.

There is one recurring difficulty facing an author who wishes to write an up-to-date account of any subject yet requires several years to accomplish his goal, and that is the problem of bringing all sections of the work uniformly to a consistent end-date. This has not been perfectly achieved in this work, but the spread is not wide. As a basis, the year 1974 has been taken as the end point of any time series, but if important developments have occurred since 1975 they have generally been included. There remain, however, some omissions; these include the latest EEC legislation, the recent changes in Belgian waterway administration, and so on. Nevertheless it is hoped that these affect only minor details of the factual accounts and not the validity of the general picture to which these accounts contribute nor the conclusions which have been drawn therefrom.

Acknowledgements are inevitably due to many but space permits only a few. All those organisations which supplied data have been meticulously credited in the references, especially in the notes to the Appendices. On a more personal level I would like to record my gratitude to Professor A.W. Skempton, Dr. David Hilling, Dr. T.A. Wyatt, Charles Hadfield and Joyce Brown for their useful comments and encouragement, and to my wife for typing the finished work.

CHAPTER 1: BRIEF HISTORY OF INLAND WATERWAY DEVELOPMENTS IN UNITED KINGDOM TO 1947

Man's use of natural rivers for transport has been widespread for millenia; we are unlikely to discover when or where this first started, indeed the practice of navigating rivers probably has no single origin, being developed independently in different areas. In contrast, there are many records, both written and archaeological, of early attempts to improve the suitability of rivers for this use. Such improvements take the form of widening and deepening the channel, regulating the flow, and ultimately of supplementing natural water-courses by the construction of artificial canals to bypass difficult stretches or even to link previously independent river systems.

The early flowering of the civilisation of ancient China was dependent in no small way upon the acquisition of highly developed skills of hydraulic engineering. This dependence was a result of several factors: the intensely seasonal rainfall, the great rivers whose utility was tempered with the threat of flooding, the need for irrigation resulting from both the soil type and the agricultural methods adopted, and the need for efficient communications to enable a central government to administer an enormous territory. The heights of skill reached by the Chinese may be judged from a few examples of innovative engineering: the construction of contour canals providing connections between rivers from 219 BC, of lateral canals* from 130 BC, of pound locks from 984 AD and summit-level canals from 1283 AD. There were comparable feats of irrigation and transport canal engineering in ancient Ceylon, Egypt and elsewhere, but China's claim to have constructed the earliest totally artificial canals for transport seems unlikely to be challenged.[1]

---

* If a river can not easily be rendered navigable by simple improvements, a lateral canal may instead be built along the same valley. As lateral canals do not cross watersheds nor stray far from 'parent' rivers, they rarely raise problems of water supply.

However, the isolation of older civilisations prevented the transmission of such skills and inventions, and they were later developed independently in the West. Thus in Europe we find the first (known) pound lock (at Vreeswijk, Holland) in 1373, the earliest summit-level canal (the Stecknitz Canal, Germany) in 1391-8, the first (known) canal aqueduct (carrying the Martesana Canal over the river Molgora, Italy) in 1462-70 and the first mitre-gates (for locks on the Naviglio Interno, Italy) about 1495.[2] It was in the evolution of waterway structures, rather than in the appreciation of major principles of hydraulic engineering, that European technology before the Industrial Revolution exceeded the achievements of the Chinese.

The slowness in the spread of ideas, even within Europe, may be judged by the delay in applying mainland technology in the British Isles. Although rivers had been extensively improved for navigation for centuries, the first pound lock dates from 1564-7 (on the Exeter Canal). It is not clear what type of gates were originally fitted to these locks, but mitre gates were certainly used for a lock at Waltham Abbey on the River Lee in 1571-4.[3] The first summit-level canal in the United Kingdom was envisaged in the 1640s but not built for another century; the Newry Navigation, linking the Rivers Newry and Bann, was opened in 1742.[4] England's first lateral canal was the Sankey (later St. Helen's) Canal, whose main line was opened in 1757.[5] This should probably rank as the first undertaking of the 'Canal Age', although that title is generally bestowed on the nearby Bridgewater Canal, built 1759-65.[6]

The successful construction and operation of these two canals started a spate of canal building which vastly increased the system of navigable waterways in Britain.

END OF YEAR	LENGTH (KM)
1760	2250
1770	2603
1780	3366
1790	3578
1800	4948
1810	5562
1820	5940
1830	6237
1840	6442
1850	6475

Table 1. England and Wales, extent of navigable waterways, 1760-1850 (7).

Table 1 shows the pattern of growth of the waterways system in England and Wales. Figures for total waterway length in the United Kingdom have yet to be agreed but the results of a careful study of the position at the close of the nineteenth century are shown in Table 2.

		ENGLAND & WALES (KM)	SCOTLAND (KM)	IRELAND (KM)	TOTALS (KM)
Navigable	Independent	4332	415	925	5672
Navigable	Railway controlled	1574	136	154	1864
			TOTAL NAVIGABLE		7536
Derelict		650	93	100	843
Converted to railway		n.a.	n.a.	n.a.	135
			PEAK SYSTEM LENGTH		851

Table 2. United Kingdom, extent of navigable waterways at end of 19th century, by country and type (8).

It must be noted that the totals in Table 2 include some navigations described as 'tidal only' (eg the Rivers Tyne and Tees) and may thus be something of an overestimate. Nevertheless, whatever the exact figures, it is clear that a concentrated period of activity, c1760 to 1840, more than doubled the British inland waterway route length.

The results of this activity were far-reaching. Compared with the road system of the day, waterways provided cheap and reliable transport, an essential component of the Industrial Revolution. Not only were they the means of supplying raw materials to the new industries, and distributing the products of those industries, but they also improved the availability of other basic materials: coal, food, building materials and fertilisers. In short, the Canal Age raised the standard of living of the nation as a whole.

Striking though the rate of canal building indeed was, it was destined to be eclipsed by the astonishingly fast spread of the railways. In 1832, the total length of working steam railway in Britain was less than 300 km; by 1851 it had reached nearly 11,000 km, and this figure was more than trebled before the era of railway building closed. Figure 1 compares the growth of the water and rail route totals.

Thus during the second half of the nineteenth century there existed two transport networks, each of which provided an extensive coverage of and links between the more highly populated and industrialised areas of the country. The result was intense competition but although both networks had been built up by numerous local companies, the railway managers had a far greater appreciation of the need for inter-company co-operation. It is a tribute to the farsightedness of railway management that from early times a standard gauge was adopted (the only important exception being Brunel's broad-gauged Great Western Railway). This enabled any rolling-stock to travel over any line; to deal with the

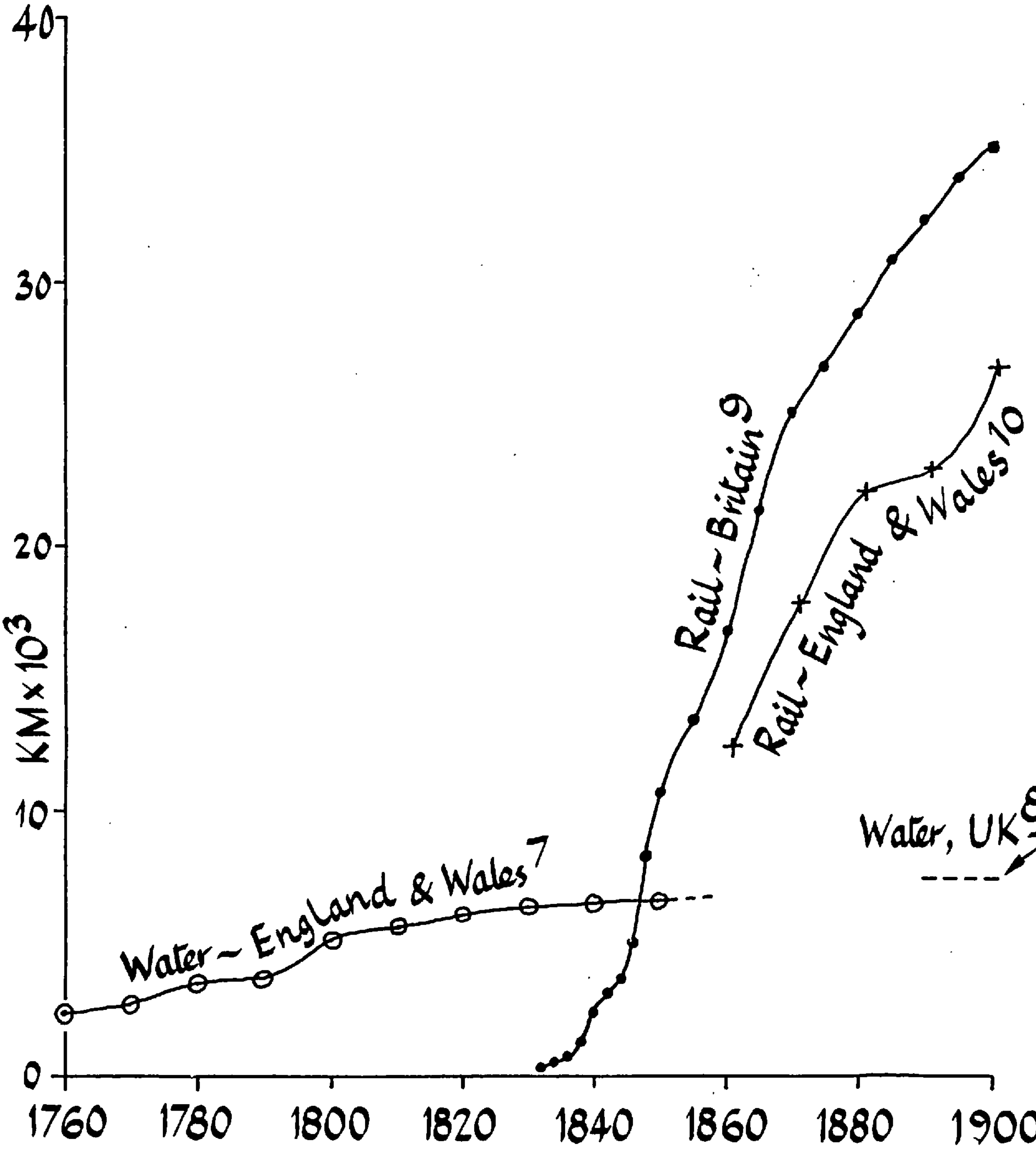


Figure 1: UK, water and rail networks, estimated lengths, 1760-1900.

highly complex affair of establishing through rates and keeping track of the rolling stock, the Railway Clearing House was formed in 1842. Thus although the railway companies maintained their independence, they wisely provided themselves with the physical and administrative infrastructures to exploit fully the advantages of a network. The advantages of this co-operation included better use of company facilities, lower administrative overheads, and co-operation on technical matters, all leading to better business for the companies and better service for their customers.[11] The wide support given to the Railway Clearing House may be judged from the proportion of U.K. track length belonging to participating companies. On formation this stood at 24%, rose to 90% by about 1865 and stayed around that level until the regionalisation of the railways in 1921 changed the role of the Clearing House.[12]

By contrast, the canal companies were essentially parochial in outlook. Although their various routes had numerous connections, none of the co-operation necessary to transform the waterways into a national system was forthcoming. Apart from a 'Meeting of Deputies from all the Navigations' held at Lichfield in 1769 (attended by representatives of only six companies) at which dimensions were agreed for narrow canals,[13] there was little inclination to develop a standard gauge and even less willingness to compete with the railways for long-haul traffic by establishing through rates. The original navigation companies were basically local concerns, and when their lucrative freight monopoly was successfully challenged by the railways, they looked more to conserving their short-haul traffic than to uniting to create an industry which could compete for traffic crossing company boundaries, even though an Act of 1888 expressly permitted the establishment of a 'Canal Clearing House'.[14] Thus the superior administration of the railways, coupled with their higher intrinsic speed and their domination of the passenger market, lent the railways a real advantage over their more fragmented competitors. This led to a general decline in the use made of canal transport, reduced revenues forcing down maintenance standards and little or no investment in new facilities or track improvement. This decline was undeniably abetted by the railways (whose significant share of the waterway network can be seen from Table 2) but the canal companies themselves must certainly take some of the blame.

The Acts under which some early railways were built had necessitated their buying up existing canals serving the same routes, this being the only way in which the Parliamentary opposition of the canal companies could be overcome. Later, the weakened financial state of the canals made them susceptible to railway take-overs and these took place to such an extent that it became generally argued that railway influence was excessively interfering with the ability of the canals to function as competitors. In 1873 the Regulation of Railways Act was passed, the first to seriously curb this influence. This was followed by other Acts and the formation of several Select Committees, all of which recognised that the lack of true competition between rail and water was not in the national interest, a view echoed by the Royal Commission on the Depression of Trade in 1886.[15] Nevertheless the general decline of the canals went unchecked, though some of the larger companies flourished, notably those controlling or connected to major rivers, where neither enlargement nor water supply posed great problems. As an example, the last significant length of new canal to be built in this country was the New Junction Canal, opened in 1905 to connect the Aire & Calder Navigation to the Sheffield & South Yorkshire Navigation.[16]

By the end of the nineteenth century, railway domination of the freight market was approaching a monopoly. In contrast to the period of rate-cutting in the early years of the railways, there were growing complaints of excessive charges. The canals were looked to by some as a means of combatting this monopoly, and the opening of the Manchester Ship Canal in 1894 served to stimulate interest in larger-gauge waterways. This revival, championed by the Associated Chambers of Commerce, led to the appointment in 1906 of a Royal Commission to study the inland waterways of the United Kingdom. The fruits of this study [17] still remain the most comprehensive investigation of the subject ever undertaken, before or since. Their recommendations were essentially that some 800 km of waterway forming the 'Cross' (ie linking the Humber to the Severn, and the Mersey to the Thames) should be enlarged to accommodate, according to area, vessels from 100-tonne to 1200-tonne capacity. In the public interest, the £17M required for this and other ancillary works would have to be provided by the State.

Had these recommendations been followed, it is highly likely that we would now have a valuable, flourishing and developing inland waterway network comparable to those to be found in many European countries. Needless to say, State endorsement was not forthcoming and traffic continued to drift away from water to rail and increasingly to road. The first decades of this century are marked by a wealth of discussion and a dearth of capital investment in waterways. Much of this discussion centred on the effect of railway control, those railway companies who owned canals arguing that loss-making canals had been foisted upon them. Their opponents' view was strictly the opposite: the railways had deliberately neglected any canals they had acquired, diverting traffic to their own lines by any means they could devise.[18]

As has been indicated, the real truth lay somewhere between the two views, but what is undeniable is that the railways had helped to foster a public image of canals as old-fashioned and inadequate. Thus although two thirds of the water route length was still independent, public attitudes to waterways meant that independent companies found it impossible to attract new traffic and, more importantly, funds for improvement. This of course lent reality to the charges of inadequacy and obsolescence and the familiar spiral of decay and decline continued. By 1928, the railways became, in some sense, the victim of their own plot. An official of the Railway Companies' Association was quoted as saying

> 'In the past three years the loss to the companies on the railway-owned canals.....has been £312,000. Altogether we own about one-third of the total canal-mileage.....and have to be responsible for the maintenance in a navigable condition of every mile.....We bought many of these.....under an Act of Parliament which forced us to do so. Now we cannot get anybody to take them off our hands, for nobody wants to be saddled with the responsibility of looking after them. We cannot even give them away'(19).

However, the early twentieth century was not one of complete inactivity by waterway interests. In 1927, a programme of improvement on the River Trent, a flourishing waterway, was completed with the assistance of Nottingham Corporation and the Unemployment Grants Committee. This involved the enlargement of a number of locks below Nottingham, and the deepening and widening of the channel.[20] These improvements resulted in a 73% increase in traffic between 1927 and 1939.[21] In 1929, four canal companies merged to form the Grand Union Canal Company which three years later took over three more waterways thus putting under united control about 500 km of waterway linking London, Birmingham and Leicester. With Government assistance, £1M was spent in the early 1930s on the London to Birmingham line, enlarging locks, dredging and piling the banks.[22] Thus, although successive Governments had ignored various recommendations for major state intervention,[23] they did provide some assistance, and the companies also showed their appreciation, albeit belatedly, of the need for improving their track.

During the Second World War, the Ministry of War Transport took control of all the transport industries, although the independent waterways remained so until 1942.[24] Following the war, the Transport Act of 1947 nationalised the majority of British waterways, including all of those formerly controlled by the railway companies. Figure 2 summarises the trend of decreasing use of waterways for freight during the first half of the twentieth century, although, as will be

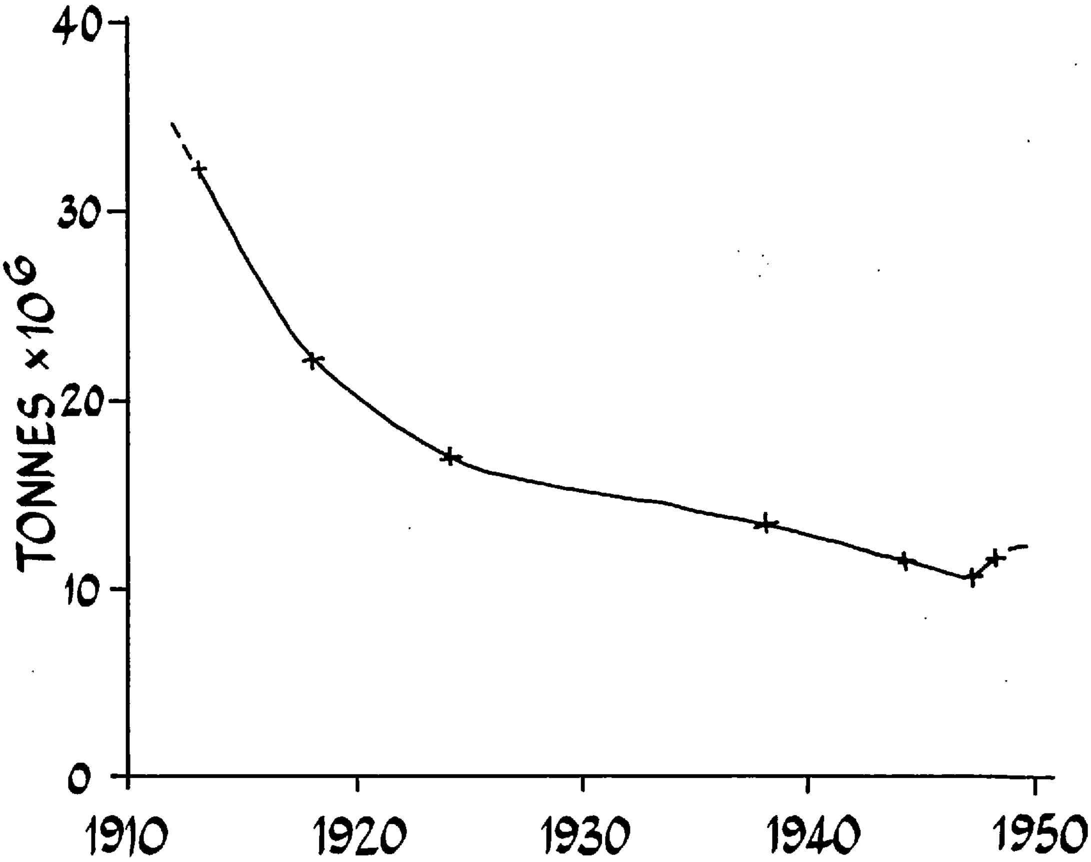


Figure 2: British waterways, estimated freight tonnages, 1913 - 1948.[25]

discussed later, without an agreed definition of waterway, the figures cannot be accepted as accurate for the whole industry. They undoubtedly underestimate the actual tonnage of inland waterborne freight; nevertheless the trend is clear.

CHAPTER 2: BRITISH COMMERCIAL WATERWAY POLICY AND ADMINISTRATION, 1948 TO 1962

2.1 The 1947 Transport Act

The 1947 Transport Act aimed to integrate the country's internal transport services so that these might be managed in the best interests of nation, industry and public. An overall controlling body was required; the Act established the British Transport Commission (BTC), whose assets included some of the previously independent canals and river navigations, some road freight and passenger undertakings, all privately-owned railway wagons, the entire railway network, and all the holdings of the railway companies and their subsidiaries which included canals, river navigations, docks, harbours, ships, hotels and road haulage units as well as railway equipment.

The Commission's affairs were managed by five (later six) separate Executives, the members of which were appointed, not by the BTC, but by the Minister of Transport. This arrangement was not conducive to fostering a unity of approach among the Executives, and has been blamed for the poor record of the BTC towards establishing intermodal transport integration.[1] The control of the waterways was the responsibility of the Docks and Inland Waterways Executive (DIWE), who accordingly took over the previously independent waterways from January 1948, along with the Caledonian and Crinan Canals (which had been vested in the Ministry of Transport since 1919.[2]) The transfer to the DIWE of the previously railway-owned canals was carried out over the next few years.[3] The contribution from each source is shown below.

PREVIOUS OWNER	LENGTH (KM)
Independent	1831
Railway owned or controlled	1553
Government	111
TOTAL	3495

Table 3. British Transport Commission waterways, length, by previous owner (4).

In the public mind, the DIWE and 'the canals' became synonymous, an understandable error as the apparently comparable Railway Executive was responsible for all railways (except those controlled by the London Transport Executive). Nevertheless it was an error, whose magnitude may be judged by listing those waterways carrying commercial traffic in the late 1940s, albeit not over the entire length of each, which remained unaffected by the provisions of the 1947 Transport Act. The most important of these were:

Bridgewater Canal	R. Hull	R. Ouse (Yorks above Goole)
Chelmer & Blackwater Nav'n	Linton Lock Nav'n	R. Ribble
R. Colne Nav'n	Manchester Ship Canal	R. Severn (below Sharpness)
R. Clyde	R. Medway	R. Stour (Suffolk)
Dartford & Crayford Nav'n	R. Mersey	R. Tay
Exeter Ship Canal	R. Nene	R. Thames
R. Forth	R. Orwell	R. Yare

(A full list is given in Appendix 1).

Additionally, although the lower River Trent and the River Humber were controlled by the DIWE, these were not considered to be inland waterways, and so were classed with the Executive's docks. Although the majority of these are rivers not canals, it must be remembered that the bulk of traffic on BTC waterways was on the Rivers Aire, Calder, Don, Lee, Severn, Trent and Weaver. The overall situation is summarised in Fig. 3.

Thus nearly 2000 km[5] of commercial waterway were not controlled by the national waterway authority, a significant length compared with the 3495 km which were taken over. It can be argued that some of the waterways listed above were merely coastal waterways, unconnected either physically or otherwise with the main network, eg the Exeter Ship Canal and the Colne Navigation. Nevertheless, some of those omitted were not only parts of the system, but integral parts, eg the Nene, the Thames, the Bridgewater Canal and the Yorkshire Ouse above Goole.

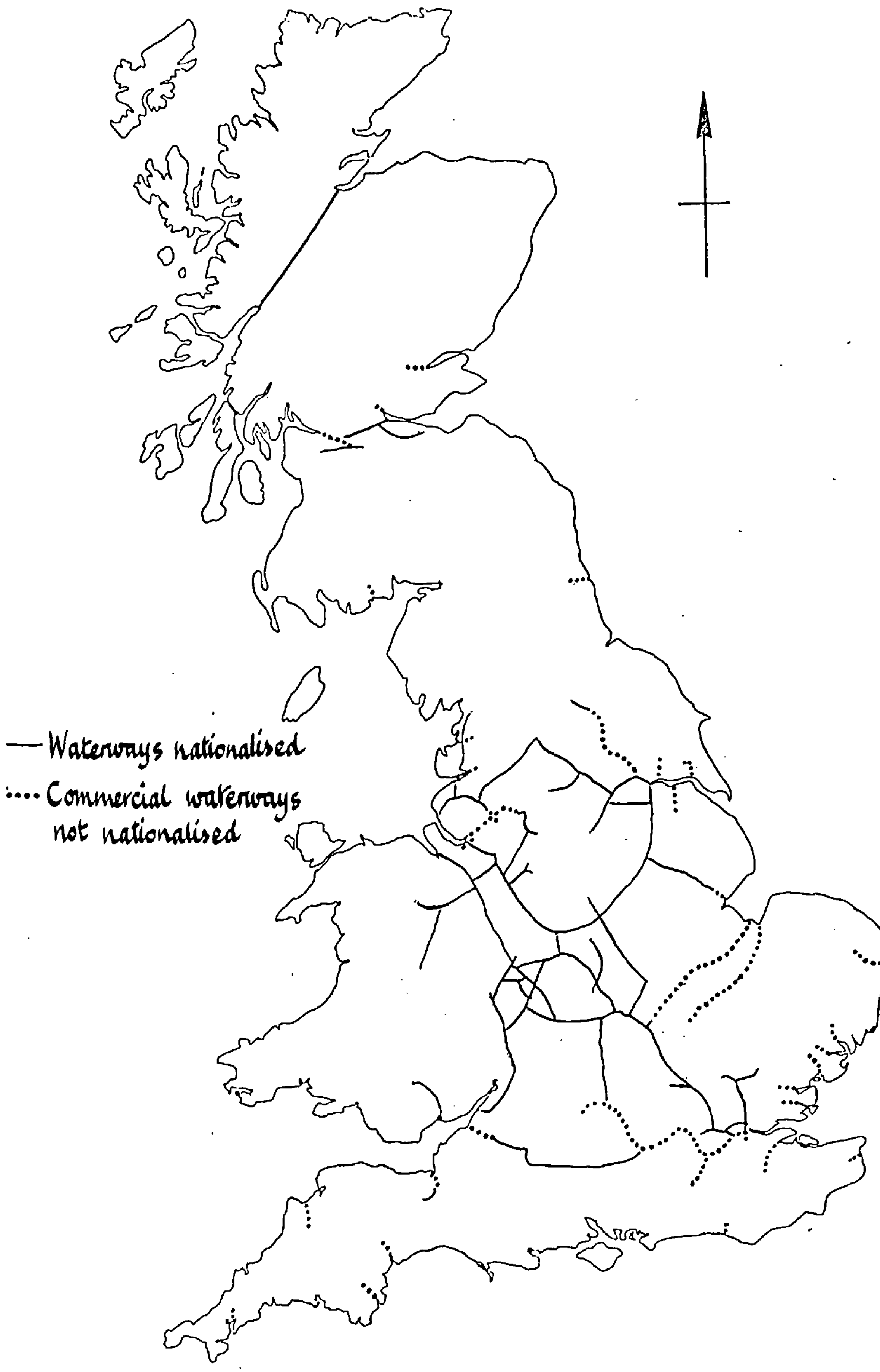


Figure 3: Great Britain, sketch map showing waterways nationalised by Transport Act, 1947.

The reason for the omission of many of the eastern waterways was apparently that they

> 'had not been included in the wartime canal control scheme upon which the nationalisation schedules had been based' (6).

Many other waterways were also excluded from the provisions of the Act for the good reason that they were too little commercially used or too run down to be the concern of a national transport undertaking. These included such waterways as the Norfolk and Suffolk Broads, the Basingstoke Canal, the Rochdale Canal and many minor rivers and river navigations.

The effects of the omission of many commercial waterways have not yet been remedied. There is no systematic collection of data for all inland waterways, though the very existence of a nationalised industry, with the excellent statistical service that this implies, misleads many who write about or study transport matters into believing that the returns from the nationalised industry must, by definition, include all waterways.[7] (These statistical deficiencies will be discussed later.) Also, many of the maps produced by the BTC and its successors are so designed that the importance of non-nationalised track is under-emphasised. This can result in apparently authoritative reproductions which omit the independent waterways altogether, creating a highly misleading impression of fragmentation.[8]

Just as the Transport Act excluded over 1800 km of commercial track, so it also included many kilometres of waterway of little value, which were to prove an embarrassment for years to come. These were acquired from the railway companies (although by no means all of the railway holdings were in this class) and had been rendered worthless either by deliberate neglect or by the change in trade patterns. The Manchester, Bolton & Bury, the Shrewsbury, and the Kennet & Avon are examples of such canals. Had these been independent in 1947, they would have remained so.

Nevertheless, the recommendations of many expert committees, made over a period of sixty years, had become reality, at least in part. The old parochialism could now be shaken off, and the bitterness between railway and canal companies forgotten. The post-war period was one of reconstruction and planning for new growth, and there was a continuing and realistic debate on the role which the now unfettered waterways could play in the post-war economy. As there was no independent British journal devoted solely to inland water transport, the debate was largely conducted in the monthly Dock and Harbour Authority, at meetings held by the Institute of Transport, and in the journal of that body.

2.2 The Docks and Inland Waterways Executive

The position from which the nationalised waterways were starting was well described by an employee of the DIWE in a paper read before the Metropolitan Section of the Institute of Transport in February 1949.[9] The paper describes in some detail the types of waterway owned by the BTC and how these were acquired. Two minor improvement schemes which had already been authorised are mentioned: one on the Severn, costing £35,000, the other on the Lee where bank works were to be carried out at a cost of £38,000 (the Lee Conservancy Board was to pay half of the latter[10]). Perhaps in keeping with his profession of barrister (and his working for the DIWE), the author made few suggestions for future policy, but did note that British waterway research, in contrast to Continental practice, was a neglected field.

Taking this paper as a summary of the status quo, the more adventurous Brigadier-General Sir Osborne Mance advanced his proposals for a canal policy later that year.[11] As president of the Institute of Transport, his views are worthy of respect, but this is overshadowed by his having been Director of Canals at the Ministry of War Transport. He was thus the first man to control such a large network of British waterways and this unique experience lends his conclusions great authority.

Mance realistically observes that changed trade patterns, centralised electricity generation, exhaustion of small mineral workings (eg coal, stone, iron ore etc.) and the gradual replacement in industry of steam power by electricity had all combined to reduce available waterway traffic.[12] Wholesale improvement, or even retention, of all waterways is unjustifiable; instead they should be assessed individually for allocation to one of three categories:

> '(1) Waterways which may be expected to pay their way commercially (with or without ancillary revenue) with fair conditions and some encouragement;
>
> (2) Waterways which may not pay their way but whose maintenance and even development are directly or indirectly in the national interest on economic or possibly strategic grounds;
>
> (3) Waterways which should be definitely abandoned, or which can be left outside any official scheme.'[13]

As to new works, the 1906 Royal Commission's idea of the improved Cross (see Chapter 1) is examined. Mance, however, suggests a slightly less ambitious scheme, but one which preserves the key feature of penetration to the Midlands from the four estuaries. He refers to the wartime 'committee of engineering and operating experts' who investigated both the Cross and the craft which should work on it. Their suggestions were that studies should be pursued using, as a design basis, the following specification for craft:

Length 28m	Air Draught 3.20m
Beam 4.47m	Capacity 100 tonnes (motor)
Draught 1.52m	120 tonnes (dumb)

Locks were to accommodate at least two such craft simultaneously.[14]

This specification defined the minimum gauge of Mance's Cross waterways, though nearer the estuaries larger gauge track was to be provided. After examining the routes in some detail, he sketches out the costs and revenues of the new system with the conclusion that

> 'With a use well within their capacity the proposed canals might not inconceivably pay their way' (15).

Finally, after a brief look ahead to the possibility of the barge-carrying ship, he closes by stressing the urgent need for a major policy decision:

> 'The alternative would therefore seem to lie between the abandonment of any idea of an inter-connected national waterway system on the one hand and a vigorous canal policy on the other....Personally, I plump for the second alternative as being the best policy in the national interest' (16).

The 'vigorous canal policy' did not materialise. The next few years were not wasted by the new waterway managers, but their sense of urgency, their vision and their belief in the value of water transport found little encouragement from those in higher office. Nevertheless, the operating record of the DIWE in its early years was encouraging; arrears of maintenance were tackled, some new equipment was provided and the traffic handled rose for the first time for nearly a century (see Figs. 4 and 5). Although these results must reflect in some way the benefits gained from having a unified management, they must be seen in the context of the post-war expansion of the economy. Figure 6 shows the growth of total freight transport from 1952 to 1962; as can readily be seen, the contributions of coastal shipping and inland waterways remained virtually unchanged, rail declined during later years, while carriage by road doubled, more than compensating for rail's decline.

The debate on the potential of waterways continued with some enthusiasm, but most contributors were by now working over old ideas: the desirability or otherwise of the Cross, the need for enlargement of existing track, and the importance of preventing transport funds from financing non-commercial waterways. Most contributions came from past or present managers in the waterway industry, although carriers took part as well.[22] The voice of the amateur was being heard for the

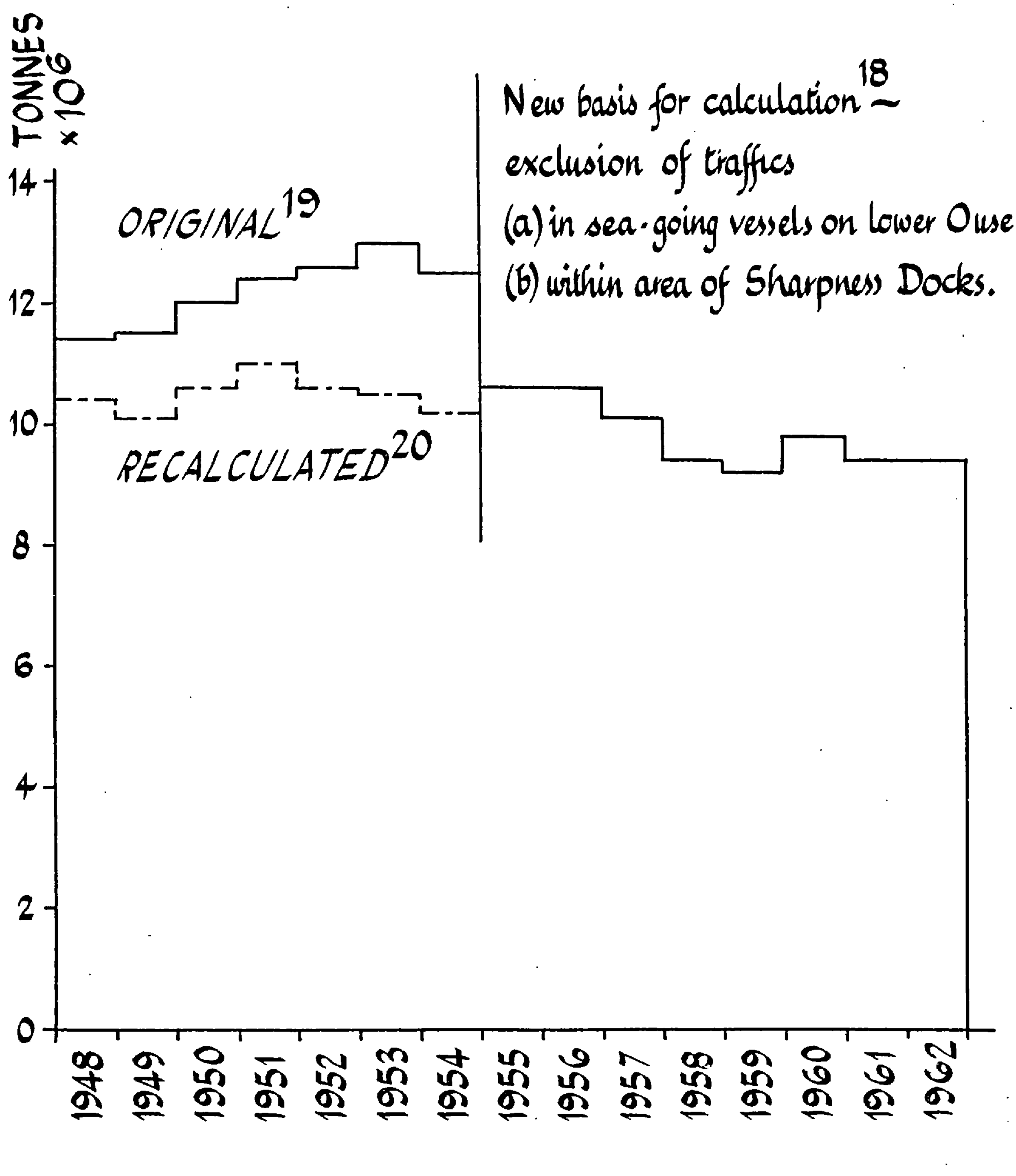


Figure 4: British Transport Commission, waterway freight tonnages, 1948-1962.[17]

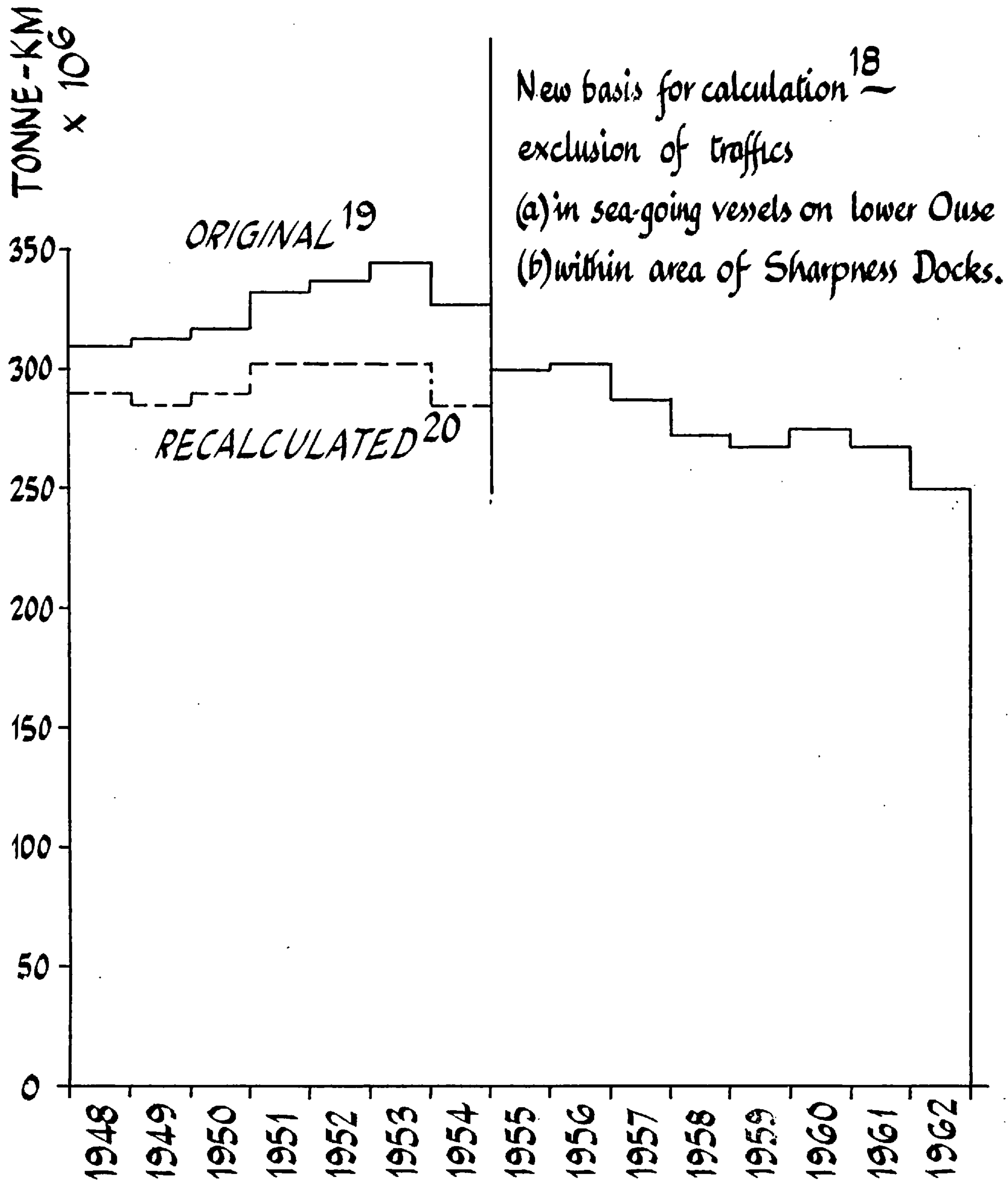


Figure 5: British Transport Commission, waterway freight tonne-km, 1948-1962[17]

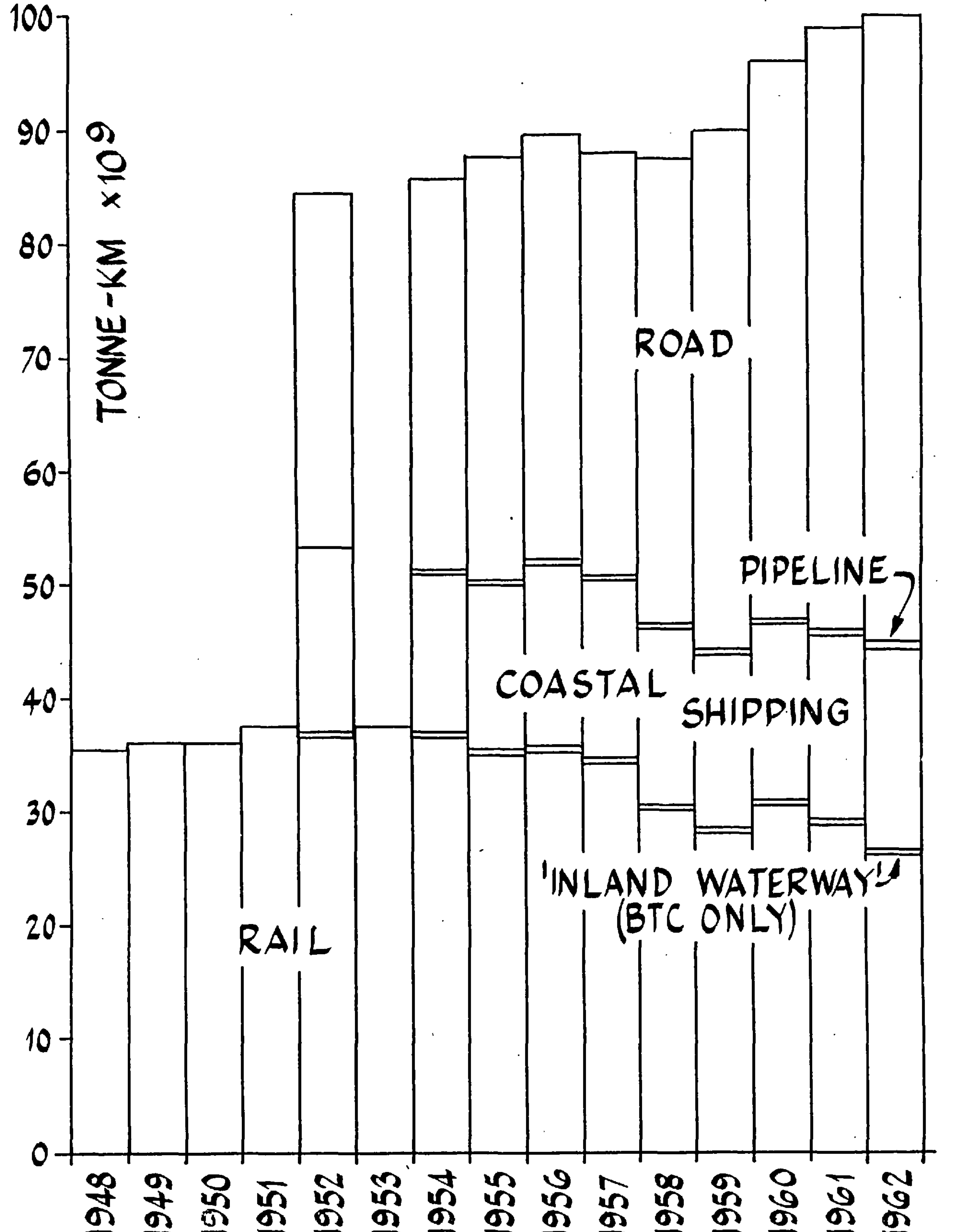


Figure 6: Great Britain, freight tonne-km, by mode, 1948-1962.[21]

for the first time. The Inland Waterways Association (IWA) had been founded in 1946[23] to promote the widest possible use of all British waterways. It was now seen to be possessed of great spirit and growing influence. Its chairman had already publicly criticised the policy of the DIWE as unimaginative,[24] though this in turn brought the scornful retort from a carrier that amateurs should confine their enthusiasm to 'roses and castles and the Basingstoke Canal.'[25] Thus the IWA emerged as a third party, allied neither to the DIWE nor to the carriers (at least not to those operating on the broad waterways).

The most contentious issue, in IWA eyes, was the fate of those canals, long past commercial use, which the DIWE were obviously preparing to abandon. Mance had called for a classification system in his bold proposals in 1949, and two years later, the DIWE classified their waterways in just this way.[26] In a review of the BTC 1951 annual report, an estimate was made of the operating results for each of four classes of waterway (Mance's three groups plus a fourth consisting of the Caledonian and Crinan Canals):

TYPE	PROFIT	LOSS
Commercial waterways	£255,000	
Waterways worth retaining for strategic or network purposes		£80,000
Closed or non-commercial		£315,000
Caledonian and Crinan		£46,000

Table 4. British Transport Commission waterways, operating results by type, 1951 (27).

Thus the necessity to maintain the commercially useless waterways turned a potential £175,000 annual operating profit into a £186,000 loss. When reviewing policy since nationalisation, the DIWE chairman, observing that 1900 km of BTC waterway carried 98% of the traffic, questioned the proposition that a transport undertaking should be required to divert transport profits to the support of redundant waterways.[28]

The obviously growing threat of closure of several hundred kilometres of waterway brought a strong reaction from the Vice-President of the IWA, who was invited to address the Royal Society of Arts early in 1953,[29] an indication of the status achieved by the Association in less than ten years' existence. In the published version of what was undoubtedly a polemic paper, a strongly-worded case was made out that all was not well within the DIWE, as instanced by a defeatist approach to gaining new traffics, poor maintenance, narrow-mindedness, and lack of capital.[30] Damning figures were quoted for advertising budgets within the BTC:

MODE	ADVERTISING BUDGET COMPARED WITH EARNINGS	
Rail	1d per £1.14.0	(0.25%)
Road	1d per £3	(0.14%)
Waterway	1d per £7	(0.06%)

Table 5. British Transport Commission, advertising budgets compared with earnings, by mode, c1952 (31).

A determined drive to build up multi-purpose use was advocated as the only salvation for the waterways, and examples of IWA activities were given. However, not all the criticisms contained in the published paper were actually advanced at the meeting, an omission which can have done little to endear the IWA to the DIWE.[32]

In the ensuing discussion, which was joined by speakers representing a variety of interests including commercial and pleasure craft operators, and members of the DIWE and IWA, there was a fair measure of agreement with what had been said. The chairman of the DIWE, Sir Reginald Hill, stated that about £7M had been spent on the main lines since 1948 and re-iterated his question about the financing of non-transport waterways by transport interests.[33] Mance briefly outlined the reasoning which had led to his advocacy, in 1949, of a modern version of the Cross, but on this occasion lamented the fact that opportunities for appropriate industrial siting had been lost during the intervening period. In contrast to his earlier views, his opinion was that

> 'It would be, of course, reckless folly to spend that money [£20M to £25M] now on canals' (34).

1953 marks the beginning of the end of the experiment with an integrated transport system. The 1951 election had put the Conservatives back into power and, not surprisingly, they began to dismantle the structure of nationalised industry. Their 1953 Transport Act was designed to return to private enterprise the BTC's highly profitable road haulage business and to decentralize railway administration.[35] 1953 also saw the abolition of the BTC's Executives (except that for London Transport) and the transfer of their powers to the Commission.[36] The original DIWE was split into two sections - Docks and Waterways.

2.3 The Rusholme Report (1954)

In the following year the Commission at last accepted that no realistic waterway policy could be created from arbitrary rules and assumptions, but must be based on an appraisal of the role of each length. They accordingly appointed a Board of Survey, which reported in November 1954. This report, (the 'Rusholme' report), after a close look at each waterway, suggested that future policy should recognise four essentially different types of waterway and treat each group in an appropriate manner. These groupings were:

GROUP	TYPE	LENGTH (KM)
1	Commercial - to be improved	541
2	Some commercial use - to be retained and maintained	1600
3	Redundant	1241
4	Caledonian and Crinan Canals	[111]

Table 6. British Transport Commission waterways, Rusholme report groupings, 1954 (37) (see also Fig. 7).

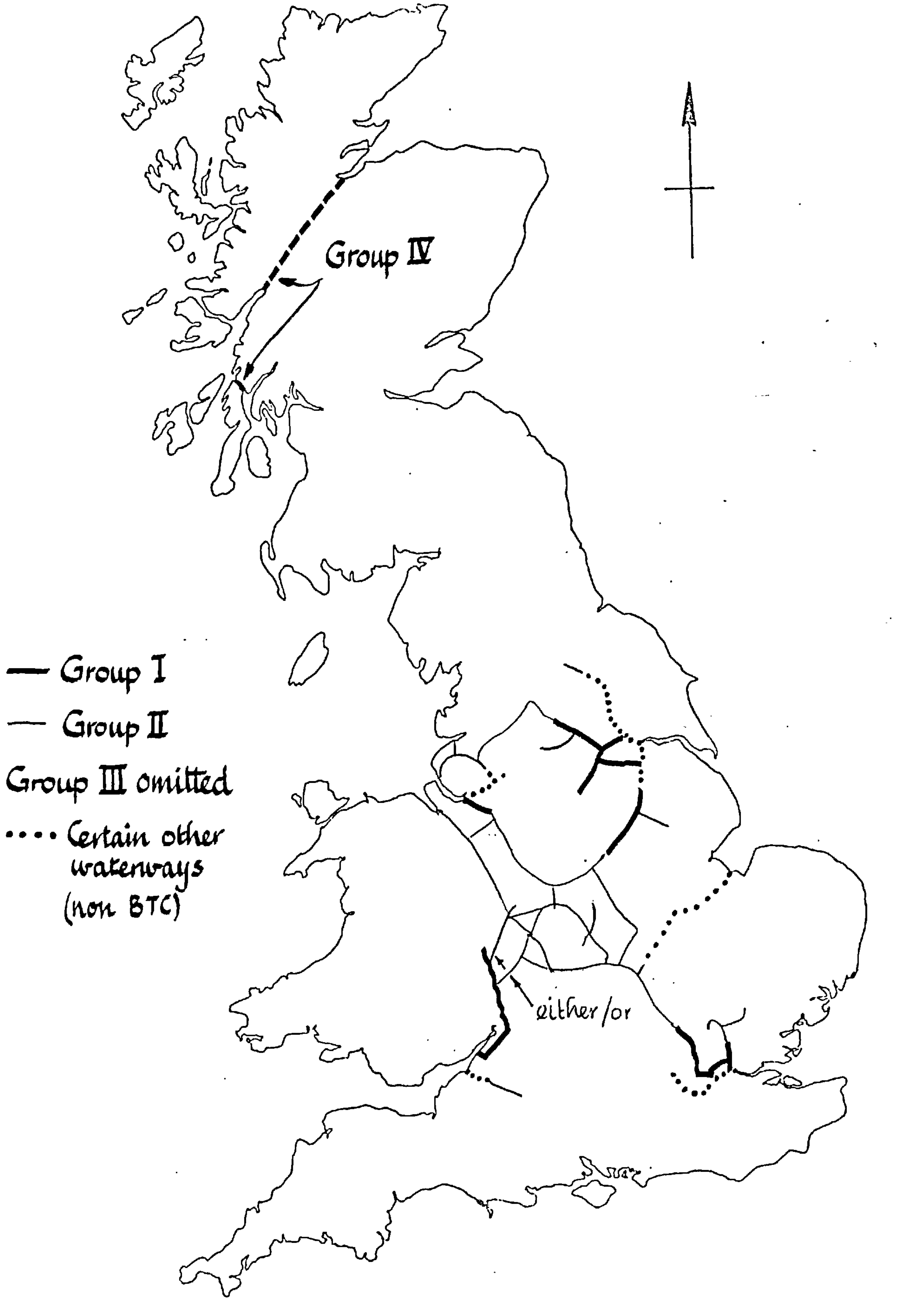


Figure 7: Sketch map showing Rusholme Report groupings, 1954.[37,38]

The Board's main recommendations followed from this classification system. They suggested that to the Group 1 waterways be added certain assets currently managed by the Docks section: Sharpness Docks, Gloucester Docks, Gloucester & Berkeley Canal, Goole Docks, Lower Ouse Improvement, Weston Point Docks and Regent's Canal Dock.[38] Thus Groups 1 and 2 would then form a national system with a clearly defined transport role. The Board also felt that the Secretary of State for Scotland should rightly accept responsibility for Scottish canals (Caledonian, Crinan, Forth & Clyde, Monkland and Union). These and the other Group 3 waterways were incurring annual losses of about £240,000.[39] Other recommendations concerned administrative reforms within the BTC.

As has been shown, the principle of assessing a waterway's potential before deciding its future had been proposed at least as early as 1949. Nevertheless, the Rusholme report's endorsement of this principle seemed to lend it a respectability hitherto lacking. The BTC acted within a year, announcing further developments on the Trent, Leeds & Liverpool Canal, Aire & Calder Navigation, and the Severn. This was just to be the beginning; the staff of British Transport Waterways (BTW - successors to DIWE) was described as being 'actively engaged in the formulation of many large improvement schemes, as recommended by the Board of Survey.'[40]

The Assistant Managing Director of a lighterage company attacked these first-stage proposals, claiming they were designed to assist BTW's own carrying operations, rather than to improve the track to the benefit of all carriers.[41] Although a predictable reaction from a carrier, the claim was not fully justified as the original announcement included the improvement of the Aire & Calder to 250-tonne standard to Leeds and to 170-tonne to Wakefield. Moreover, when details of the 'large improvement schemes' became available, it could clearly be seen that track improvement was the goal of the programme. £5.5 M was allocated to be spent as follows:

WATERWAY	EXPENDITURE
Aire & Calder Nav'n	£765,000
Sheffield & S. Yorks Nav'n	£614,000
R. Trent	£595,000
R. Weaver	£387,000
Grand Union Canal (lower)	£1,396,000
R. Lee (lower)	£852,000
Severn and Gloucester & Berkeley Ship Canal	£891,000

Table 7. British Transport Commission, waterway development programme 1956, planned expenditure, by waterway (42).

The allocation of type of work was as follows:

TYPE OF WORK	EXPENDITURE
Dredging, widening, realignment, weir repair	£3,345,000
Lock enlargement	£1,105,000
Dredging craft and plant	£636,000
Dry docks, slipways etc	£414,000

Table 8. British Transport Commission, waterway development programme 1956, planned expenditure, by type of work (42).

This was presented as a five-year plan, but although its overall cost estimate was raised to £6M in 1958,[43] by 1961 only £4.25M had actually been spent.[44]

2.4 Commodities carried by waterway

The mid-1950s can now be seen as an important point in the history of inland water transport in Britain. Nearly a decade of nationalisation had seen the decline in traffic on BTC waterways halted (see Figs. 4 and 5). Although as yet unsolved, an approach had been made to the difficult problem of deciding the fate of the narrow canals, whose falling traffics offset gains on the broad waterways, and whose operating costs swallowed up the profits earned on those parts of the system which had a real future as transport routes. Nevertheless, unified management had achieved a great deal, culminating in the launching of the five-year plan. To appreciate why this did not signal a period of expansion of waterway carryings, it is necessary to examine the commodity classifications of the traffic carried by waterway (see Fig. 8).

2.4.1. Solid fuels (coal, coke, patent fuels and peat)

From the middle of the nineteenth century, coal had been the mainstay of canal trade. Mines were fairly widespread, and consumers even more so, as not only was every house heated by coal, but the majority of factories depended on coal-fired steam plant for power. The economic expansion in the post-war period gave the fuel trade a boost, but oil, gas and electricity had made great inroads into coal's traditional markets, and 1953 marks the peak coal traffic on BTC waterways. For coal alone, National Coal Board figures for the period 1948 to 1953 show inland waterway tonnages roughly constant while total coal consignments rose by over 10% (see Table 9).

YEAR	BY INLAND WATERWAY	TOTAL CONSIGNMENTS
1948	3,455,534	193,416,644
1949	3,322,453	201,840,420
1950	3,301,182	204,549,714
1951	3,513,482	209,988,180
1952	3,437,413	209,264,695
1953	3,369,022	214,181,240

Table 9. National Coal Board, tonnages of coal consigned by inland waterway compared with total, 1948-1953 (46).

The National Coal Board ascribed the inland waterways' falling share of the coal traffic to reduced consignments to power stations;[47] the British Electricity Authority explained this by referring to the NCB's policy of closing coaling basins and increasing charges for

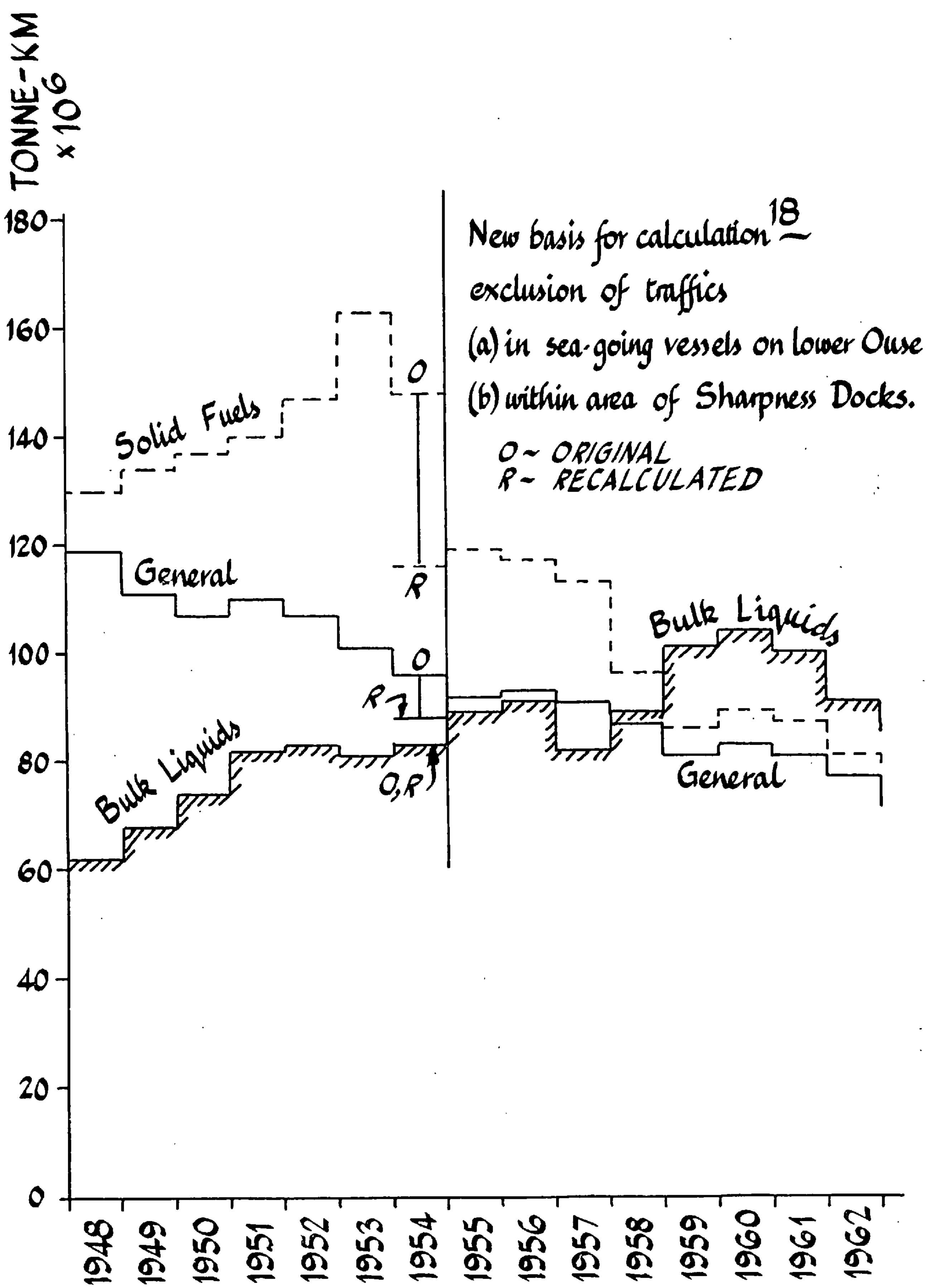


Figure 8: British Transport Commission waterways, freight tonne-km, by commodity, 1948-1962.[45]

coal moved to waterheads.[48] Table 10 shows the weakening status of waterways as carriers of coal to power stations.

	ESTIMATED TOTAL OF WATERBORNE COAL TO POWER STATIONS	
YEAR	TONNES	% OF TOTAL INTAKE
1939	1,465,000	9.5
1947	2,032,000	7.1
1953	2,148,000	5.7
1960/1	1,642,000	3.4

Table 10. Great Britain, waterborne coal to power stations, 1939-1960 (49).

Thus even in the traditional field of the bulk coal movement, water was not successfully competing with road and rail.

2.4.2 Bulk liquids (mainly oil)

The post-war growth of oil traffics did much to encourage the view that waterways had a new and important transport function, and to offset the decline in solid fuel carryings. Figure 8 shows the BTC share of this traffic, but there was a more extensive traffic on the estuarial waterways outside BTC control.[50] By 1950, about 650,000 tonnes per annum were moving inland annually from the lower Humber and another 400,000 tonnes from Avonmouth. The Thames boasted about 200 oil tankers carrying up to 500 tonnes each. Some BTC waterways benefitted strongly from these estuary-based traffics (oil contributed 64% of traffic on the Severn above Gloucester), but on the whole the capacity of BTC waterways was too small for this traffic to be held. The tonnage of oil carried on all BTC waterways at this time was about 2 million tonnes.[51]

2.4.3 General merchandise

Here road transport strongly eroded waterway carryings. The growing use of the lorry was reinforced by the relocation of facilities away from water routes, remarked on by Mance in 1953. The commodity category is, however, a broad one, embracing some successful bulk cargo types such as aggregates, as well as many types better carried by road or rail, eg the smaller scale and local consignments.

Thus the oil traffic was a stop-gap while solid fuels and general cargoes declined. Only major investment in waterway track (or, possibly, direction of traffic) could have reversed this situation. By condemning carriers to operate on track little changed since its construction a century or two earlier, the decline was made inevitable, as road transport, and to some extent rail transport too, had been enabled to raise its productivity dramatically, even since the war. By contrast, waterway cross-sections effectively limited both speed and payload (whose product gives a crude measure of output); lock reconstruction and channel realignment could not alter these basic limiting factors.

2.5 Independent waterways

The post-1948 history sketched out above has been based largely on data relating to BTC waterways, but the independent waterways must not be forgotten. Detailed information is not easy to collect, but some examples can be quoted. The Manchester Ship Canal, normally regarded by British Civil Servants as a port, had an erratically growing traffic during the period under consideration, assisted by the opening of the Queen Elizabeth II dock near the canal entrance at Eastham, though barge traffic on the Canal fell (see Fig. 9). The returns for its subsidiary, the Bridgewater Canal, are given in Figure 10.

The River Colne Navigation, tidal throughout, serves several quays along its length as well as the Hythe at Colchester. Tonnage figures are not available, but the growth of its income from dues showed a five-fold increase between 1948 and 1962 (see Fig. 11). One factor contributing to this increase was doubtless the £143,000 spent on improvements to the navigation between April 1946 and March 1964; over £90,000 was spent on quay reconstruction, £26,000 on dredging and allied equipment, and £4,000 on a mobile crane.[56]

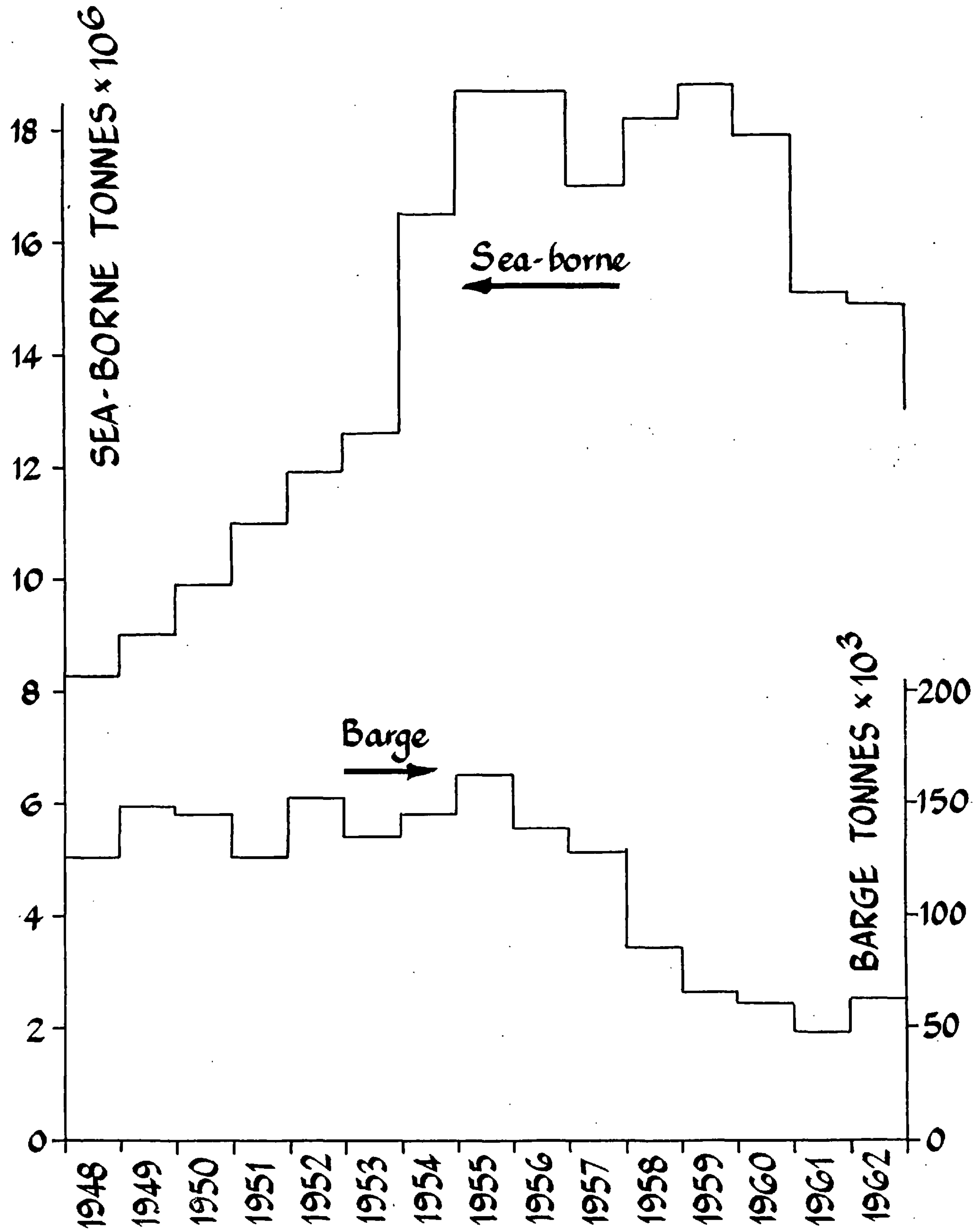


Figure 9: Manchester Ship Canal, sea-borne and barge freight tonnages, 1948 - 1962.[52]

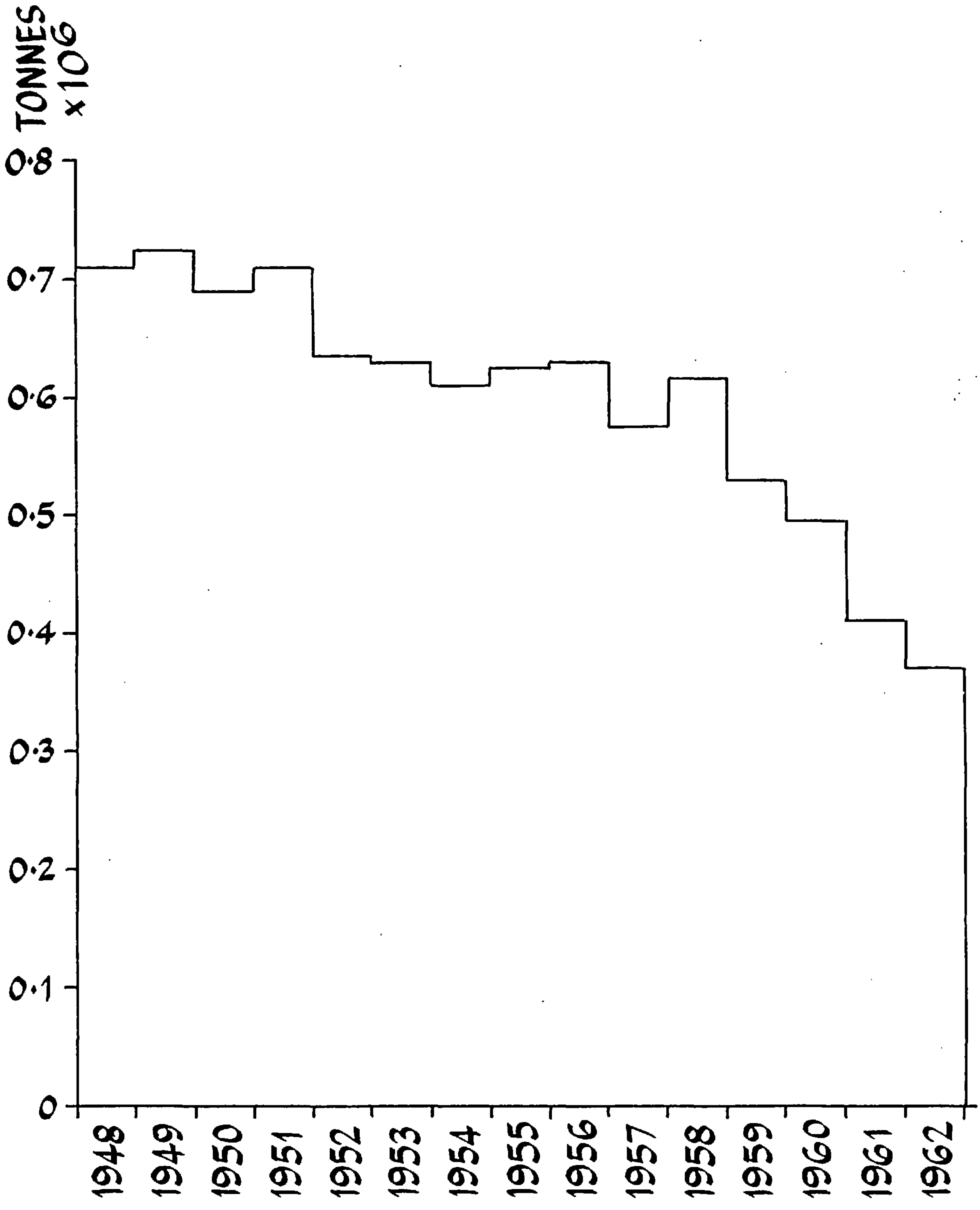


Figure 10: Bridgewater Canal, freight tonnages, 1948-1962.[53]

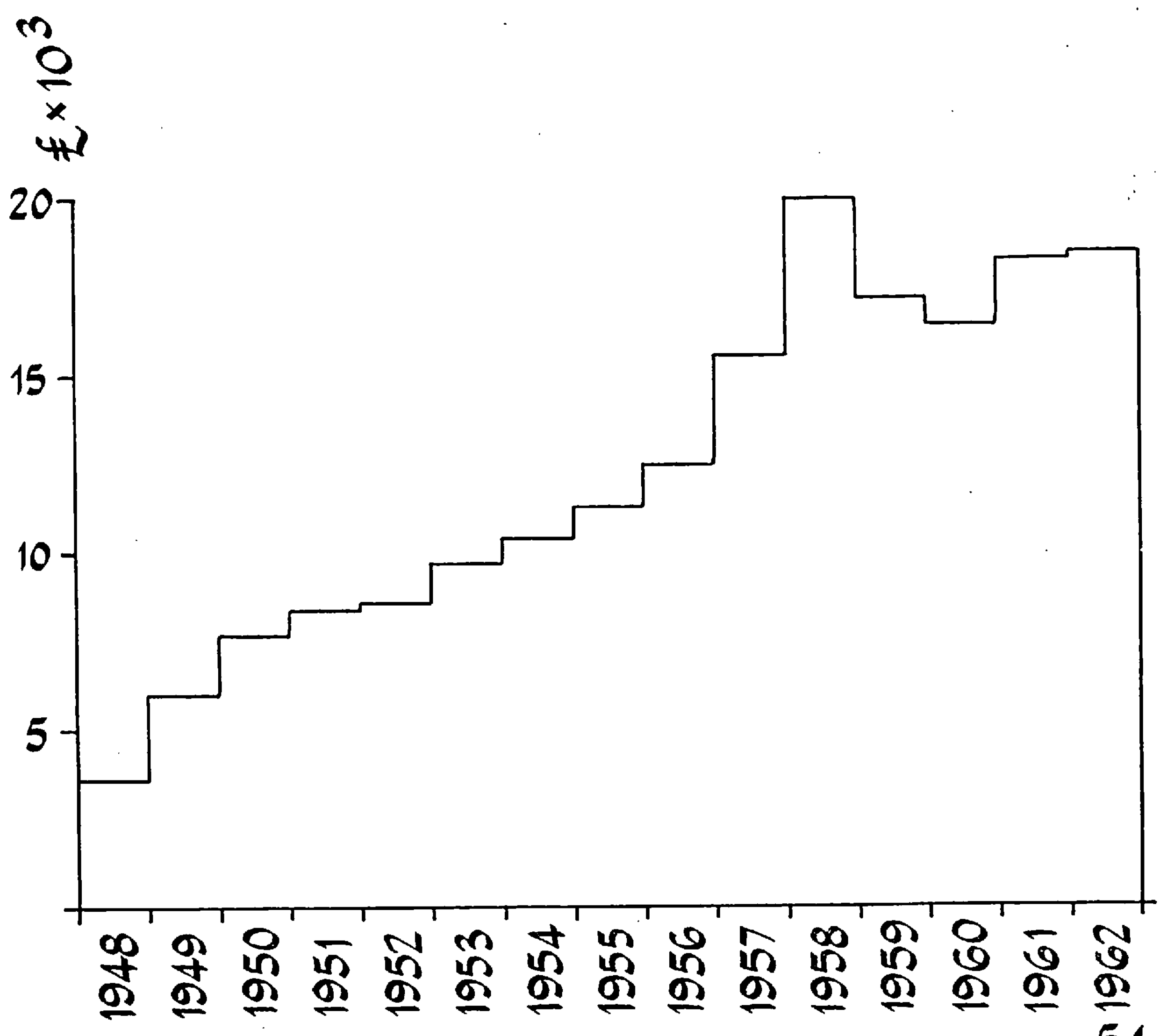


Figure 11: River Colne Navigation, dues income, 1948-1962.[54]

Note: incomes for years shown are for 12 months ending 31 March of following year.

The Dartford & Crayford Navigation, a short partly tidal waterway leading off the Thames, depends on the lighterage trade for its business. Its traffic returns for the period show little change, though exhibit a fluctuation of about ±10% (see Fig. 12). On the tidal Thames itself the lighter freight tonnage was estimated, in 1961, to be 15 to 17 million tonnes per year.[57]

This brief survey of independent waterways is not designed to be comprehensive, but to provide a representative sample of independent waterway fortunes during the period as a complement to the well-documented performance of the British Transport Commission. The leading features are summarised in Table 11. This table suggests that the larger waterways, open to sea-going vessels or lighter traffic from ports, were enjoying a growing trade whereas the smaller waterways, traditionally geared to truly internal traffics, were rapidly becoming obsolete.

2.6 The Bowes Report (1958)

The Rusholme Report of 1954 had made classification recommendations and, as we have seen, this provided the impetus for a capital investment programme on the Group 1 (commercial, profitable) waterways. The fate of the Group 2 (non-profitable, but to be retained) and Group 3 (redundant) waterways aroused a controversy which led to the appointment of a Government Committee of Inquiry in February 1956.[58] Their report, the 'Bowes report', was published in July 1958.

Its conclusions were not strikingly different from those of the Rusholme report. The BTC waterways were divided into three groups, with the same general reservations about the Scottish canals. These groupings are shown below, compared with those of the earlier report (see also Fig. 13).

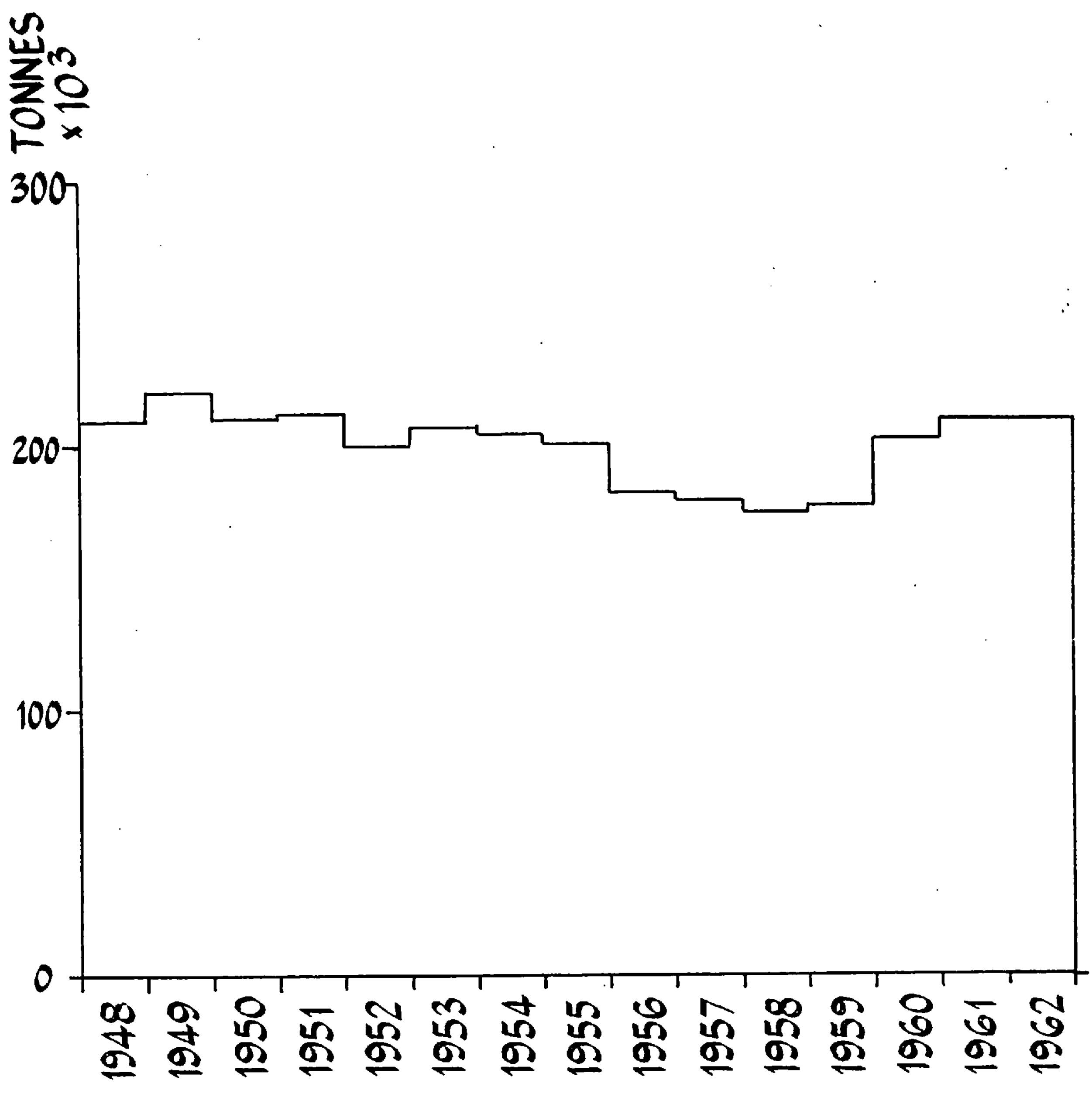


Figure 12: Dartford & Crayford Navigation, freight tonnages, 1948-1962.[55]

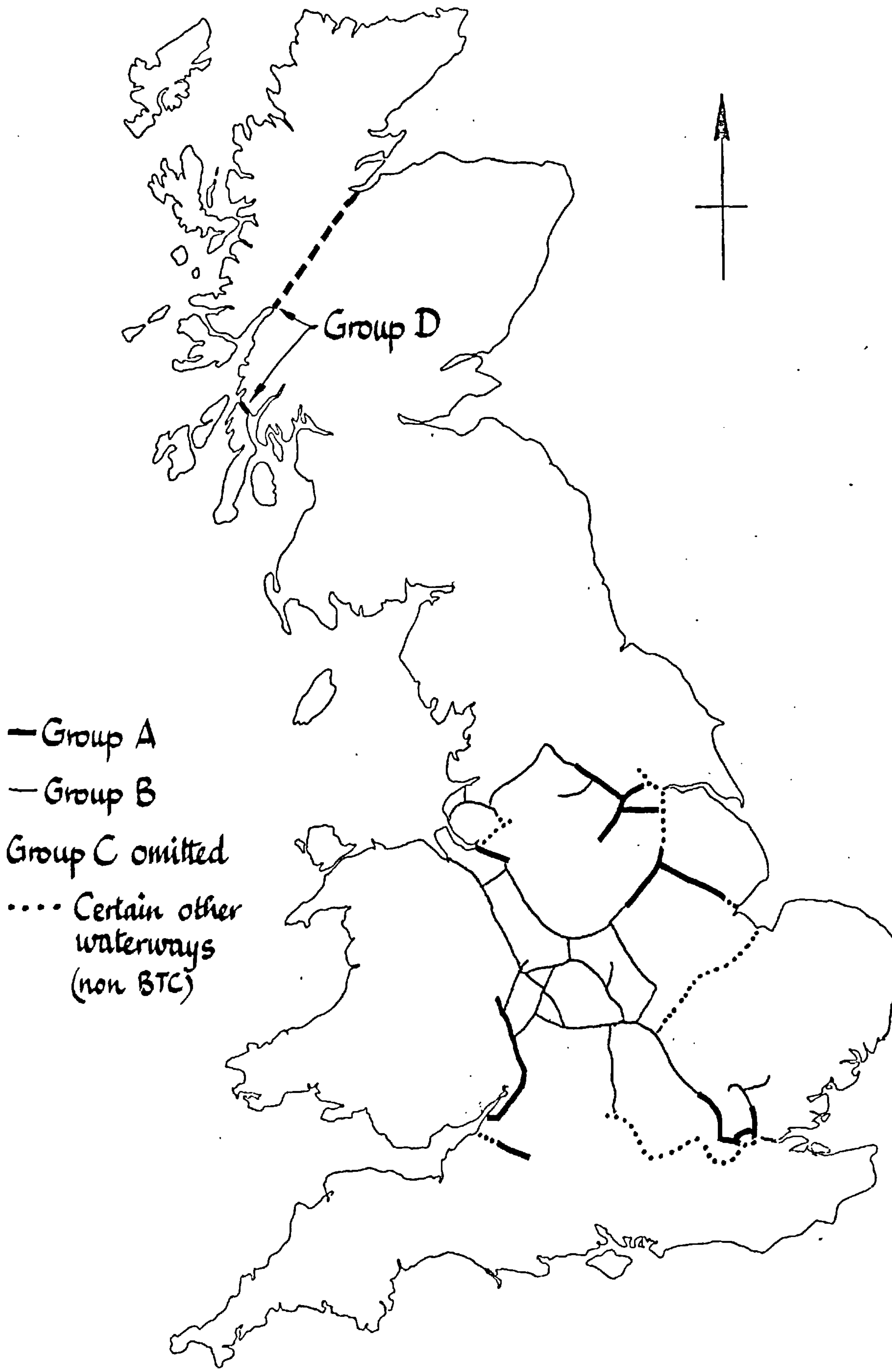


Figure 13: Sketch map showing Bowes Report groupings, 1958.[59]

WATERWAY	TYPE	OWNER	LENGTH (KM)	APPROX. CAPACITY (TONNES)	FREIGHT TONNAGE 1962 (TONNES)	FREIGHT TONNAGE 1960/2 as % of 1948/50	NOTES
BTC	Mixed	Nationalised	3495	25 to 1000	9,412,000	82%	
MANCHESTER SHIP CANAL	Ship canal	Private	58	12,000	14,911,011 62,959	176% 41%	Sea-borne Barge traffic
BRIDGEWATER CANAL	Barge canal	Private	84	80	371,075	60%	
R. COLNE NAVIGATION	Tidal navigation	Local Authority	18	800	n.a.	309%	Percentage relates to dues
R. THAMES (tidal)	Estuarial navigation	Public Authority	74	>1000	15,000,000-17,000,000	n.a.	Tonnage is 1961 estimate for lighters
DARTFORD & CRAYFORD NAVN.	Extended dock	Commission	6	550	210 986	97%	

Table 11. Great Britain, selected waterway statistical summary, 1948-1962 (for sources see text)

BOWES, 1958			RUSHOLME, 1954		
GROUP	TYPE	LENGTH	GROUP	TYPE	LENGTH
A	To be retained; capital programme to continue	612	I	To be improved	541
B	To be restored to full order	1505	II	To be retained and maintained	1600
[C]	The rest to be handed over to the Redevelopment Board	[c1265]	III	The rest to be disposed of	1241
[D]	Caledonian and Crinan - to be state funded	[111]	IV	Caledonian and Crinan - to be handed over to Sec. of State for Scotland	[111]

Table 12. British Transport Commission waterways, Bowes report groupings (1958) compared with Rusholme report groupings (1954) (59).

The Committee recognised that the lack of a secure future was a major deterrent for carrier and client alike and therefore recommended that Groups A and B

> 'should be put into good working order, and maintained to prescribed standards, for not less than twenty-five years' (60).

As well as giving the current capital investment programme their blessing, the Committee advised the undertaking of two technical and economic investigations: the enlargement of the Grand Union Canal to Birmingham to 90-tonne capacity, and an 'improved link' from Wolverhampton to the Mersey via the River Weaver.[61]

Government response to these suggestions was not very encouraging. The twenty-five year guarantee was not granted, the recommendations for the Scottish canals were to 'receive consideration', but the two improvement schemes were to be studied within the BTC. Perhaps the most positive step related to the redundant waterways; an Inland Waterways Redevelopment Advisory Committee was to be established.[62]

2.7 The 1962 Transport Act

In 1960, a Government White Paper hinted at the impending dissolution of the BTC,[63] and this uncertainty as to the future prompted a member of the Board of Management of British Waterways (Boards of Management had replaced Executives within the BTC) to deliver a paper the following year on the future of the waterways.[64] This set out to describe, in general terms, the status of the waterways, to plead for the establishment of a policy towards waterways, and to place on record the extensive social services provided by them. These services included water conservation, agricultural water supply and recreation facilities, for which no or minimal revenue was obtained. After a strong attack on then current IWA theories (not actually described as such) that waterways offered the cheapest transport, could all be made to pay, and were cheaper to restore than to infill, the author concluded with the important observation that the major problems could only be resolved by 'Government decision and Parliamentary action', not by the exercise of any option then open to the Board. The paper is thus a stimulating one, designed to inform and influence in order to assist in the creation of as favourable a basis as possible for the new authority about to emerge from the ruins of the BTC.

The Transport Act of 1962 dissolved the British Transport Commission, replacing the Boards of Management with four separate Boards and a Transport Holding Company, all directly responsible to the Minister of Transport.[65] Thus the British Waterways Board (BWB) came into being, taking office from the beginning of 1963.

2.8 Conclusion

Although, in 15 years, the British Transport Commission had not achieved for the waterways as much as some, in early days, had hoped for, its record is not discreditable. Amalgamation had produced some benefits, overall traffic levels had been largely maintained, and the problem of the redundant waterways nearly solved. Given the relative unimportance of waterways compared with the docks, let alone with the railways, it is not surprising that the waterway managers within the BTC did not succeed in obtaining the major investment looked for by Mance and others. With the benefit of hindsight, the first few years of the Commission's existence would seem to have offered the best time to request investment, as the century-old decline in freight carryings had at last been reversed. Small independent waterways fared no better than those nationalised, but many flourishing waterways were outside BTC control, while the Commission's larger waterways were financially hampered by redundant routes. This had the result of preventing transport earnings being reinvested in track improvement, and of perpetuating an image of waterways as narrow, old-fashioned, ill-maintained and obsolete. While this image prevailed, neither the man in the street nor the man in Whitehall could envisage inland water transport as complementary to road, rail, air and pipeline.

CHAPTER 3: BRITISH COMMERCIAL WATERWAY POLICY AND ADMINISTRATION 1963 to 1975

3.1 The British Waterways Board, 1963-1968

The newly formed British Waterways Board took office in January 1963. Between the passing of the Transport Act and its implementation, an assessment of its impact on the waterway scene was made by W.L. Ives, who had been appointed as Assistant General Manager of the new Board.[1] His major point of criticism was that the most pressing issues facing the nationalised waterways had not been tackled, let alone resolved, by the Act. While welcoming some of the changes introduced, Ives pointed out that the financial situation of the Board would be poor, but without a policy towards commercial development, towards social services provided virtually free (water conservation etc) and towards redevelopment of the Bowes report's Group C and parts of Group B (see section 2.6), no attempt could be made to establish economic priorities or to dispel the uncertainty surrounding the multiplicity of functions performed by the nationalised waterways. It is striking that Ives chose to close his analysis with the same words he had used a year previously (before the Act had even been introduced to Parliament as a Bill):

'There has been too much uncertainty for too long'[2]

Clearly, then, the Act had failed to prepare fully a path for the Board to follow, though it had smoothed out some of the bumps. The Board, in certain ways more independent than its predecessors, though still of course responsible to the Minister of Transport on policy matters, set about its task of restructuring with vigour. It had been given, by the Transport Act, five years' exemption from the requirement to balance its books.[3] This lent a certain urgency to the Board's task of formulating proposals for a new approach to managing and financing the waterways - a task which turned out to be the basis for new legislation to make good the policy deficiencies of the 1962 Act.

One of its first moves was to cease carrying by narrow boat and to disband the fleet.[4] As the obvious implementation of numerous recommendations made since the War, this may have been regarded as having been long since overdue, but its significance lies in its being the overt abandonment of a national system of canal transport. Hitherto, the BTC or BWB could rightly have claimed to be offering nationwide commercial service (even if this were little used); from 1963 it restricted its carrying activities to the wider waterways of the North-East Midlands and South-West. It is true that many ex-BWB boats were leased, or later sold, to independent carriers, and although it is still possible to charter commercial craft over a large portion of the network, those on the narrow canals can not be said to offer a nationwide service, and their licence revenue to the BWB is nowhere near sufficient to provide for the necessary track maintenance. Thus 1963 marks the end of a commercial service over the whole network, even though the finances of the service had been ludicrous for many years.

This formal end to a transport network seems to have been reflected in general attitudes to waterways. Little interest was shown, as instanced by contributions to technical journals, in either the current waterway scene or its prospects. In contrast to the informed, if occasionally heated, exchanges of the previous decade, the 1960s yielded little discussion of commercial possibilities for inland waterways. This can in part be correlated with the growth of pleasure boating; the public was slowly beginning to see the canals as providing sites for water-based leisure activities, to the relief of the long-established but hard-pressed Thames' and Broads' facilities.

The Board continued its self-examination and in 1963 submitted to the Minister of Transport an interim account of its work to date;

this was published early the following year.[5] This interim report was in no way intended to represent any firm policy proposal, but to clear the ground, to establish the leading facts about the options open, and to solicit the views of interested parties. Waterways with major transport use are listed, totalling about 600 km[6] (see Fig. 14). No pretence is made of their commercial viability; in 1962 they had lost about £200,000.[7] Another 600 km with some transport use are scheduled,[8] but one indication of the new approach taken by the Board is the suggestion that future policy should be guided not solely by transport potential, but by the possibility of maximising multipurpose use. In its adoption of this view, the Board was in no small way echoing the ideas put forward by the IWA in the early 1950s.

The report also contains certain reservations about the commencing capital debt inherited by the Board. At £19.2M, this required an annual interest payment of nearly £750,000.[9]

The interim report was followed two years later by the final report.[10] The changes in the intervening period are reflected in the reduced length designated as 'commercial': this now totalled 433 km[11] (see Fig. 15). However, in contrast to the comparable classification in the earlier report, this reduced group was now considered to be capable of earning an annual operating profit of about £120,000 (before interest payment).[12] These waterways, the Aire & Calder, Calder & Hebble, Sheffield & South Yorkshire, Trent, Weaver, Lee, Gloucester & Sharpness, and Severn, would become part of a Commercial Division, which would also include the Board's docks, fleets, warehouses and estates. The whole Division was estimated to be capable of producing a net maintainable revenue of £136,000 after payments of £357,000 interest on a capital value of £5.95M.[13]

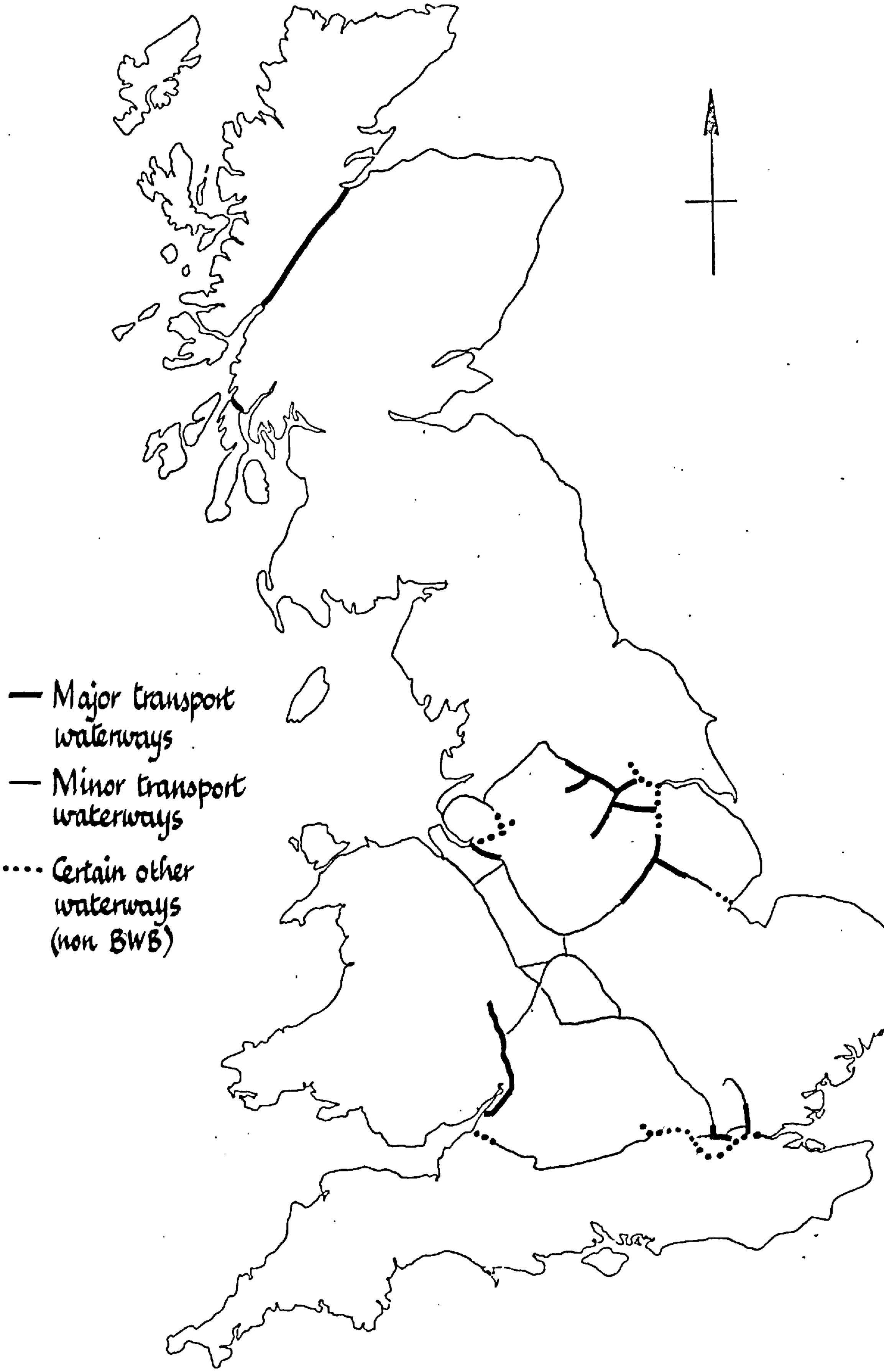


Figure 14: Sketch map showing '<u>Future of the Waterways</u>' groupings, 1963.[6,8]

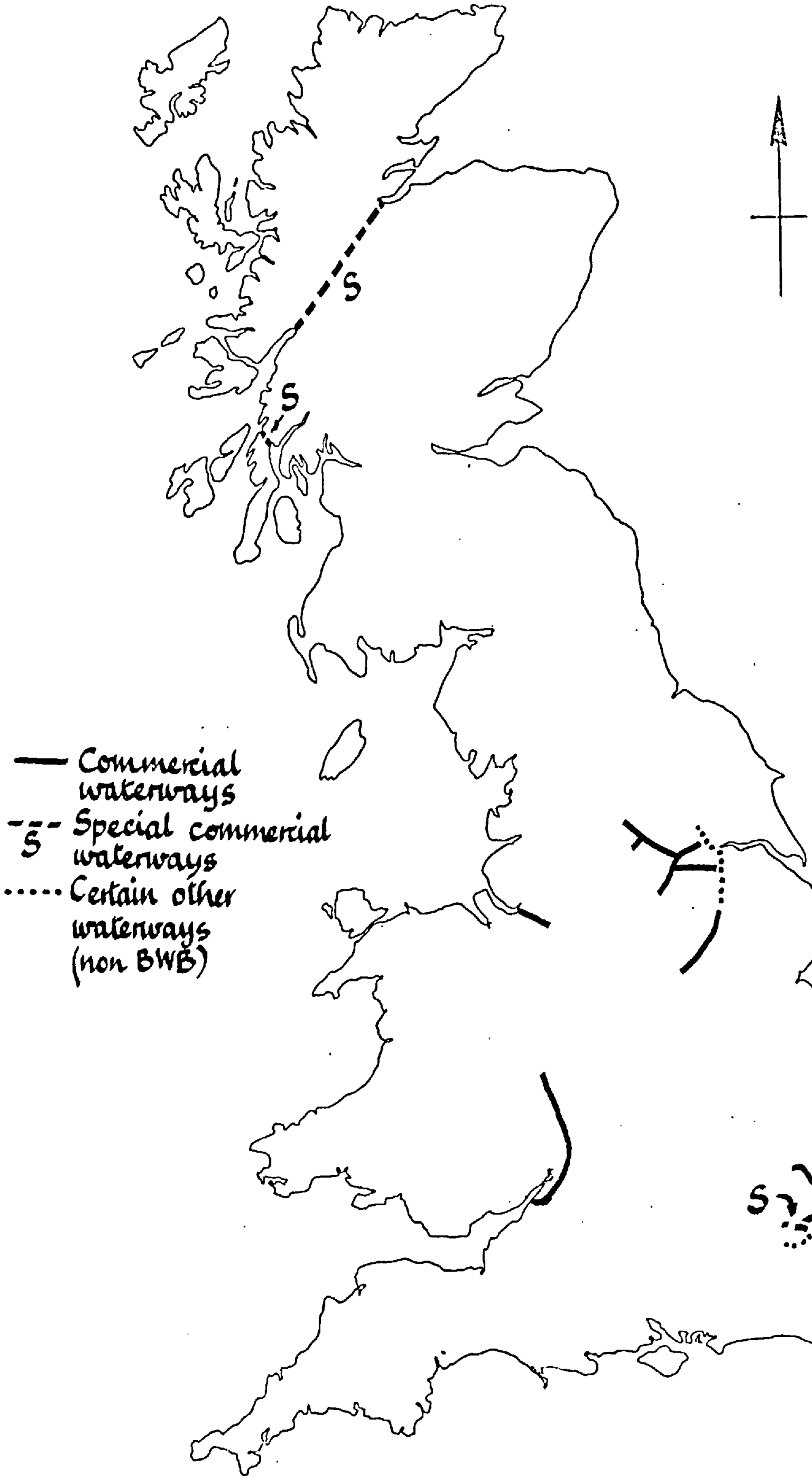


Figure 15: Sketch map showing '<u>Facts about the Waterways</u>' groupings, 1965.[11,14]

A small secondary group of waterways are described as 'special commercial'; they owe this designation to having a real transport function coupled with a hopeless financial situation. The report recommends that these, the lower Grand Union, Caledonian and Crinan Canals, be subject to a specific annual operating subsidy of about £150,000.[14] To so designate the Scottish canals was only to be expected as they had for many years been acknowledged liabilities - the Crinan had last had an operating profit in 1919, the Caledonian in 1914.[15] In contrast, the exclusion of even the lower Grand Union Canal from the commercial group marks a dramatic change. It was the Grand Union, linking London's docks to Midlands coal and industry, which had received financial assistance between the Wars; it was the Grand Union which had received by far the largest allocation under the BTC improvement scheme (see Table 7). The disbanding of the narrow-boat fleet and the description of the lower Grand Union Canal as hopelessly uneconomic indicate most clearly the end of an era. From now on, inland water transport would only be carried on by vessels whose size restricted them to specific areas.

For the other waterways, the report does not re-examine the cruising network concept introduced in the interim report,[16] but instead produces the evidence on costs to enable any network decision to be correctly based. This evidence, which makes up over half the entire report, consists of a canal-by-canal analysis of the costs of operation, of water channelling (ie maintaining the canal as a water course but not as a navigation), and of elimination. The result of this exercise is to show that the <u>minimum</u> cost to the nation of the non-transport canals would be £600,000 p.a., if the cheapest course of action were followed (being elimination, water-channelling or preservation as appropriate).[17] To maintain nearly 1900 km for pleasure cruising would add £340,000 to this inescapable minimum.[18]

The financial prognoses then become:

TYPE	LENGTH (KM)	ANNUAL OPERATING RESULT
Commercial	433	£120,000 profit before interest
Special Commercial	165	£150,000 subsidy required
Remainder currently navigable	1895	£600,000 inescapable cost £340,000 extra cost of maintaining for cruising
SUB-TOTAL: NAVIGABLE	2493	
Remainder currently non-navigable	767	(Not applicable)
GRAND TOTAL	3260	

Table 13. British Waterways Board waterways, classification by type in '<u>The Facts about the Waterways</u>', 1965 (19).

3.2 The Transport Act of 1968 and its effect on the British Waterways Board

The work the Board put in on its two reports was of great value to the Government in the preparation of further legislation in the transport field. Between 1966 and 1968, six transport White Papers were published, two of which related to the fate of the nationalised waterways.[20] The first of these was general, dealing with transport policy as a whole;[21] however, although it accepted much of the Board's thinking, it did not (by demanding five-yearly reviews) provide the security which any network of cruising waterways would require. Consultations, as planned, followed publication of this policy statement. These in turn resulted in the production of the other five White Papers, the first of which was devoted entirely to describing how a substantial waterway network would be retained for amenity use - with the necessary security ensured by abandoning the call for periodic review.[22]

These important recommendations were embodied in the 1968 Transport Act. As far as waterways are concerned, this is possibly the most revolutionary piece of legislation on the statute book, in that amenity use alone is accounted as sufficient grounds for maintaining a considerable length. The Act divided BWB waterways into three classes: commercial, amenity and remainder.[23] The commercial class, totalling 545 km, was compounded of the Board's commercial plus 'special commercial' groups with the exclusion of the lower Grand Union Canal.[24] Thus successive recommendations that the Caledonian and Crinan Canals be recognised as in need of specific support (possibly via the Secretary of State for Scotland) had been ignored. The Board had pointed out that these two canals were between them losing £75,000 annually,[25] and that

> 'Unless the whole pivot of the commercial structure we have suggested (ie the commercial part really having a proper chance of earning a reasonable commercial return on its assets) is to be jolted out of true, then it follows in our opinion that the commercial part cannot safely accommodate any more losing waterways' (26).

However, the Board's capital debt was reduced below its own expectation to £3.75M, and the costs of the cruising network were to be met from public funds.[27] At about 2000 km, the amenity track far exceeded the commercial track, another factor to reinforce the growing public view that waterways have an amenity rather than a transport role in the late twentieth century.

Since the Transport Act there has been little dramatic change on the Board's commercial waterways, merely a steady decline. Regent's Canal Dock, which had recently received substantial investment in new cranage and improvements to the entrance lock, was officially closed in 1969.[28] (There is, however, still some commercial activity in the dock, but this is now credited to the cruising waterways, which together account for about 3% of the freight handled by BWB.[29]). In the same year the Board's Severn fleet was disbanded.[30]

The Board did not regard its decline passively, but implemented a number of significant improvements on its commercial waterways. For example, a major new coal contract was arranged in 1964 on the Aire & Calder,[31] but the receiving tippler at Ferrybridge 'C' power station (not the Board's responsibility) has given a lot of trouble with long periods of inactivity.[32] On the same waterway two years later a major new oil contract was negotiated with Esso and the carriers Harkers and Whitakers, the Board agreeing to carry out improvements to allow 500-tonne craft to work on this contract to Leeds (this being twice the capacity previously admissible).[33] On the Gloucester & Sharpness, a new wharf was built at Monk Meadow,[34] and a turning bay for 64.3m long by 9.1m beam tankers built at Quedgeley.[35] Enlarged dock facilities were provided at the western terminal of the Caledonian Canal for the import of timber to a pulp mill.[36] This was in service in 1964.[37] The isolated position of the Caledonian has always made it a transit waterway rather than a freight artery; after mechanisation of the locks, a long task completed in 1968, the number of transits rose to 1959 in 1969 compared with 1497 in 1968[38] and between 600 and 900 annually in the years 1951 to 1956.[39] A programme of deepening the Trent was started in 1969,[40] and the following year traffic increases were recorded on the Weaver as a result of channel improvement.[41]

The two most important events of the decade were undoubtedly the preparation of a project for enlarging the Sheffield & South Yorkshire Navigation (see Section 4.7.2) and the Board's decision to re-equip its general merchandise fleet in the north-east with push-tows.* These were designed by the Board's engineers[42] and

---

* Push-towing is the practice of lashing together dumb craft to form a rigid raft, and then propelling this from the rear by use of a 'push-tug'.

came into service in 1970.[43] The modular barge concept was then fused with the Board's determination to investigate the possibilities of a North Sea service without trans-shipment.[44] The result was the introduction, in 1974, of the BACAT 1, (BACAT being an acronym for Barge Aboard Catamaran), a Danish-built and Danish-owned barge carrier, geared to handling the Board's push-tow barges.[45]

Despite these activities and improvements the Board's traffic returns continued to fall in terms of both tonnage and tonne-km (see Figs. 16 and 17). In contrast, total freight movements showed a 30% rise between 1963 and 1973 (see Fig. 18).

3.3 The independent waterways

The performance of the BWB waterways is again compared with a number of other waterways of different types. The Manchester Ship Canal returns (Fig. 19) show the same erratic growth as in the previous period. Although no enlargement has been carried out since the opening of the Queen Elizabeth II Dock, considerable sums have recently been spent on container-handling facilities at Ellesmere Port and Manchester Docks, which has resulted in an annual container traffic on the canal of over 1 million tonnes.[54] Barge traffic on the canal is low but fairly stable. Commodity returns for later years include figures for movements of sludge (from sewage works etc.) by tanker, for disposal by discharge at sea. This traffic is essentially of a different nature from the normal import/export traffic. Its rapid growth is unlikely to continue; but it should remain as a waterway movement unless lost to an off-shore pipeline.

On the Ship Canal's subsidiary, the Bridgewater Canal, the last decade has seen the traffic eliminated (see Fig.20). Coal and grain were the most important commodities in recent years; general merchandise contributed little. Since the war, three waterside gas-works and two power-stations on the Bridgewater have been closed

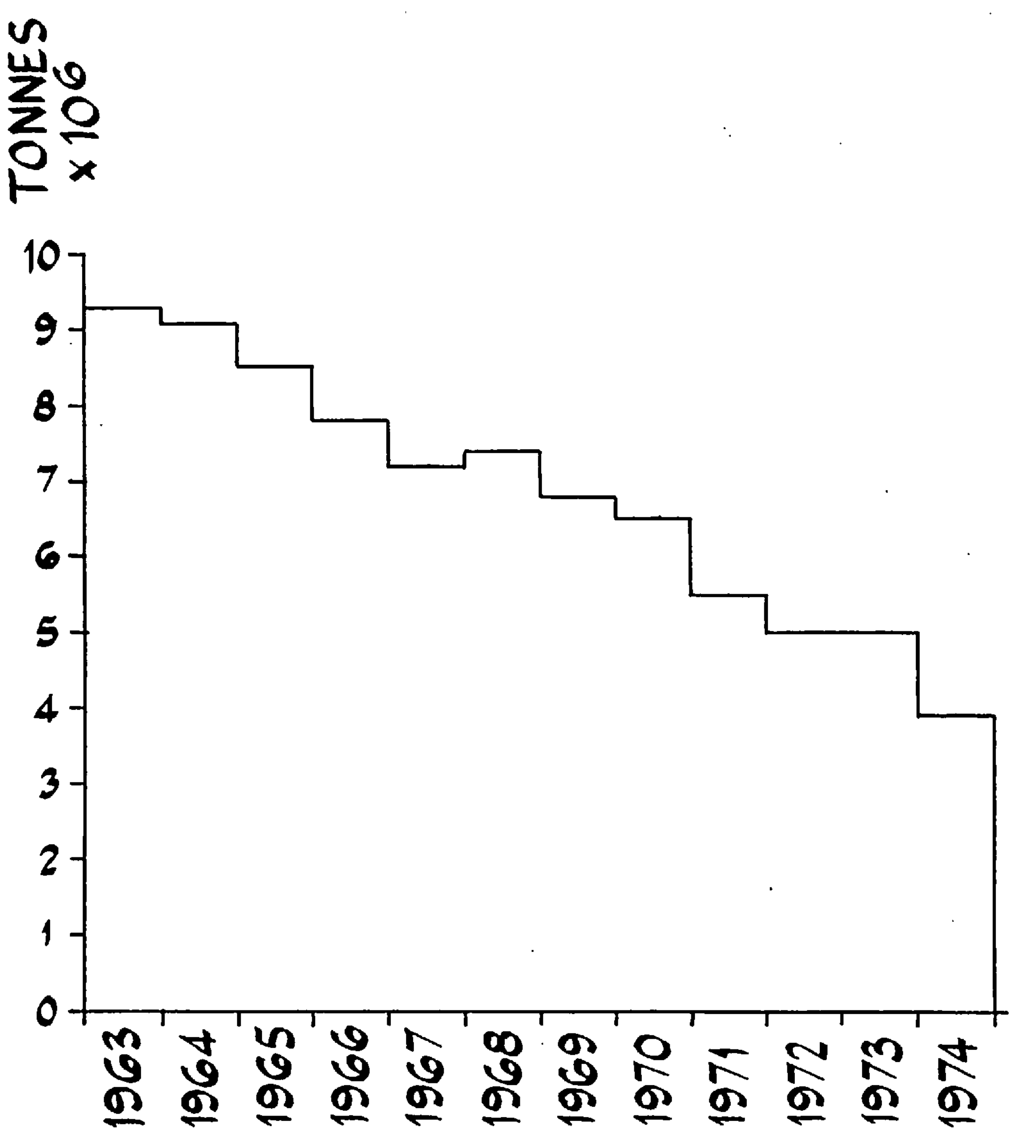


Figure 16: British Waterways Board waterways, freight tonnages, 1963 - 1974.[46]

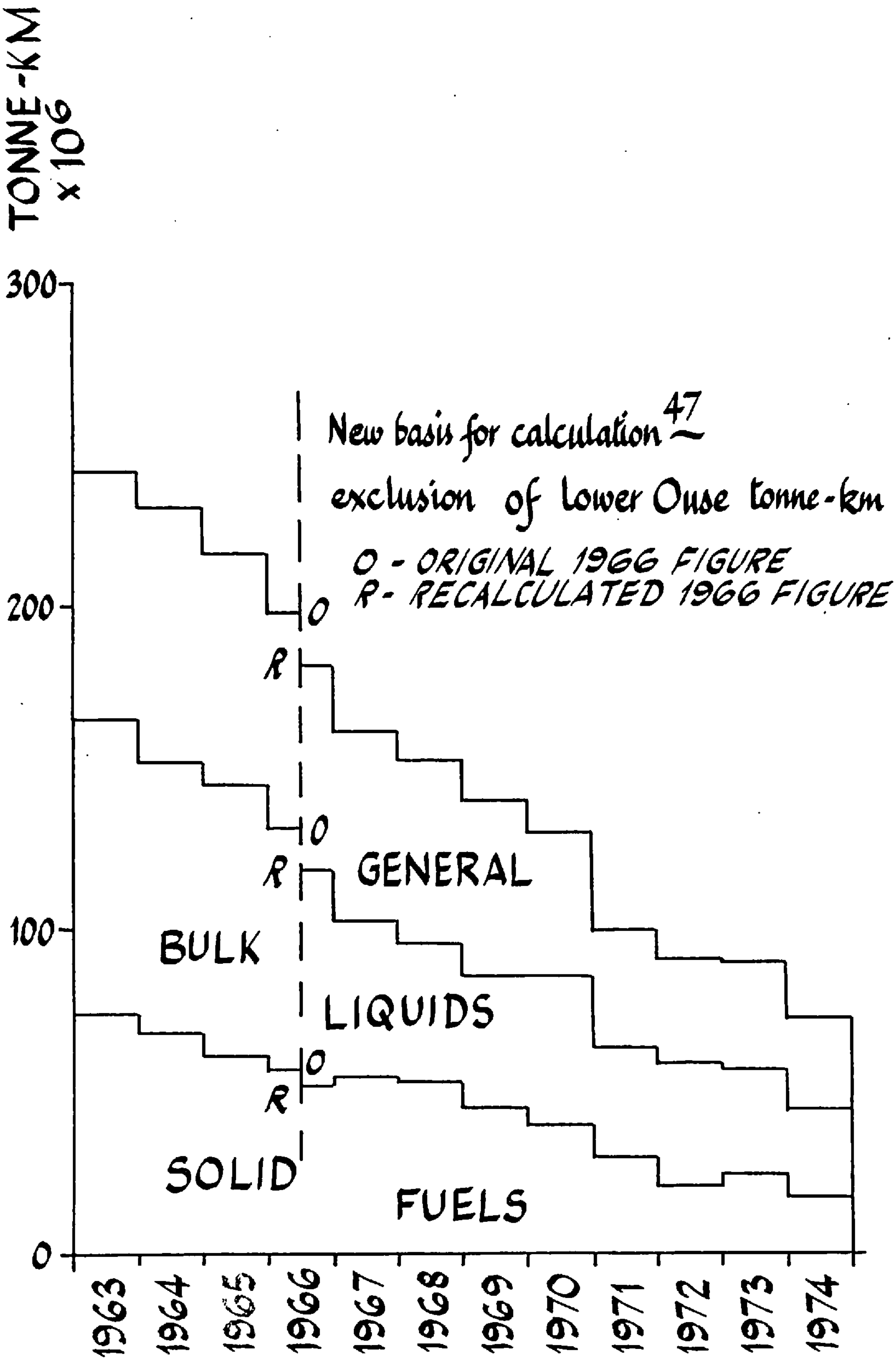


Figure 17: British Waterways Board waterways, freight tonne-km, by commodity, 1963 - 1974.[46]

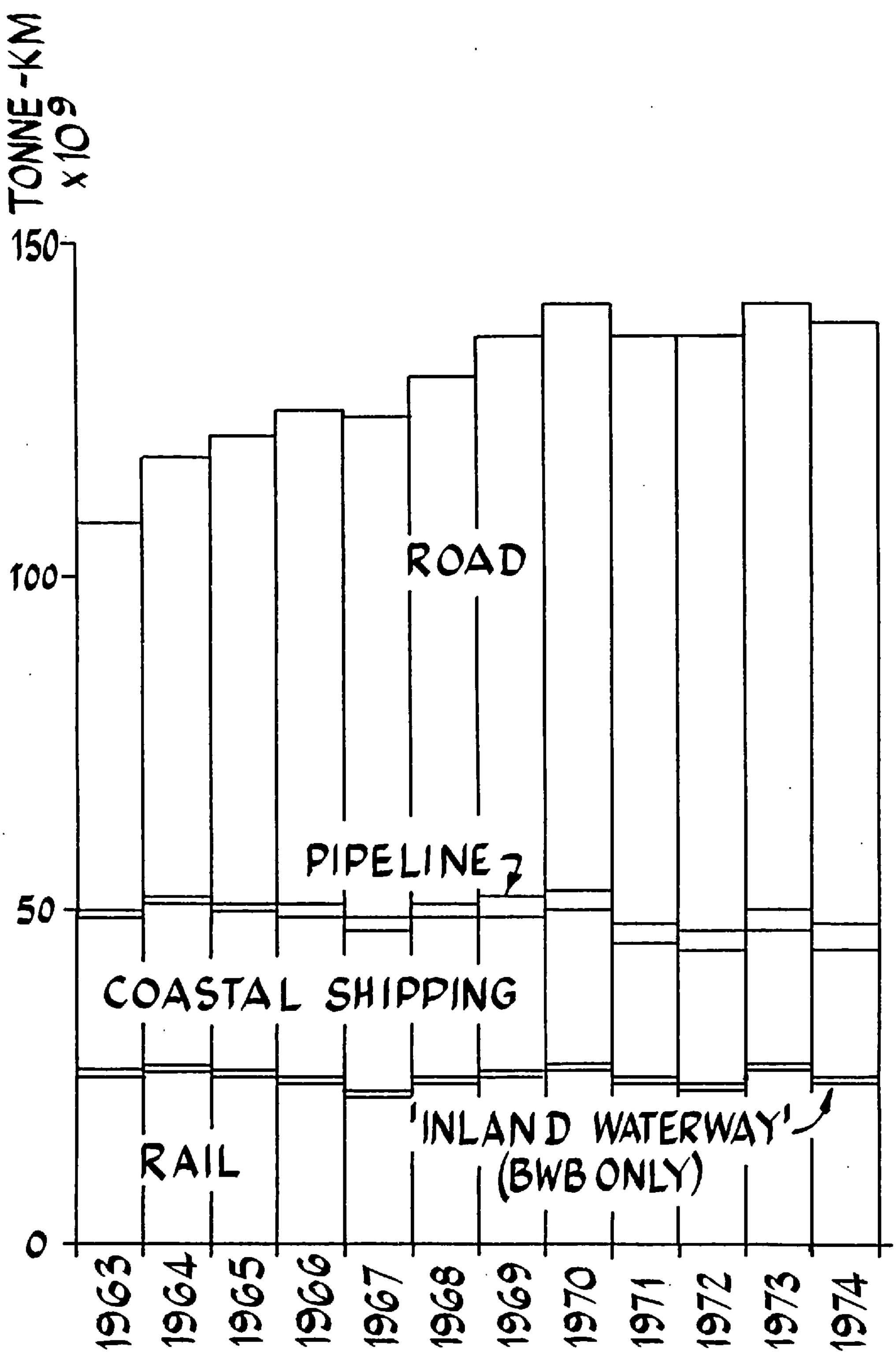


Figure 18: Great Britain, freight tonne-km, by mode, 1963 - 1974.[48]

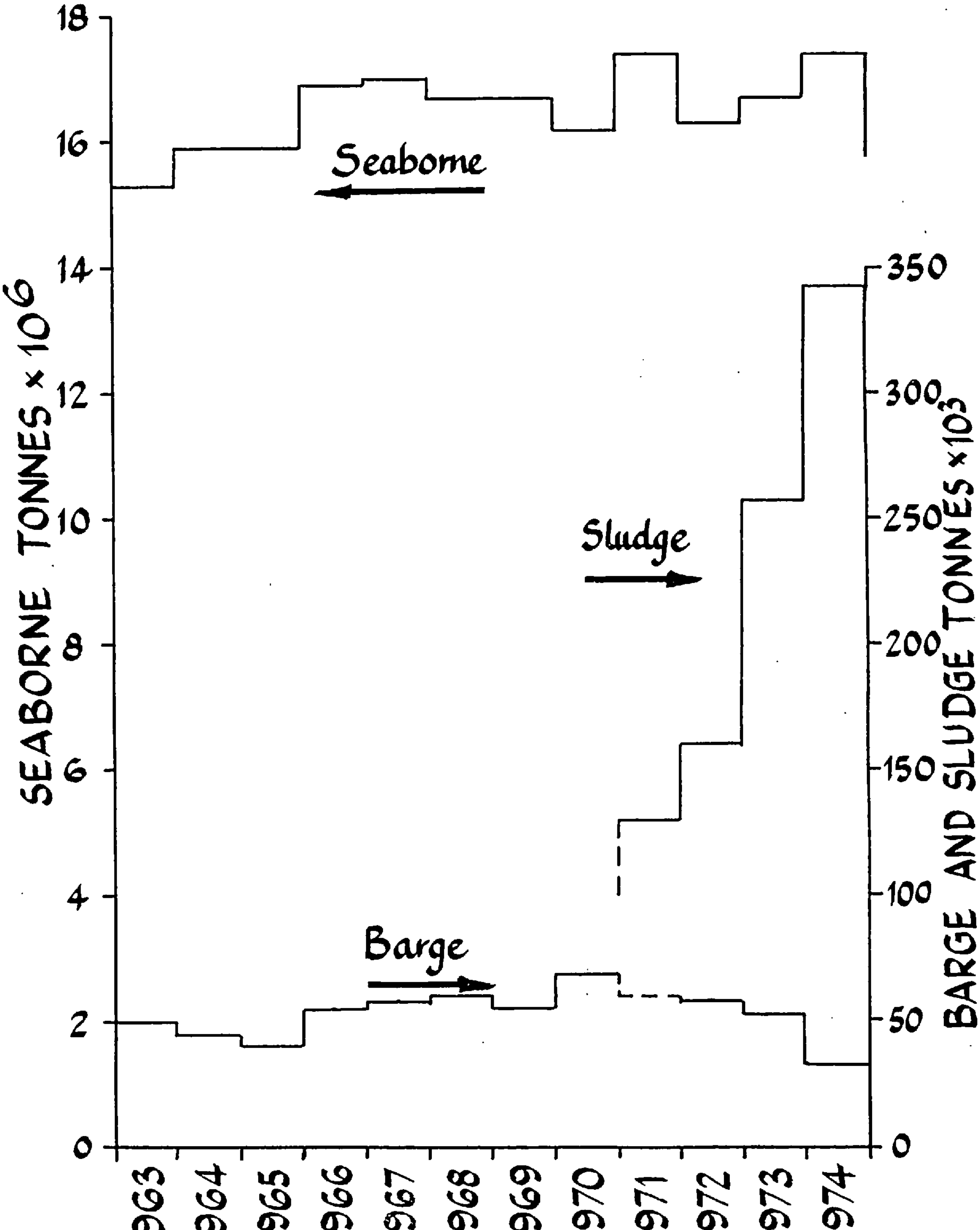


Figure 19: Manchester Ship Canal, seaborne, barge and sludge tonnages, 1963-1974.[49]

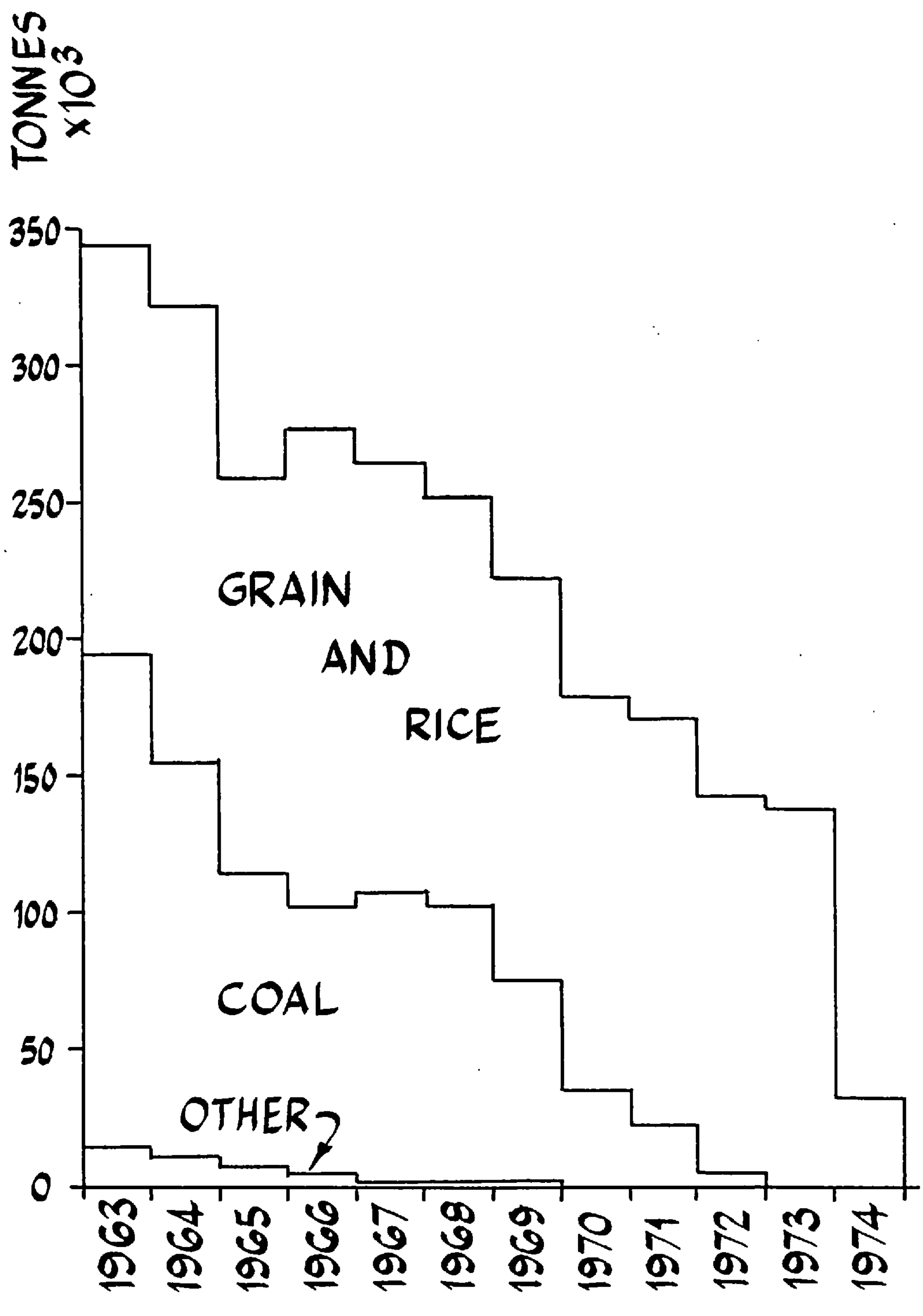


Figure 20: Bridgewater Canal, freight tonnages, by commodity, 1963-1974.[50]

and there has been a rapid run-down of local coal-mines.[55] This has resulted in falling consignments of coal by canal.

Only the grain traffic held up until 1974. This commodity was carried almost entirely on behalf of a single customer, Kellogs, whose Stretford Mill was largely fed by grain brought to Manchester Docks and thence overside to Bridgewater barges, though occasionally barges would deliver to Stretford from Liverpool.[56] (Note: overside loadings at Manchester Docks are not included in the Ship Canal barge traffic in Figs. 9 and 19). Kellogs had planned, for some years, to import via the Seaforth Grain Terminal, but labour disputes delayed its commissioning. The grain carryings continued until March 1974 when the disputes were resolved and now all the grain is road-hauled to Stretford.[57]

The River Colne Navigation enjoyed an increasing revenue during the period (see Fig. 21). For later years, tonnage figures are available showing that the use made of this waterway is more linked to general economic activity than the income figures would suggest. There is no doubt that the retention of traffic reflects, in part, improvements made to the river by Colchester Borough Council. Between April 1964 and March 1974 over £81,000 was spent on the navigation and its facilities; over half of this was devoted to the reconstruction of two quays, £11,000 on mobile cranes, £9,000 on floodlighting the navigation, £10,000 on other navigational aids (including ship-to-shore radio), and £2,000 on capital dredging.[58]

On the tidal Thames, the lighterage traffic has been reduced significantly since the early 1960s. In 1961, the annual tonnage carried by London's lighterage industry was estimated at about 16 million tonnes (see Section 2.5). The decline of coastal traffic

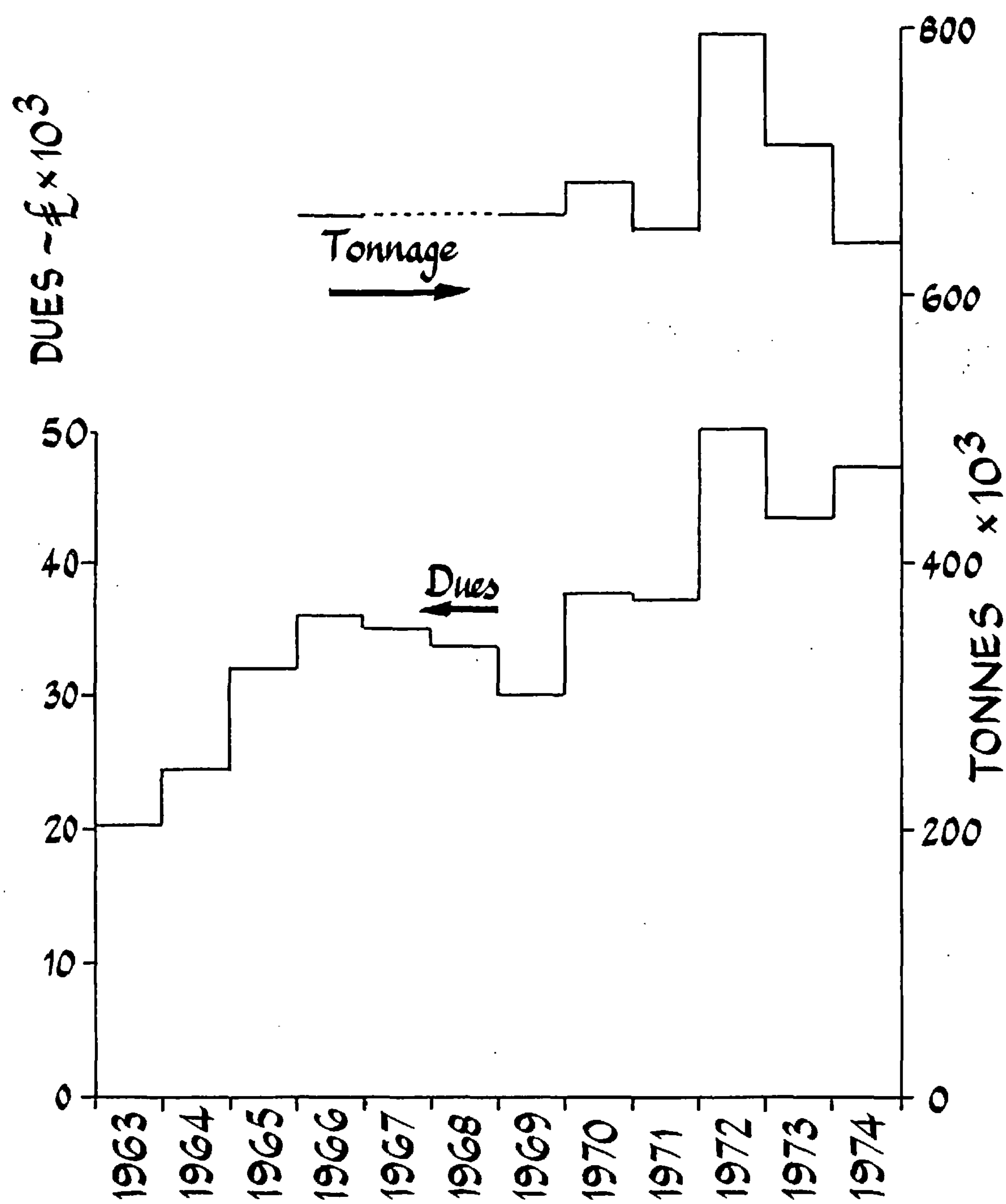


Figure 21: River Colne Navigation, dues income and freight tonnages, 1963 - 1974.[51]

Note: figures for years shown are for 12 months ending 31 March of following year.

and the use of coal in gas and electricity production, industrial disputes, the movement of Continental shipping away from London, and the redevelopment of industrial sites along the waterfront have been considered jointly responsible for reducing the volume of lighter traffic by nearly a million tonnes per year for a decade[59], though in recent years the fall in conventional lighter traffics has been slightly offset by movements of barges from barge-carrying ships (see Fig. 22). However, it seems that the most significant factor causing loss of lighter traffics has been the trend away from breakbulk cargoes and towards unitised loads. These latter, whether containerised, palletised or packaged are not suitable for carriage by conventional lighters, raising as they do problems of stowage, mechanical handling and trimming. Table 14 shows the rapid contraction of the industry both in terms of its assets and its output.

		c1957	c1960	1974
LIGHTERS -				
Open	No	4000		969
Hatched	No	2200		505
Insulated/Refrigerated	No		some	35
Tank	No	400		59
Others	No			6
Total	No	6600		1574
(Index		100		24)
Fleet Capacity	Tonnes	>1 million		325,410
Average Capacity	Tonnes	c 150		207
Largest Capacity	Tonnes	<500	500	1000
TUGS - (for lighterage)	No	390	349	70
(Index		100	89	18)
OUTPUT -				
Annual carryings*	Tonnes	c15-20 x10^6	15-17 x10^6	3,685,253
Lighter utilization (tonnes carried/tonne of capacity/annum)		c15-20		11
Tug utilisation (tonnes moved/tug/annum)		38,000 to 51,000	43,000 to 49,000	53,000

(*excluding movement of barges ex barge-carriers)

Table 14. Thames lighterage industry, leading statistics, 1957 to 1974[60]

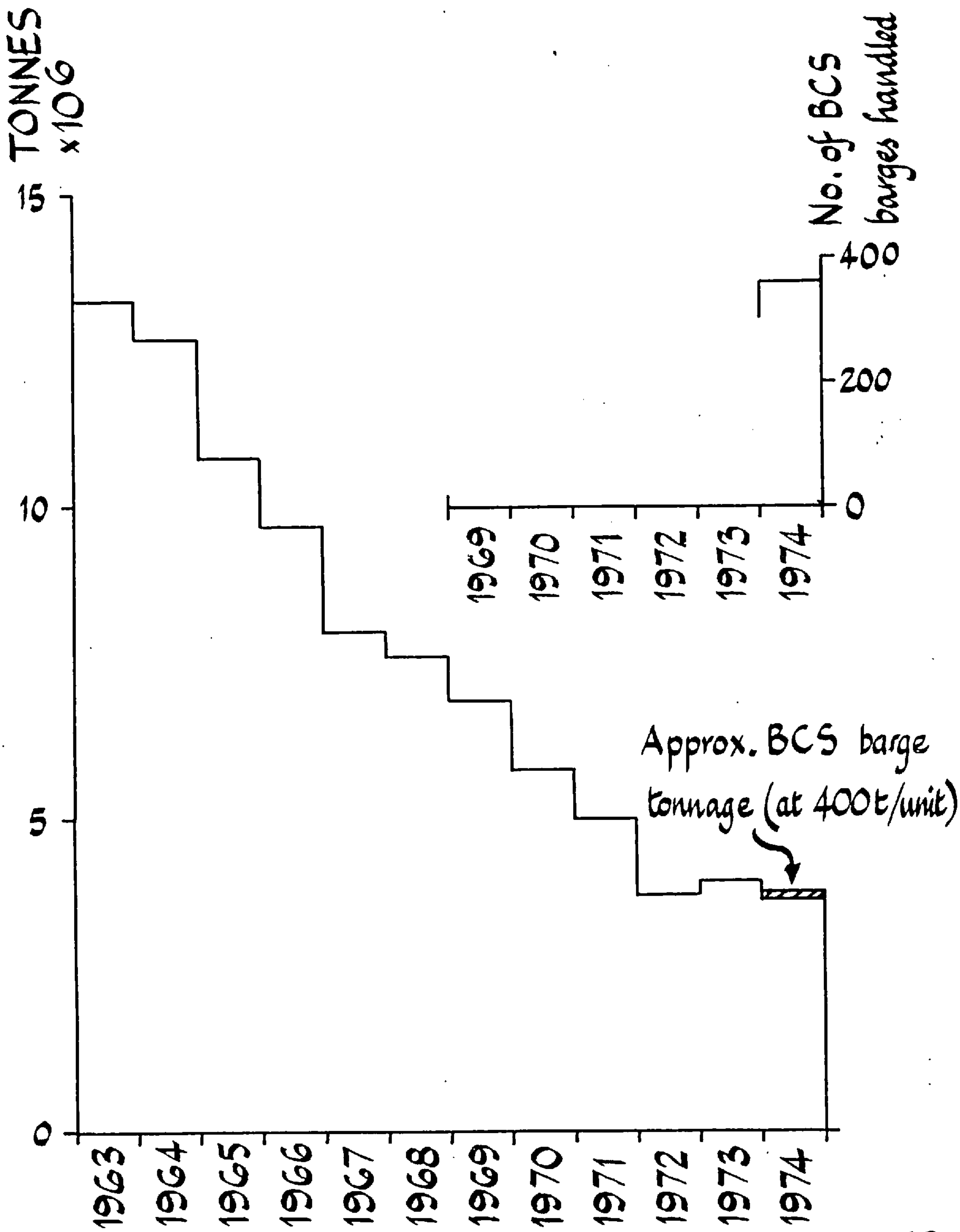


Figure 22: Estimated Thames lighter traffic, 1963-1974.[53]

This table shows a faster fall in the number of tugs than lighters. At the same time the tug utilisation (crudely expressed in tonnes rather than tonne-km) has risen, while lighter utilisation has fallen. This suggests that tug statistics provides a surer guide to the activity of the industry than do lighter statistics. This correlation accords well with a financial comparison of the two types of asset; the tug is relatively more expensive to buy and maintain and more saleable if unrequired, the lighter has lower costs and this, combined with its lower saleability, explains why large numbers of lighters may often be seen tied up and unused for long periods.

Lighterage does not, of course, represent the only internal traffic movements on the Thames; there are also motor-barge and motor-tanker services in operation, as distinct from vessels in the coasting and short sea trades which penetrate as far upstream as Isleworth.

The fortunes of the Dartford and Crayford Navigation (see Fig. 23) conform closely to the general trends observed above; declines in lighterage and in coal movements have contributed to a reduction of this waterway's traffic of nearly 50% compared with 1964 (which had the highest annual post-war total).

The leading features of the performance of these various waterways are summarised in Table 15. This confirms the continuing decline, indicated in Table 11, of smaller waterways providing internal services, whereas the larger waterways allowing inland penetration of ocean-going and coasting craft show a pattern of growth related to the prevailing economic conditions.

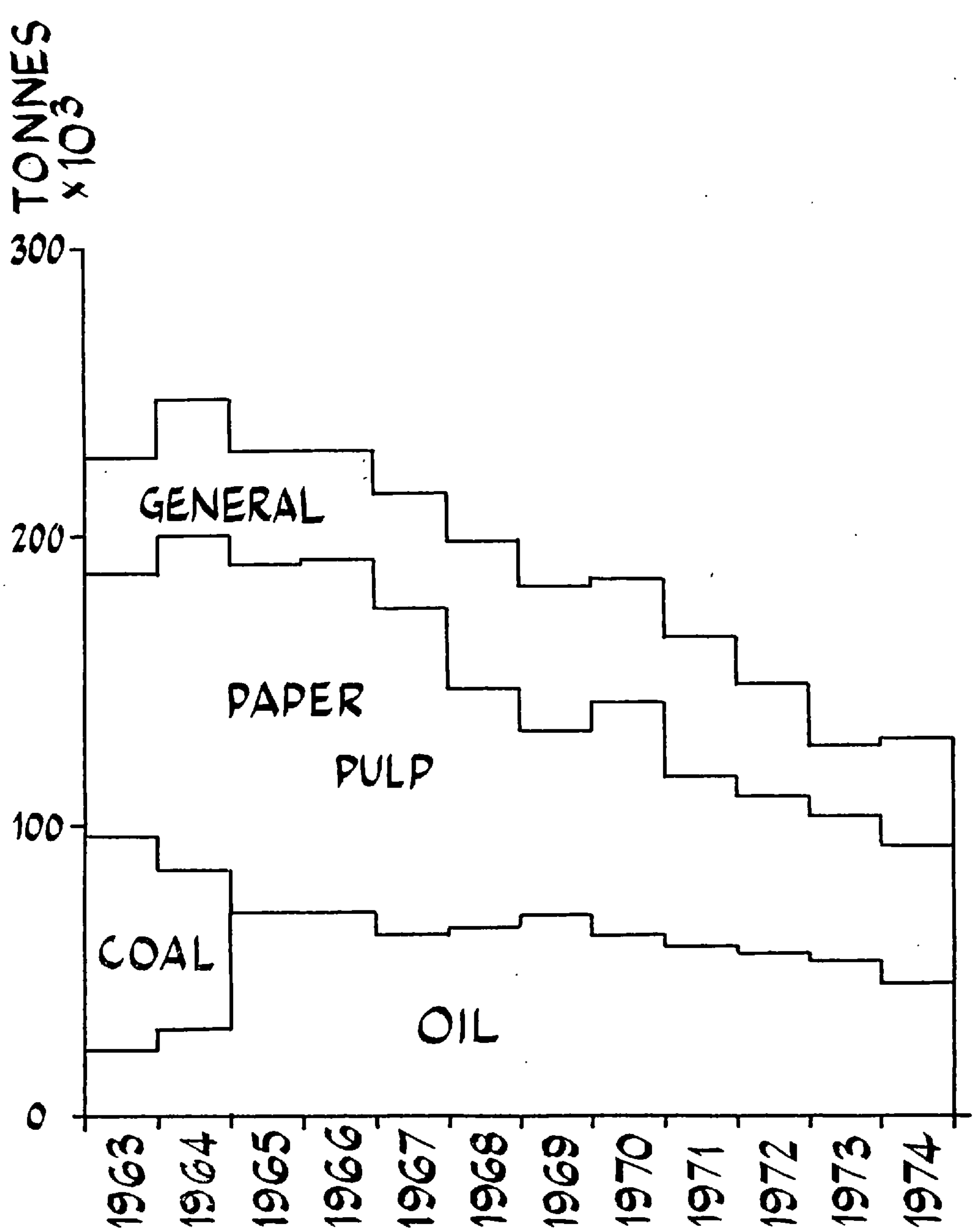


Figure 23: Dartford & Crayford Navigation, freight tonnages, by commodity, 1963-1974.[52]

WATERWAY	TYPE	OWNER	LENGTH (KM)	APPROX. CAPACITY (TONNES)	FREIGHT TONNAGE 1974 (TONNES)	FREIGHT TONNAGE 1972/4 as % of 1963/5	NOTES
BWB	Mixed	Nationalised	c650*	80 to 1000	3,862,000	51%	
MANCHESTER SHIP CANAL	Ship Canal	Private	58	12,000	17,369,123 33,059	107% 105%	Sea-borne Barge traffic
BRIDGEWATER CANAL	Barge Canal	Private	84	80	33,461	34%	
R. COLNE NAVIGATION	Tidal Navn.	Local Authority	18	800	655,310	184%	Percentage relates to dues
R. THAMES (tidal)	Estuarial Navn.	Public Authority	74	1000	3,685,253	31%	Tonnage is for lighters only
DARTFORD & CRAYFORD NAVN.	Extended Dock	Commission	6	550	129,045	57%	

*Making the simplifying assumption that the disbanding of BWB's narrow boat fleet in 1963 took the narrow canals out of commercial use.

Table 15. Great Britain, selected waterway statistical summary, 1963-1974 (for sources see text)

3.4 Public interest in waterways

The general decline of inland waterways as a third mode of transport to rival road and rail seemed widely accepted, if regretted by the BWB and certain members of the IWA, and seemed fit to continue unquestioned until about 1970. There was then a wave of concern sweeping the country, in which people were asked to re-examine their own stance and that of their society relative to the 'environment'. To those aiming for preservation of natural and man-made environments, for the husbanding of resources, and for the minimising of new investment in capital-intensive technologies, the waterways offered a ready-made cause celebre. In the past few years, claims have been made that compared with road and rail, water transport consumes less energy, is quieter, cheaper, costs less in maintenance, is 'environmentally superior', offers greater scope for multi-purpose use (both for amenity and industry), and so on. Few of these claims have been supported with much evidence, but now a plea for the development of inland water transport is included in the manifestos of many of the environmental pressure groups (eg Friends of the Earth, Conservation Society, Committee for Environmental Conservation) as well as those of comparable groups with especial interest in transport (eg Transport 2000, Transport and the Environment Group). The admission of the U.K. to the European Economic Community (EEC) in January 1973 provided more material for pro-waterway campaigning, in view of the extensive use made of this mode in other EEC countries.

As yet, it is difficult to show that such campaigning has achieved anything, but it is worth noting that not only was greater use of water transport a specific Labour Party pledge in the 1973 GLC elections,[61] but was also included in the Labour Party Manifesto in the General Election of October 1974.[62] This was the first time that one of the three main parties had adopted such a policy in recent years.[63] There are numerous other instances of similar changes from other points of the spectrum. As an example, the Central Office of Information produces reference pamphlets for distribution at home and overseas, one of which is entitled '<u>Freight Transport</u>'. The 1971 edition of this pamphlet made no reference to inland waterways; the second edition (1975) contained a good illustrated account of the work of BWB.[64]

In December 1971, the Government announced its proposals for the reorganisation of all aspects of water supply, sewage disposal, flood control etc.[65] All the hydrological functions in any area were henceforth to be the concern of a single Regional Water Authority (RWA). The existence of the BWB alongside the RWAs was considered anomalous and so its property and functions were to be assigned to RWAs.

The IWA accepted the reorganisation, but saw it as an opportunity to establish a new waterway management structure which, by embracing all waterways, would be able to act on a truly, rather than nominally, national scale. The IWA views were contained in a report submitted to the Department of the Environment (DOE) in May 1972.[66] This argued that if BWB were to be abolished, it should be replaced by a bigger and more powerful body, responsible primarily for navigation and amenity, the National Waterways Conservancy.

Later in the year, the DOE published a consultation paper in which they clarified their intentions towards the BWB and towards the amenity use of water generally.[67] This suggested the need for a body similar to the Board's Freight Services Division, even though the RWAs were to have duties to consider freight facilities.[68] The paper also recognised, without attempting to resolve, the problems raised by the absence of any uniformity in the ownership and management of waterways.[69] In view of the many previous comments on the Scottish canals, it is interesting to learn that the DOE were not only considering transferring these to Scottish administration, but also stated

> 'They are losing money and will continue to need subsidy' (70).

This consultation paper stimulated the IWA to further comment; in October they published 'Towards a Future for Inland Shipping', devoted solely to consideration of how a reorganised water industry could best serve the ends of freight transport by water.[71] To concentrate on the subject of freight transport, the IWA had recently formed a 'Commercial Carrying Group' under the chairmanship of Charles Hadfield, a former member of the British Waterways Board.[72] Not surprisingly this paper was well-argued, marred by none of the blind enthusiasm so apparent in the IWA's previous report on this subject (in 1965).[73] It examines possible futures for the BWB's Freight Services Division, recommending that it should either become a separate nationalised industry, or a member company of the National Freight Corporation with a 49% interest held by the RWAs.

When the proposals for the reorganisation of the water industry eventually came before Parliament as a Bill, changed Government views had led to the exclusion of the dissolution of BWB. This change of heart has been ascribed to the widespread support (eg from the National Farmers' Union, and the Confederation of British Industry) which was expressed for the apparently doomed Board;[74] more realistic observers have noted that legal expediency can not be ruled out as an explanation, for had the Board been dissolved, the Water Bill would have been swollen to twice its size to accommodate the complications raised by the multitude of existing canal and navigation Acts.[75]

So the Board survived the passing of the Water Act 1973, though many of the anomalies surrounding water transport in Britain survived with it. Many of these stem from the absence of any centralised body with responsibility for all waterways. The IWA's commercial sub-committee, now retitled the Inland Shipping Group (ISG), exposed a number of the resulting inconsistencies in a report in March 1974, 'Barges or Juggernauts?'.[76] Though not free from polemic, the report contains an undogmatic statement of the potential of inland shipping with the qualification that it is more investigation which is being advocated, not a new Canal Age. By drawing comparisons with other industrialised countries, especially fellow EEC member states, the report supposes that were these investigations performed, using criteria currently applied to road planning, then further development of inland water traffic would be the result. The first edition (3,000 copies) was soon exhausted and was followed by a revised edition (1,000 copies) in June 1974, and a reprint of another 1,000 copies in 1975.

Also in early 1974, BACAT I, the first 'British' barge-carrier came into service after a publicity visit to London.[45] This probably represented the first demonstration to an English public of any new waterway technology this century; technological advances had not, of course, been totally lacking in the past, but the public had had little information on (or interest in) earlier achievements. BACAT I was by no means the first barge-carrier to work to UK ports; a LASH (Lighter Aboard Ship) service had started in December 1969 when Acadia Forest off-loaded at Sheerness 38 barges carrying pulp for paper mills up the River Medway.[77] In 1972, the first SEABEE barge-carrier, Doctor Lykes, came into service on the transatlantic run, and by the time BACAT I started operations in the North Sea, there were 27 other barge-carriers, mostly LASH vessels, either built or building.[78]

In June 1975, Freightwaves 75: Britain's First International Conference on Waterborne Freight was held at the World Trade Centre, London. Poorly organised and thinly attended, this escaped the notice of the Press generally. Nevertheless, it served as the platform to launch a new trade lobby to campaign for commercial waterway development, the National Waterways Transport Association (NWTA). Although warmly supported by those attending the conference, and having a committee representing the widest possible spectrum of commercial interests from industrial clients and trade unions to marine engineers and foreign shipping lines, it remains to be seen whether NWTA develops either the political, industrial or intellectual muscle to match the enthusiasm of its founders.

To coincide with the first day of this conference, the IWA published a new document on the waterways of France, Germany, Holland and Belgium.[79] This report is not only the largest but by far the most thorough in its coverage and mature in its approach of all IWA publications. Resulting from months of research in Europe by David Edwards-May, a member of the IWA's Inland Shipping Group, the report discusses the details of finance, administration, planning and policy of the waterway industry in these four countries. How relevant to the British situation are the results of such a survey is still an open question, though in his foreword, the ISG Chairman urged Government analysis of the lessons to be learnt from other EEC countries, and the diversion of road funds to waterway construction.[80]

3.5 Conclusion

Thus the period 1963-1975 is one of changing attitudes of the public, though of little change on the commercial waterways. In the public view, waterways have begun to emerge from the gloom, but proponents of leisure use outnumber advocates of transport use. The popular 'environmental revolution' has left in its wake a number of serious-minded amateurs who devote time and effort to publicising the virtues of inland water transport. There has probably not been a time since the eighteenth century when there was more popular support for the use of waterways for freight transport, though traffics continue to decline as popular interest is unmatched by Government involvement or investment. There is still a remarkable ignorance in Government, Parliament and Civil Service of waterway matters - new developments here and elsewhere, new technologies, even the extent of the industry itself. The contention of the supporter of the waterway case is that were this ignorance dispelled, investment would result and benefits flow to all. The case is appealing but unproven. The remainder of this study is devoted to an examination of this case.

CHAPTER 4: THE PRESENT STATUS OF THE WATERWAY INDUSTRY IN GREAT BRITAIN

4.1 Introduction

The previous chapters have traced the development of this country's waterway industry largely from an administrative viewpoint, and with especial reference to the activities of post-war Governments in relation to the nationalised industries. This chapter sets out to establish the extent of commercial use of the waterway network, to examine the organisation of the navigation authorities and of the carriers, and to identify the current Government and Civil Service attitudes towards inland shipping as a mode, in competition with other freight modes.

4.2 Definitions of inland waterway and inland water transport

The necessity for all concerned with transport planning and policy to have access to correct information on the use made of various modes needs no elaboration. In the face of fundamental inaccuracies in published statistics, it has been necessary for the purposes of this study to estimate the transport use made of waterways by a user/owner survey backed up by reference to primary sources. There are, however, no agreed or acceptable definitions of inland waterway or inland water transport.[1]

Therefore, for the purposes of this study, an inland waterway is defined as any waterway to the landward of the seaward limit of a port (or similar) authority. This is justified on the grounds that the authority has duties associated with provision of a waterway (eg dredging, traffic control, and channel-marking) as distinct from true port functions (eg loading, unloading, customs, and bunkering). On these waterways, inland water transport is defined as comprising only those movements which occur in competition with other modes.

Thus all traffics to seaboard ports carried in craft which cross the seaward limit of the authority are excluded. This rule is modified to allow the inclusion of traffics to small ports up tidal river navigations (eg Boston, Colchester) on the basis of the notional competition offered by the chance to build road- or rail-served facilities nearer the sea, and the fact that the port authorities often have to carry out substantial channel maintenance works of an inland navigation type.

Nevertheless it is still true that included within such a definition is a wide range of traffic and track types. Therefore the results of the survey of commercial waterway traffics are presented as a matrix with four waterway types and three movement types (see Tables 18 & 19). This avoids any confusion which would inevitably attend the reduction of the results to a single total.

4.3 British commercial waterways - extent and ownership

As we have seen, the BWB's waterways were divided into three groups by the 1968 Transport Act (see section 3.2); only 545 km were designated as 'to be principally available for the commercial carriage of freight'.[2] The number of independent commercial waterways has also shrunk since 1948, but since the relevant list of commercial waterways has never before been compiled,[3] a fully referenced tabulation is given in Appendix 2, with Appendix 3 listing those waterways sometimes described as commercial, but on which freight carriage has in fact recently ceased. Table 16 classifies the commercial waterways by owner type, and Table 17 by waterway type.

OWNER	LENGTH(KM)
Regional Water Authorities	51
Local Authorities	216
Port Authorities (exc LAs)	585
Other	179
SUB-TOTAL: NON-BWB	1031
British Waterways Board (commercial)	545
GRAND TOTAL	1576

Table 16: Great Britain, lengths of commercial waterways in use, by owner, 1974 (see App. 2).

TYPE	LENGTH(KM)	NO	NOTE
Extended Docks	19	8	(1)
Locked Waterways-BWB	545	10	(2)
-other	116	3	
Tidal navigations	523	25	(3)
Major estuaries	373	6	
TOTAL	1576	52	

Table 17: Great Britain, lengths of commercial waterways in use, by type, 1974 (see App. 2 and 4).

Notes: (1) Excluding the terminal basins of the Caledonian and Crinan Canals, and Queen Elizabeth II Dock, Manchester Ship Canal.

(2) Excluding amenity waterways.

(3) Counting the Rivers Fal and Truro as one, and the Wensum and Yare as one.

The first of these tables shows unmistakably that there is a considerably greater length of independent commercial waterway than of BWB commercial waterway. It might be argued that some of the independent waterways are river navigations unconnected physically or otherwise with any waterway system; the same is true for the majority of BWB's commercial waterways. The Severn and its lateral canal, the Gloucester & Sharpness, form a single transport line, with no inland waterway connections now used commercially. The Weaver is in much the same category. Only in the North-East Midlands can BWB's track be said to represent anything of a network - though this is impaired by some of the major links (Ouse, lower Trent and Humber) being outside BWB control (see Fig. 24).

Thus the network concept offers no rationale for the continued division of ownership of the waterways, nor can this be said to represent either a distinction between canals and rivers, or between waterways accepting only inland craft and those accommodating sea-going vessels. The former criterion fails in respect of the artificial Manchester Ship Canal (non-BWB) and the Rivers Severn and Trent (BWB); the latter overlooks the exclusive use of the Dartford & Crayford Navigation (non-BWB) by lighters and the total absence of inland craft from the Board's Caledonian and Crinan Canals.

In short, the situation is more a result of history and accident than of a logical approach. The 'nationalised industry' operates less than half of the country's commercial waterways yet there is no fundamental distinction between the Board's waterways and the others.

It is worth remarking on the considerable total length owned by port authorities; if we add to this the length owned by Local Authorities in their capacity as port authorities (eg Bristol and the Avon, Colchester and the Colne), the port-controlled total is over 700 km. This extensive control over waterways by ports was noted by the Minister of Transport in 1974 in a written reply to a Parliamentary question. Referring to transport on non-BWB waterways he described these as 'a number of lengths of river or canal controlled as part of port undertakings.'[4] A further, rather extreme, statement of this situation was provided by the Department of the Environment (DOE)

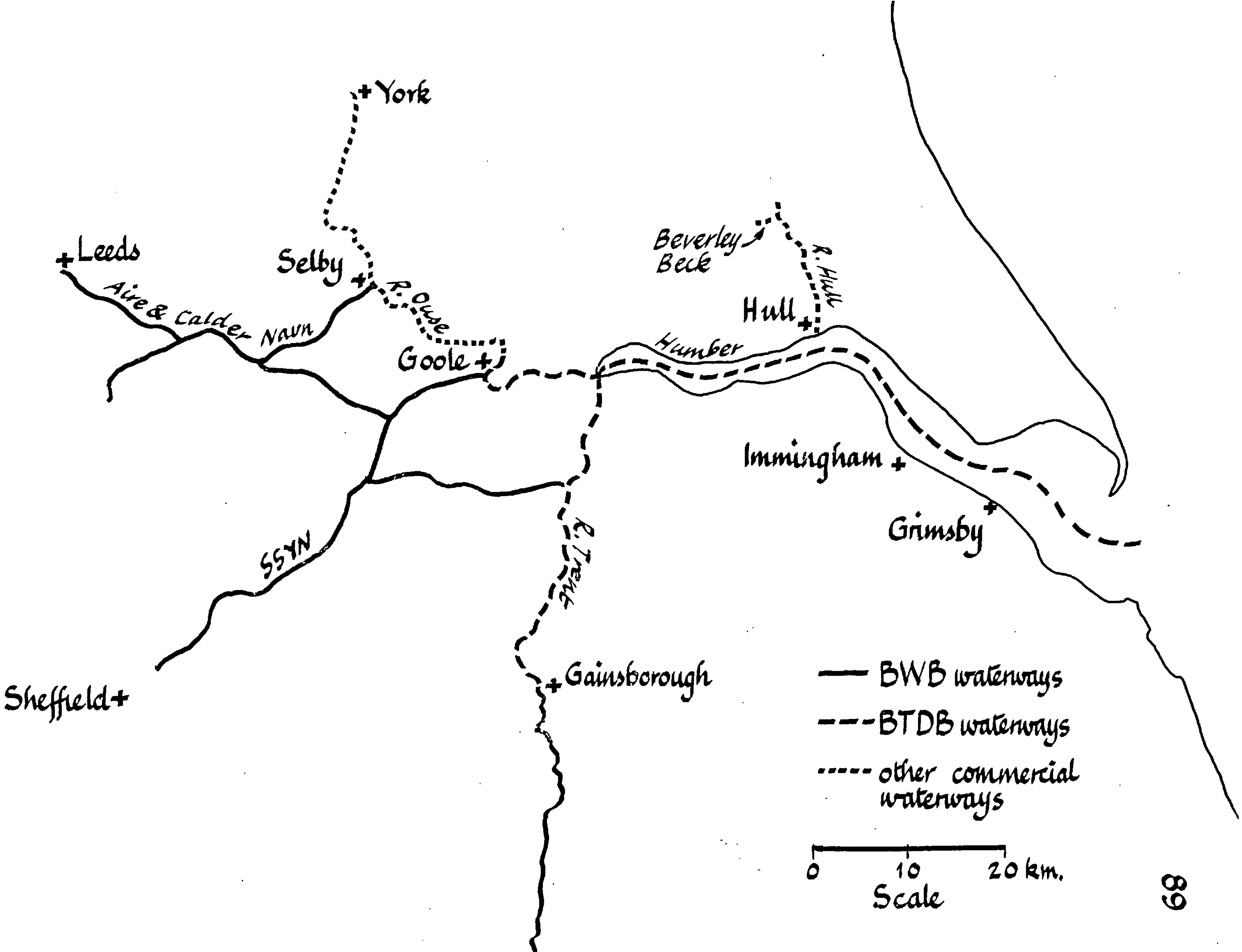


Figure 24: Great Britain, sketch map showing commercial waterways in north-east Midlands, by owner, 1974.

when discussing the classification of waterways to accord with EEC legislation. Rather than define the lower Thames, the Humber and Manchester Ship Canal as maritime waterways (see section 5.4.6), the DOE stated that 'in this context, they do not rank as inland waterways but as ports.'[5]

During 1975, consultative documents were circulated by the DOE in pursuit of the Government's stated aim to bring all ports into public ownership.[6] Aware of DOE statements on inland waterways and ports, the Committee for Environmental Conservation suggested that the proposed port reorganisation provided an opportunity to establish a British Waterways Authority with responsibility for all navigable waterways. The DOE's reply was that 'inland waterways are not affected by the proposed reorganisation'.[7] Whereas it is true that the 700km of waterways owned by port authorities were not specifically referred to in the consultation document, these waterways would undoubtedly be affected by a restructuring of the port industry. There is therefore some evidence to suggest that the DOE attitude to waterways is inconsistent.

Apart from the results of such confusion on transport statistics and planning, there is another serious disadvantage which can occur when a single authority is responsible for a port installation and for the waterway on which it lies, if that waterway also provides access to other freight-handling installations beyond the port authority's control. In such situations a conflict of interest can arise, whereby the port authority tries to increase its share of total traffic entering the waterway by discriminating against traffic moving upstream to other ports or wharves. No clear-cut documented case of such discrimination has been produced, but allegations of this perfectly legal practice have been made by the London lighterage industry against the Port of London Authority (PLA). It would certainly be in the PLA's short-term interest to maximise the percentage of freight handled over their dock quays rather than overside to lighters; this reflects a long-established system whereby dues paid are higher in the former case than in the latter by the operation of the 'Free water clause'.[8]

On the Humber, port authority discrimination has also been alleged, possibly with more supporting evidence than in the case of the Thames. Firstly, Hull was the only other UK port besides London to have a 'Free water clause'; this was abolished in 1973 by an Act of Parliament sponsored by the owners of the docks, the British Transport Docks Board (BTDB). Secondly, the introduction of a BACAT service to the Humber allowed more freight to bypass the major Humber ports of Hull, Immingham, Grimsby and Goole (all BTDB). Within a few months, the BWB complained that the BTDB were levying charges on the unpowered barges as if they were sea-going vessels.[9] This dispute seems to reflect a difference of interest based on the division of responsibilities between the BTDB and the BWB.

4.4 British commercial waterways - present transport role

The paradoxical situation of a nationalised industry owning only one third of that industry (on the basis of track length) might not in itself be so important if the existence of the other two thirds were in fact recognised by the Civil Service. On the contrary, for the whole of the post-war period the official published statistics[10] for inland water transport have been taken directly from the annual returns of BWB or its predecessors, ignoring all other inland waterways. In 1974, the magnitude of this error was revealed in 'Barges or Juggernauts?', where an approximate summation of all known waterway traffics raised the BWB's total of 5 million tonnes to a national figure of about 50 million tonnes.[11] This revelation led to a question being asked in the House of Commons: 'What is the annual tonnage of freight currently conveyed on inland waterways?'. The Minister of Transport was forced to reveal his ignorance.

> 'About 5 million tons a year are carried on the inland waterways administered by the British Waterways Board. Various tonnages are carried, mostly by sea-going ships, on a number of lengths of river or canal controlled as part of port undertakings, notably some 16 million tons on the Manchester Ship Canal.' (4)

Later in the year came two further repercussions. In the new volume of official statistics, the erroneous classification 'Inland Waterways' was changed to the misleading 'British waterways'.[12] Secondly, the DOE started discussions with the IWA on the subject of statistics; this led to a DOE resolve to remedy the revealed deficiencies in the future.[13] As a result, it is to be hoped that correct and comprehensive information will soon become available.

However, for this study, it was necessary to establish the transport use of inland waterways in Britain. Besides the problem of definition (see section 4.2), there are four other difficulties:

(1) there are no complete lists either of inland ports and wharves or of waterways used for the carriage of freight;

(2) there are problems of confidentiality with single-user ports and wharves;[14]

(3) if the real transport function is to be assessed, information on total tonnages must be supplemented by information on distances travelled; and

(4) for certain waterways there is no compilation of statistics, sometimes no navigation authority at all.

The first difficulty was tackled with the assistance of what published information is available.[15] With this as basis, it was then necessary to make a large number of direct enquiries to firms, public bodies, and navigation authorities, backed up by personal visits on occasion. Eventually some quantitative information was collected for waterways found to be in commercial use. This information naturally varied in its degree of precision and comparability, and this, together with the difficulties mentioned under points 2 to 4 above, required estimates to be made in the light of best available knowledge.

The detailed tabulations of the data are given in Appendices 4 and 5. The matrices for 1973 and 1974 resulting from the survey are shown as Tables 18 and 19 and represent the first full assessment of waterway traffics ever undertaken. It must be stressed that traffics to sea-board ports which cross their seaward limits are excluded (eg almost all traffic to Avonmouth, Hull, Immingham, Leith, Liverpool, etc).

Tables 18 and 19 show that, if a functional, rather than an administrative, definition is used, the transport performance of inland waterways is considerably higher than suggested by conventional published statistics. Thus if we include all inland transport on any waterway, the true tonne-km total is about four times the published figure. If we include all freight movements on all locked waterways, the ratio is again about four. Taking the wider definition indicated in section 4.2 raises the ratio to over thirty.

In general, the totals in Tables 18 and 19 are underestimates, for if, for instance, a particular non-foreign movement could not be definitely assigned to either the inland or the coastal category, it has been assigned to the latter. One result of this has been to underestimate the inland movements on the Humber, Hull and Trent, for which little precise information is available. No inland movements were identified for the Clyde or Forth although it is likely that some take place. Also transit use has not been quantified, although those waterways which are known to provide routes for fishing craft or to shipyards have been noted in Appendices 4 and 5.

	FREIGHT MOVEMENTS (T-KM x 10^3)			
	INLAND	COASTAL	FOREIGN	TOTAL
Extended docks	1,262	19	29	1,310
Locked waterways	86,245	119,970	193,570	399,785
Tidal navigations	37,704	99,495	123,213	260,412
Major estuaries	285,722	1,253,056	1,387,697	2,926,475
TOTAL	410,933	1,472,540	1,704,509	3,587,982

For comparison: Annual Abstract of Statistics gives 100,000 x 10^3 t-km (rounded up from 89,776 x 10^3 t-km)

Table 18: Great Britain, inland waterway traffic in t-km, by waterway type and movement type, 1973 (see Appendix 5)

Note: Inland movements are between two points connected by inland waterway.

Coastal movements are domestic traffics to or from British inland ports, where part of the journey is by sea.

Foreign movements are between UK inland ports and foreign ports.

	FREIGHT MOVEMENTS (T-KM x 10^3)			
	INLAND	COASTAL	FOREIGN	TOTAL
Extended docks	866	5	43	914
Locked waterways	69,182	146,992	169,160	385,334
Tidal navigations	34,744	90,281	127,190	252,215
Major estuaries	261,431	1,267,959	1,341,765	2,871,155
TOTAL	366,223	1,505,237	1,638,158	3,509,618
For comparison:	Annual Abstract of Statistics gives 100,000 x 10^3 t-km (rounded up from 73,046 x 10^3 t-km)			

Table 19: Great Britain, inland waterway traffic in t-km, by waterway type and movement type, 1974 (see Appendix 5).

(see note to Table 18)

It must be pointed out that to accommodate these new figures, the conventionally accepted freight modal split statistics will need more adjustment than merely increasing the waterway figure. The published 1973 freight movements were as follows:

MODE	TONNE-KM x 10^9	%
Road	90.4	64.6
Rail	25.5	18.2
Coastal shipping	20.6	14.7
British waterways	0.1	0.1
Pipelines	3.4	2.4
TOTAL	140.0	100.0

Table 20: Great Britain, freight transport by mode, 1973, uncorrected (16)

Some of the freight movements shown in Tables 18 and 19 were previously ascribed to coastal shipping, but others were not recorded at all. Examples of the latter would be movements by vessels between foreign ports and UK inland ports (eg Selby), and possibly many lighter movements, especially of goods of no concern to Customs Officers (eg refuse). The tonnages carried between foreign ports and UK inland ports are of course recorded as port traffic, but the transport function implicit in bypassing a seaboard port in order to penetrate further inland is overlooked. Thus adjustments must be made not only to the waterway figure but also to the coastal shipping and total figures. The final result would then be:

MODE	TONNE-KM x 10^9	%
Road	90.4	63.7
Rail	25.5	18.0
Coastal shipping	19.1	13.5
Inland waterways	3.6	2.5
Pipelines	3.4	2.4
TOTAL	142.0	100.0

Table 21: Great Britain, freight transport by mode, 1973, corrected. (cf uncorrected version, Table 20)

4.5 Coastal Shipping

It will be clear from the foregoing that there are strong ties between inland and coastal shipping; nor is the latter free from difficulties of definition.

From the Customs' point of view, any traffic between United Kingdom ports (ie including those in Northern Ireland) is classified as coastal, although certain authorities include UK traffics to or from Irish ports as well. Under the Merchant Shipping Act of 1894 (or powers stemming from it) maritime traffics are divided into four categories. These are Home Trades, (British Isles), Middle Trades (British Isles plus European ports between Bergen and Santander plus the Baltic), White Sea/Black Sea Trades (British Isles plus Europe from the White to the Black Seas plus the North African coast as far as Casablanca) and Foreign Trades (elsewhere). These four classifications have successively more stringent legal controls on manning, certification and life-saving appliances. Other designations, eg short sea trades and near sea trades, have no such legal significance and merely refer to certain trading areas. The legal definitions are under review and will probably be replaced by new area limits with definite deep-sea boundaries in addition to coast-line boundaries. The net result will be to extend the range of ports available to vessels currently registered in the Home or Middle Trades.

From the port or vessel operators' standpoint, there are additionally a number of traffics of the coastal type (ie which are carried in snall sea-going craft) but which are excluded from National Ports Council (NPC) statistics describing individual and total port activities in terms of foreign and coastwise trade. The most important of these are the landings of marine-dredged aggregates, the loading of materials for dumping at sea, and the supply of bunker fuels. These established traffics have recently been joined by a fourth: freighting to and from off-shore oil and gas rigs. This is not yet extensive, but is growing rapidly and its uneven distribution means that it will be highly important to certain smaller ports. There are some other excluded categories but these four are the most significant.

It is essential when discussing coastal freight figures, to be aware of all these different classes of freights and trades if the figures compiled are to be usefully compared with other modes. There is, moreover, one further source of possible error; port operators frequently aggregate loadings and landings. Thus summing port handlings can lead to double-counting of cargoes.[17]

Because this study is primarily concerned with intermodal comparison, in this section the term coastal shipping will be reserved for traffics between UK ports, excluding those with Northern Ireland and offshore islands, and excluding truly inland traffic (as defined in Table 18). Unfortunately it is not always possible to reduce published statistics to this form as, for instance, the NPC describe lighter movements between Avonmouth and Lydney as coastal, and the Manchester Ship Canal Company describe barge movements between the Mersey and Weaver via the MSC as coastal. Both these movements are actually inland in that the craft used do not (and can not) go to sea. In this study, such trips are classified as inland.

The coastal trades have received little study, frequently appearing only as an afterthought to studies on foreign or deep-sea shipping. Coastal traffic in the last century is only now being systematically assessed, and found to have withstood railway competition far better than has generally been appreciated (eg producing approximately the same tonne-kms as rail in 1875).[18] The oft-repeated assertion that coal is the mainstay of coastal shipping has not been true since about 1960 (see Fig. 25), though one can preserve the truth of the assertion by referring to fuels rather than solely to coal, for petroleum and coal between them now constitute about nine tenths of all coastal cargoes (as defined by the NPC). The remainder is largely minerals, chemicals and unmilled cereals (see Table 22).

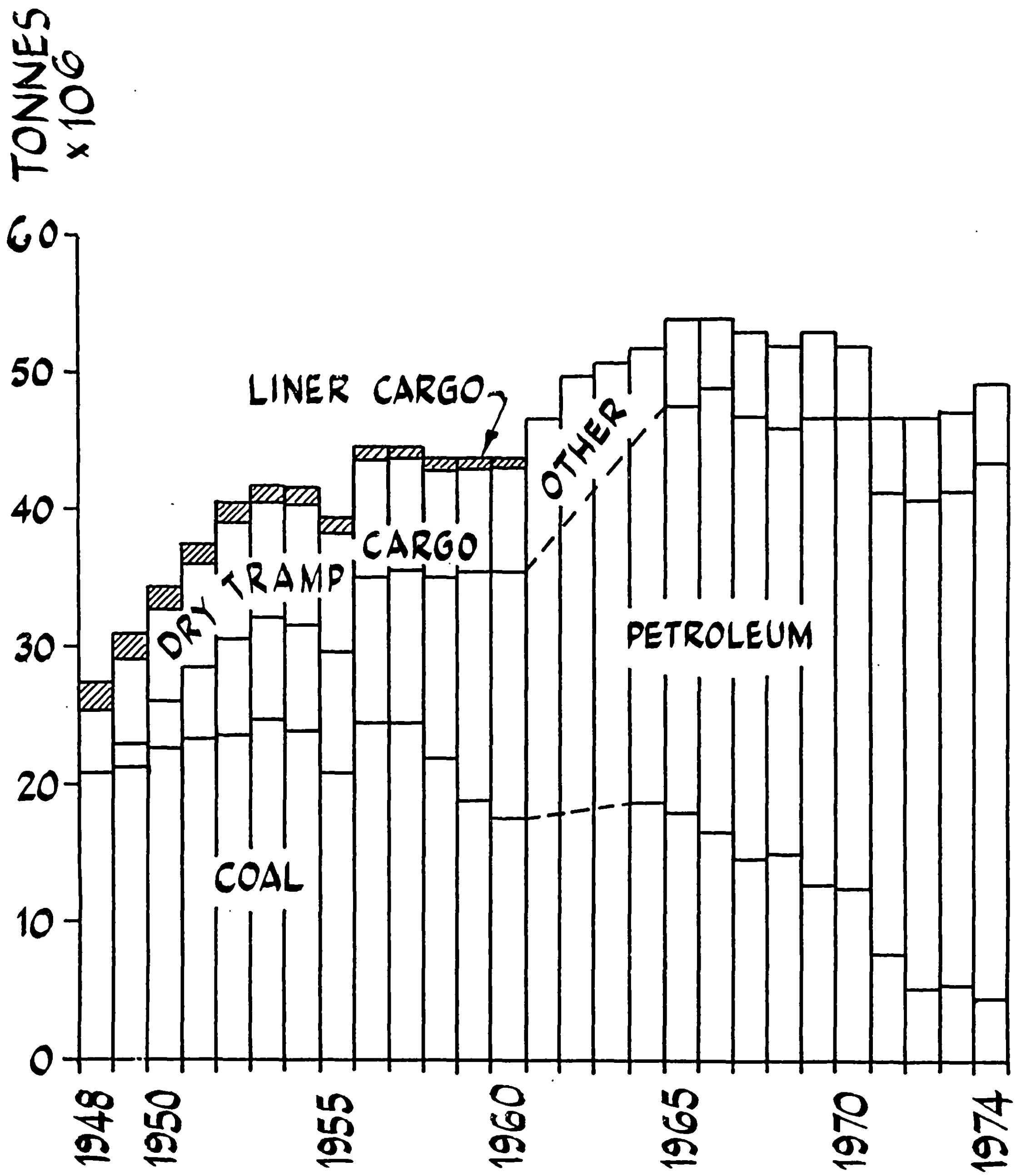


Figure 25: Great Britain, estimated mainland coastwise freight tonnages, by commodity, 1948 - 1974.[19]

COMMODITY AND TRAFFIC	MILLION TONNES 1973	1974	REMARKS
Traffic between mainland ports			
Fuels - petroleum etc	37.15	n.a.	
- coal etc	5.45	n.a.	
Foodstuffs	0.94	n.a.	two thirds cereals
Basic materials	2.03	n.a.	
Manufactured goods	1.73	n.a.	two thirds chemicals
TOTAL	47.30	n.a.	truly coastal
Traffic to N. Ireland and islands	9.97	n.a.	
TOTAL	57.27	56.89	all UK ports
Other traffics			
Marine-dredged aggregates	13.85	13.06	
Bunkers	4.98	4.47	
Oil and gas rig traffic	0.23	1.28	
Sub-total	76.29	75.70	
Materials for dumping at sea	n.a.	7.32	
TOTAL	n.a.	83.02	traffic available to coastal ships in UK waters

Table 22: Great Britain, freight tonnages carried by coastal craft, by commodity, 1973 and 1974 (20).

The decline of coal shipments and collier fleets can be correlated, inter alia, with the substitution of natural gas for coal gas. Figure 26 shows the virtual elimination of coal as a feedstock for the gas industry, and the concomittant decline in the fleets operated by the North Thames and South Eastern Gas Boards (the only British gas undertakings to operate their own craft in recent years). The other major coal consumer, the Central Electricity Generating Board (CEGB), has also run down its fleet since the war, but this is more the result of changed policy, rather than of changing

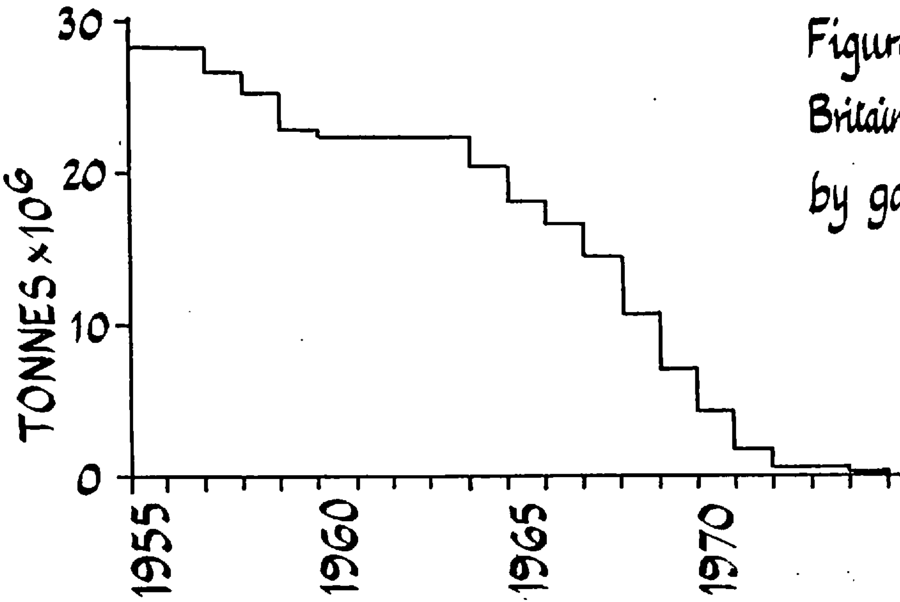


Figure 26 (a): Great Britain, tonnage of coal used by gas-works, 1955 - 1974.[21]

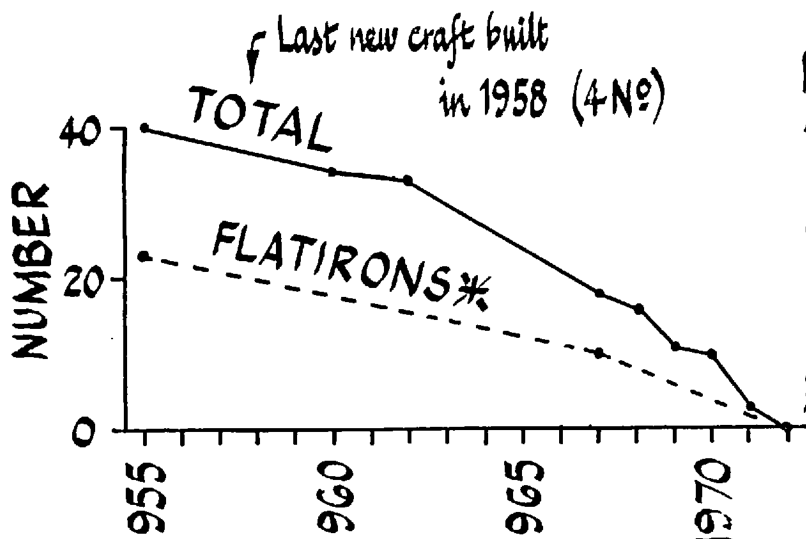


Figure 26 (b): North Thames and South Eastern Gas Boards, number of craft owned, 1955 - 1974.[22]

* Low air-draught craft built to pass Thames bridges

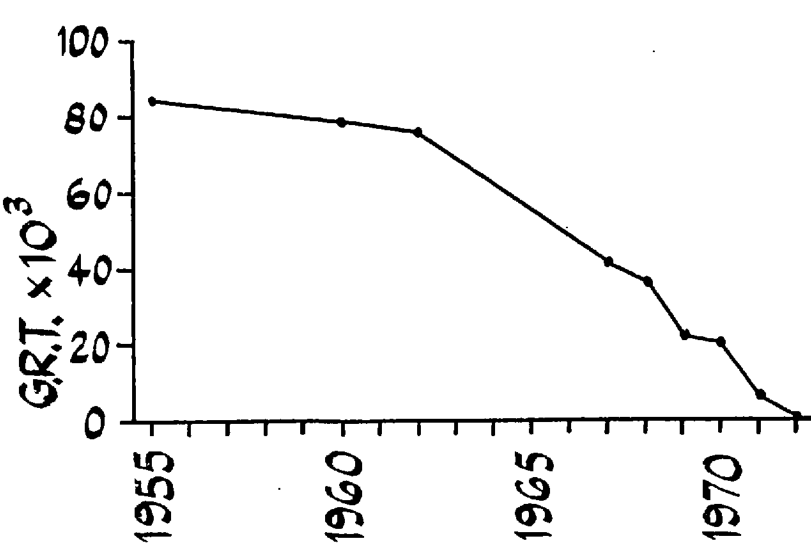


Figure 26(c): North Thames and South Eastern Gas Boards, total tonnage of craft owned, 1955 - 1974.[22]

fuel requirements. As Figure 27 shows, the size of the CEGB fleet has fallen drastically in the past two decades though the average size of vessel in use has increased by about 40%. The CEGB has also got seven large coasters on long-term charter, and if these are added to the Board's own craft, the total tonnage at its disposal now is not much below that owned in 1955.

4.6 Organisation of the inland waterway industry

The industry comprises two distinct elements, one providing the track, and the other offering carriage upon it. Thus in some respects, this mode is more similar to road than to rail, as for the latter, carriage and track are the virtual monopoly of a single body.

4.6.1 Track control

The diversity of authorities responsible for providing and maintaining the waterways themselves has been shown in Table 16. Although the biggest single commercial navigation authority is the British Waterways Board, its holding is not a majority. Now that the Board's commercial waterways no longer form a unified system, they are amenable to regional control, backed by the design and research benefits stemming from a central management.

Since the dissolution of the Canal Association in 1948,[23] there has been no body representing the interests of navigation authorities as such. Many authorities do belong to associations concerned with other aspects of their work, eg The Dock and Harbour Authority Association, but, clearly, waterway interests are not directly served thereby. The newly-formed National Waterways Transport Association (see section 3.4) will hope to represent navigation interests, but not exclusively as the original committee of 18 contained only three representatives from navigation authorities (BWB, Manchester Ship Canal and Port of London Authority).[24]

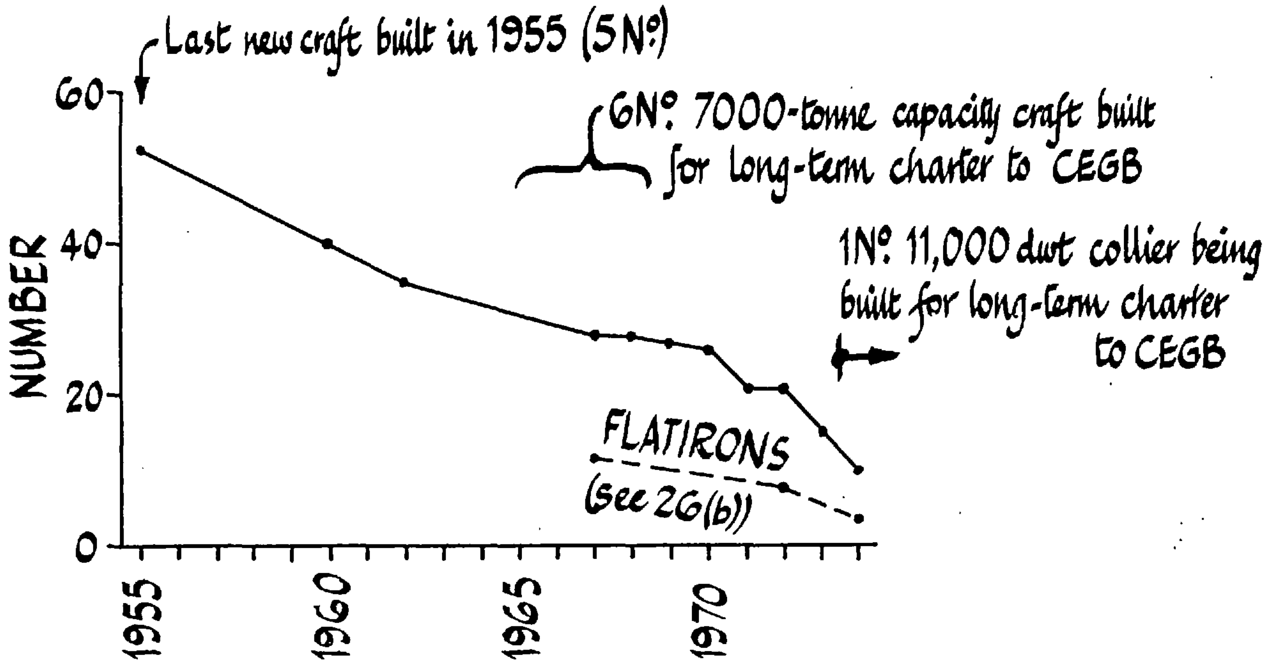


Figure 27(a): Central Electricity Generating Board, number of craft owned, 1955-1974.[22]

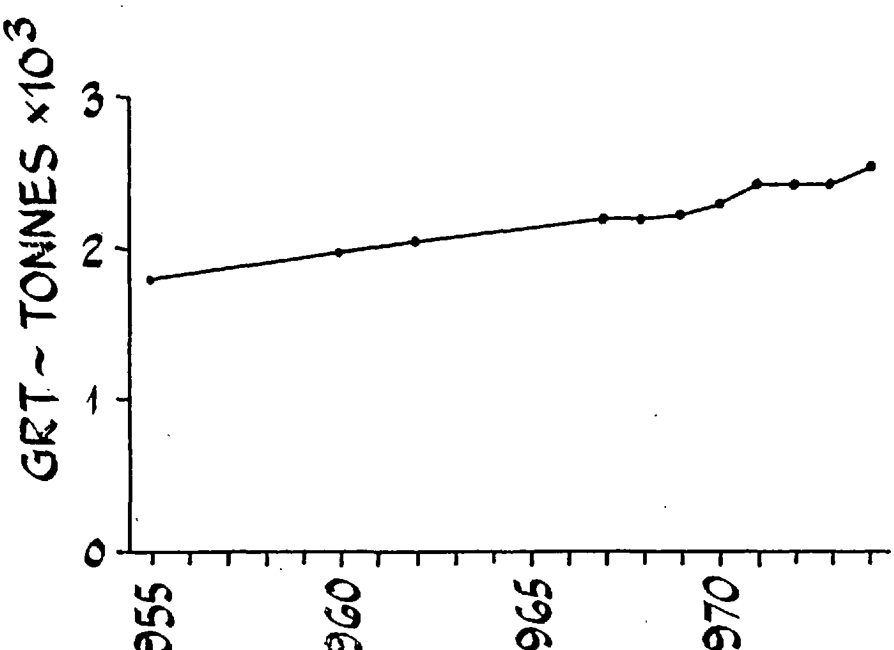


Figure 27(b): Central Electricity Generating Board, average size of craft owned, 1955-1974.[22]

4.6.2 Carriers

Although BWB operate a compartment boat* fleet and a general merchandise fleet, both in the north-eastern Midlands, these only account for around 5% of the freight tonnage on the Board's waterways (but about 10% of t-km). Virtually all the freight is carried either by independent operators or by own-account craft (eg owned by ICI, oil companies, aggregate suppliers, water authorities). In contrast to the easy availability of statistics of craft and operators for other EEC countries, there is no nationally aggregated information for British inland waterway craft and carriers. The Barge and Canal Development Association has compiled lists of working or workable narrow boats and (Leeds & Liverpool) short boats, but these are undoubtedly of sub-economic size. The only extensive data on carriers and their craft has been collected by members of the North Eastern Inland Shipping Committee** and is summarised below.

---

* rectangular steel boxes called compartments, pans or Tom Puddings, each holding 40 tonnes when laden, coupled in trains or tows of up to 20 craft. Referred to hereinafter after as Tom Puddings.

** Inland Shipping Committees are the Inland Waterways Association's regional counterparts to its (national) Inland Shipping Group.

TYPE	NUMBER	TOTAL CAPACITY (TONNES)	AVERAGE CAPACITY (TONNES)
Tankers	49	14,265	291
Other motorised	210	42,645	203
TOTAL MOTORISED	259	56,910	220
Dumb (exc. Tom Puddings)	(63)	(11,220)	(178)
TOTAL (exc. T.Ps.)	(322)	(68,130)	(212)
Tom Puddings	331	(13,240)	40
TOTAL CARRYING CRAFT	(655)	(81,370)	(125)
Tugs	22	-	-
TOTAL CRAFT	(675)	-	-

Table 23: Great Britain, inland commercial craft in Humberside area, by type, 1975[25]

Note: Figures in brackets are only estimates as some lighters have not been included.

Figure 28 shows the detailed size distribution of these craft, and Table 24, using the EEC inland waterway size categories, contrasts the Humberside fleet with the fleets of other Community countries.

CAPACITY (TONNES)	BELGIUM	FRANCE	GERMANY	NETHERLANDS	BRITAIN HUMBERSIDE
≤ 249	6.1%	5.8%	7.6%	56.2%	87.7%
250 - 399	59.0	70.7	11.6	15.0	9.2
400 - 649	16.7	14.9	17.7	12.7	2.6
650 - 999	7.8	5.0	28.8	8.3	0.5
1000 - 1499	7.3	1.0	26.8	4.6	-
1500 - 2999	2.8	2.6	7.5	2.9	-
≥ 3000	0.2	0.1	-	0.2	-
Year	1973	1973	1973	1973	1975

Table 24: European inland water fleets, composition, by capacity, 1973/75 (26).

The small size of the British craft (and to a lesser extent the Dutch) can be seen clearly. It should also be noted that although BWB operate 354 commercial craft (of which 331 are Tom Puddings), there are another 321 independent craft in the Humberside area and around 1500 on the Thames and Medway (see Table 14).

Figure 29 shows the distribution of size of firm (by number of craft owned) operating in the Humberside area. The industry thus has a large number of small firms (with five craft each or less) and, by international standards, a small average craft size. Whereas the latter undoubtedly reflects the small gauge of the waterways in Britain, these two features together suggest that there are many operators for whom financial return on investment may not be the most important criterion. Table 25 compares the distribution of size of firm in the Humberside area with similar data for firms in other European countries; it can be seen that in

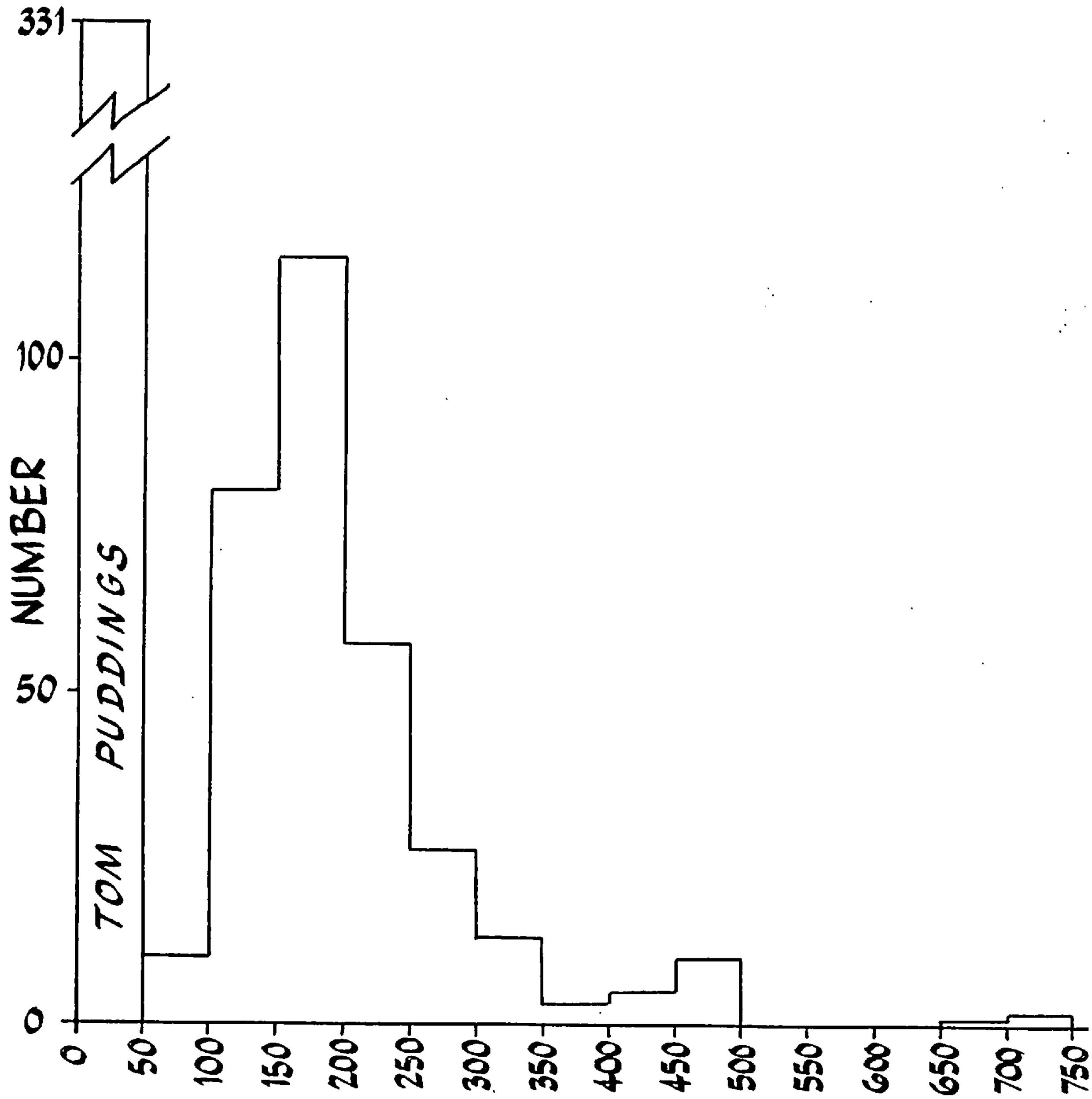


Figure 28: Great Britain, inland carrying craft in Humberside area, all types, by capacity, 1975.[25]

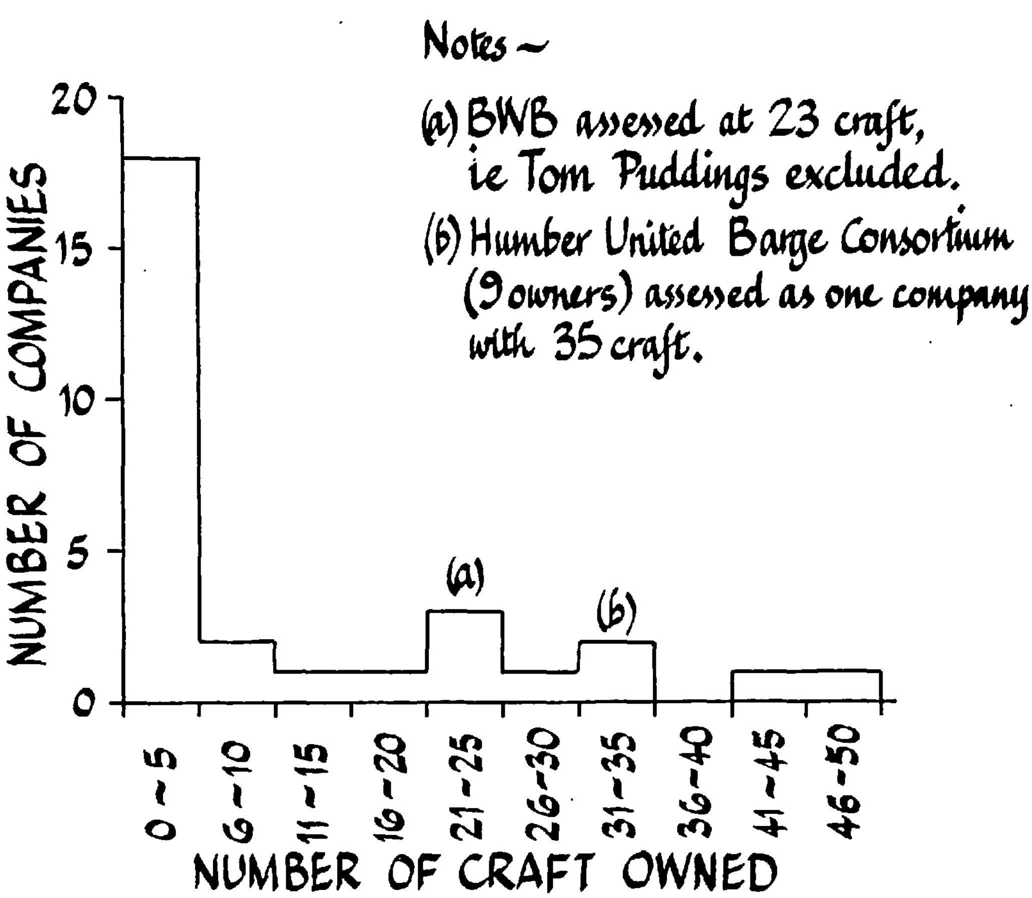


Figure 29: Great Britain, inland waterway carriers in Humberside area, by company fleet size, 1975.[25]

these countries small firms are even more predominant, with a very large number of craft in the hands of owner-operators, for whom the boat is both home and business. Since the disbanding of BWB's narrow-boat fleet in 1963, there have been few commercial craft used for accommodation in Britain. This fact, plus the low earning power associated with the small size of English craft, probably explains the different distribution of firm sizes between the Humberside area and the Continental countries examined.

COUNTRY	% UNDERTAKINGS WITH ... VESSELS						
	1	2	3	4-5	6-9	10-19	20
Belgium	84.7	11.4	1.7	1.1	0.6	0.3	0.1
France	81.5	12.5	2.1	1.4	1.0	0.9	0.6
Germany	86.2	8.1	2.6	-	1.4	0.9	0.8
Netherlands	79.6	11.8	3.1	2.1	1.5	1.1	0.8
Britain: Humberside	31.0	3.5	13.8	10.3	3.5	10.3	27.6

Table 25: European inland waterway fleet owners, by number of craft owned, 1971/75 (27).

On the Thames and Medway, there have been continuing amalgamations and mergers of companies; although many craft have been scrapped or sold for non-carrying use, the average holding of lighters in the London area is around one hundred craft per firm.

In contrast to the strong organisational and political powers of the Continental owner-operators,[28] the British carriers are poorly organised. There are two bodies which can claim to have some standing in the industry (though no apparent political power): the National Association of Inland Waterway Carriers (NAIWC) and the Association of Master Lightermen and Barge Owners (AMLBO). NAIWC members are largely drawn from the north-east Midlands, AMLBO members from the Thames and Medway. Neither can be said to be truly national in coverage, and both seem to be in retreat, contributing little to public debate on waterways issues. The London lightermen have themselves organised a campaigning and public relations body - Transport on Water (TOW) - which although nominally concerned with inland waterways throughout the country, is effectively a lighterage trade protection body. TOW is the most active trade association and extends its activities to participation in motorway Inquiries and making use of local radio and other media.

Thus the carriers are not well represented, although it was hoped that the National Waterways Transport Association could perhaps do this. There are of course amateur and enthusiast groups who lend support to the carriers' cause, including the Barge and Canal Development Association, the Canal Transport Marketing Board, and the Inland Waterways Association's Inland Shipping Group.

4.7 Government and Civil Service attitudes

Although Government views have been described in general terms in Chapter 3, and the anomalies of classification and statistics demonstrated in earlier sections of this Chapter, it is worth examining in greater detail the attitudes taken in recent years by the DOE towards the commercial use of waterways. There are two convenient examples which may be taken to show these attitudes over a period of several years: the stance taken by the Department in successive circulars on the Transport Supplementary Grant and the case history of the Sheffield & South Yorkshire Navigation improvement scheme.

4.7.1 The Transport Supplementary Grant system

Recent years have seen fundamental changes in the way local authorities are required to operate, largely resulting from the Local Government Acts of 1972 and 1974. This section traces the treatment of waterways in these Acts and in the Department of the Environment circulars which have been issued in conjunction with them.

One general aim of the re-organisation of local goverment practice was to allow local authorities more direct control over the structuring of their expenditure. This has been achieved by terminating the old system of Exchequer grants for specific projects, instead allowing the local authorities to make most of the decisions on the allocation of their expenditure.

In the transport sector, central control has not been totally relinquished. The 1974 Act established the Transport Supplementary Grant (TSG) to provide a sizable portion of County Council and Greater London Council transport expenditure from central funds,[29] the balance coming from the Councils' own budgets. The Act itself did not provide details of the working of the TSG and, therefore, before the Act became law in February 1974, a DOE circular was issued to explain the operation of the grant.[30] A second circular, giving a fuller explanation, appeared soon after the Act was passed.[31]

The avowed purpose of the TSG was to replace the multiplicity of grants previously made directly for a variety of transport services, including transportation studies, rural buses, and unremunerative rail services.[32] The level of TSG each council receives is based on its Transport Policy and Programme (TPP) which is submitted annually to the DOE. The importance of the process may be judged from the TSG allocations for 1976/7; for England and Wales these totalled £285M.[33]

The Act defined types of transport expenditure eligible for TSG, which are: public transport, highways, traffic regulation, provision of parking places, and freight-handling facilities.[29] The second DOE circular listed categories of eligible and ineligible expenditure, the latter including expenditure on canals (except for freight-handling facilities).[34] Thus the creation of the TSG, while allowing County Councils to exercise their own discretion to a far greater extent than previously, did not entirely free their transport expenditure from central control.

There was also in early 1974 a Parliamentary Committee studying inter-urban transport planning and investment procedures. They were disappointed by their discoveries:

> 'We formed the distinct impression that the general approach of inter-urban transport investment is _ad hoc_ and confused...We therefore recommend that in the interest of transport co-ordination and a proper allocation of public expenditure, canal, road and rail investments should be analysed on a comparable basis.' (35)

More specifically, they recommended that the exclusion of canals from TSG should be reconsidered.[36]

The DOE's reply to this latter recommendation was so oblique as to be irrelevant.

> 'Canal expenditures are primarily the responsibilty of the British Waterways Board. The bulk of the Board's revenue shortfall is currently met by direct subsidy from the Department of the Environment and the Government does not consider that to include this expenditure in the TSG system would at present serve any useful purpose.' (17)

This failed to make any provision for existing or new non-BWB canals, and did not acknowledge that the bulk of the shortfall is in fact a _social_ grant made under the Transport Act 1968 to meet the costs of amenity waterways. Independent observers have judged the results from this social grant to represent 'a high rate of social return.'[38]

In addition to the two circulars already mentioned, the DOE have issued a circular each year to assist the County Councils in the preparation of their TSG submissions for the coming year. These therefore provide a record of the adjustments to the TPP/TSG system which experience alone has allowed the DOE to make. That for 1975/6 made no comment on freight transport per se,[39] but its successor, for 1976/7, included a highly relevant statement:

> 'The Government wishes to see the maximum sensible use made of the railways and waterways for freight carrying, and local authorities will no doubt wish to encourage the diversion of suitable traffic from heavy lorries to other modes, where this is sensible on economic, social or environmental grounds.' (40)

A virtually identical statement occurs in the circular dealing with submissions for 1977/8.[41]

With regard to waterways, the most important feature of this series of TSG circulars is the apparent change in the DOE's attitude to canals since 1973. There is now, overtly at least, a readiness to accept and encourage the transport role of waterways. Nevertheless, the actual categories of eligible and ineligible expenditure have not been amended to allow any implementation of the Government's expressed desire to see the maximum use made of waterways for freight carriage.

There is another, albeit less significant, anomaly which results from the terminology used in the circulars. These refer to canals and not to waterways when defining ineligible expenditure (though as can be seen elsewhere, eg the 1968 Transport Act, Parliamentary draftsmen are well aware of the distinction between these terms). Thus rivers and river navigations are not specifically excluded by the circulars from TSG funding, but neither do they readily fall within the eligible categories as defined in the 1974 Act, viz: public transport, highways, traffic regulation, provision of parking places, and freight-handling facilities.

The existence of these two anomalies, and the failure of the DOE to accept the recommendations of the Parliamentary Committee, suggest that the role of waterways in freight movement has been given insufficient attention. The declared attitude of encouragement may be a response to external pressures of a generally 'environmental' or even possibly anti-road type, but there does not appear to have been any attempt to implement, nor make possible the implementation of, this stance, nor even to clarify the ambiguities which undoubtedly exist.

4.7.2 The Sheffield & South Yorkshire Navigation (SSYN) improvement scheme

This navigation, which connects Sheffield to Goole via the New Junction Canal, can currently accommodate craft of 100-tonne capacity. This is a barely economic size and is certainly not enough to encourage investment in new craft or even to retain existing traffics for much longer. As the navigation is a canalised river (the Don) there is no possibility of eliminating it; there are inescapable costs associated with the maintenance of any watercourse in an area as developed as the Don valley.

Accordingly, the British Waterways Board considered the possibility of restoring the SSYN's commercial viability by enlarging the locks and improving the channel between Doncaster and Rotherham. Their proposals were examined in 1964 by the Economist Intelligence Unit and by NAIWC.[42] By 1966 the Board were convinced of the value of the enlargement and therefore submitted their proposals to the Minister of Transport.[43] They were turned down in 1967,[44]

> 'on the ground that the traffic should go by rail, an argument that did nothing to hinder construction of the later motorway.' (45)

In 1969, the Board decided not to resubmit the scheme to the Minister,[46] but nevertheless two years later commissioned a consultants' report (INBUCON) on a modified version of the improvement.[47] From this report, the Board concluded that the improvement scheme (750-tonne capacity to Mexborough, 400-tonne to Rotherham) would make the SSYN a real competitor for freight, with good future prospects. In April 1972 they therefore decided to submit the scheme, estimated to cost £2.4M, to the Secretary of State for the Environment.[48]

A year later, the DOE refused to approve the financing of the scheme.[49] Although acknowledging that it had received the widest possible support, the DOE felt that there was insufficient evidence that the predicted traffics would materialise. The scheme could therefore only be reconsidered if its financial viability were guaranteed (by the carriers and possibly by the clients as well).

The consultants' report has not been published by the DOE, and cannnot be published by BWB nor by the consultants themselves. Nevertheless some of its conclusions were made available: that, for instance, within ten years of the improvements' being made the tonnage handled on the navigation would be 5 to 7 times the 1972 level, and the toll revenue would be 2.5 to 3.5 times the operating costs.[50] If the lower level were achieved, this would yield an annual return of £220,000 on a capital investment of £2.4M, after meeting operating costs. This excludes any social returns, and the £2.4M includes £0.6M for arrears of maintenance which will have to be spent irrespective of any commercial use of the waterways. Thus the minimum rate of financial return on the £1.8M required for improvement would be over 12%.

Although faced with more stringent requirements than any public transport project has ever met, namely financial guarantees from the users, the Board were not disheartened and set about reinforcing the evidence of the market study.[51] However, when the question of the navigation's future was raised in the House of Commons, Eldon Griffiths (for the DOE) returned to the argument that the local railway was underused.[52]

In July 1973, the Board replied to the DOE.[53] Of course, guarantees of traffic were unobtainable, but many potential customers did guarantee to offer freight for carriage on the improved waterway. These freights totalled 950,000 tonnes per year, 28% higher than required for break-even. The Board also pointed out the injustice, and the effect on the financial evaluation, of requiring all the capital to be repaid from toll revenue, an objective not met by roads.

This new submission to the DOE, and possibly the public support for the scheme, especially in south Yorkshire, led the Secretary of State for the Environment to give consent for a Bill to be introduced into Parliament to grant the BWB the powers necessary for executing their improvement plans.[54] No provisions were made for financing the work.

Following the passing of this enabling Act, the Board continued to press for financial approval, and the case they made for this was sympathetically reported in the technical and general press.[55] Although the DOE has frequently asserted that the Government would like to see maximum use of commercial waterways wherever this is sensible on economic, environmental or social grounds, (eg in the TSG circulars referred to in section 4.7.1) there has been no real attempt by the DOE to show how the proposal as it now stands measures up to (or fails to measure up to) Departmental criteria of economic, environmental or social sense. No published assessment of the scheme has given any quantified evaluation of environmental or social factors.

Thus there appears to be a gap between explicit DOE policies expressed in general terms, and DOE practice in this particular case. There also seems to be a singular difference between the DOE's view of the worth of the scheme and the local view, for, soon after the DOE announced in May 1976 that they would not provide finance,[56] the local authority (South Yorkshire County Council) decided to try to raise the capital elsewhere.[57]

4.8 Parliamentary Committees

There have been three recent House of Commons Committees which have made recommendations relating to the Government's treatment of waterways. The views of the first of these, the Environment Sub-committee of the Expenditure Committee, have already been referred to in section 4.7.1.

This sub-committee reported in 1974 on public expenditure on transport.[58] In their report they criticised the approach to the appraisal of inter-urban transport investment as being '*ad hoc* and confused', possibly leading to a misallocation of resources.[59] To remedy this, they recommended that investments in different (but competing) modes should be anlaysed on a comparable basis.[60] They also recommended that the exclusion of canal expenditure from the Transport Supplementary Grant be reconsidered.[61]

The Select Committee on Nationalised Industries reported in 1975 on the use of shipping by nationalised industries.[62] Although the activities of the British Waterways Board were somewhat peripheral to the field of investigation, the committee nevertheless recommended that

> 'Proposals submitted by BWB which are still outstanding for major new investment both in craft and in route improvements should be brought to Ministerial notice for urgent review.' (63).

The 'route improvements' referred to undoubtedly relate to the Sheffield & South Yorkshire Navigation.

In the same year, the Select Committee on Science and Technology reported on energy conservation.[64] Their report covered the whole field of energy use, but nevertheless, when dealing with transport, the committee felt that waterways should not be overlooked:

> 'Although we recognise that the scope for the transportation of passengers and freight by inland waterways is limited in comparison with alternative means of transport, we believe that the more intensive use, of inland waterways and coastal shipping should be considered.' (65).

Thus from three different viewpoints, the House of Commons has recently been critical of the current treatment of waterways.

4.9 Conclusion

This chapter has shown that, firstly, the present role of waterways in freight movement is systematically underestimated to a significant degree, and secondly that the planning and financing framework does nothing to encourage development, although lip-service is paid to this possibility. The waterway industry (both track and carriers) is more extensive than generally appreciated, but has no corporate voice and no political influence. Even so, support for the industry is widespread with many observers considering that the current situation is neither fair to inland waterway transport (on an intermodal competition basis) nor in the national interest. The next chapter of this work will demonstrate that the position of inland waterways in Britain, described above, is in sharp contrast to the position in comparable European countries.

CHAPTER 5: THE ROLE OF WATERWAYS IN EUROPE

5.1 Introduction

Suggestions that the role of British waterways be expanded are not based upon hypothesis or untried technology but rely on evidence from other countries. It is certainly true that most other industrial countries make greater use of this mode than does Britain (see Table 26).

	ANNUAL FREIGHT MOVEMENT BY INLAND WATERWAY		% OF T-KM BY INLAND WATERWAY	NOTES
	TONNES X 10^3	T-KM X 10^6		
AUSTRIA	7,322	1,545	6 (in 1972)	
BELGIUM	101,785	6,494	22 (in 1972)	
BULGARIA	6,723	n.a.	6 (in 1966)	
CZECHOSLOVAKIA	4,657	2,374	3	(1)
FRANCE	108,877	13,792	6	
GERMANY, E	12,667	1,884	3	(1)
" W	245,831	48,480	31 (in 1960)	
HUNGARY	2,889	1,490	5	(1)
ITALY	4,109	391	1	(2)
NETHERLANDS	254,738	31,997	57	
POLAND	10,246	1,945	1	
ROMANIA	7,165	n.a.	2 (in 1966)	(1)
SWITZERLAND	9,603	50	n.a.	
USSR	419,200	189,500	5	
YUGOSLAVIA	26,260	6,581	11	
USA	559,000	384,000	16	(3)
UK 'OFFICIAL'	4,989	90	0	
ACTUAL	c70,000	3,588	2.5	

NOTES: n.a. indicates 'not available'
(1) All traffics carried by national fleets
(2) Data for 1972
(3) Data for 1965; includes Great Lakes traffic (c 40%)

Table 26: Europe and USA, freight carriage on inland waterways, by country, 1973 (1).

There is also considerable investment in inland waterways and associated equipment in developing countries. Nigeria acquired its first push-tow system twenty years ago,[2] Sudan took delivery of nearly forty push-tow units in 1973,[3] and Columbia was recently reported as having started work on an interoceanic canal to facilitate development of the hitherto almost inaccessible jungle region of Choco.[4] These are merely three examples of many similar developments in South America, Africa and India which demonstrate the relevance of inland waterway transport to a wide variety of terrains and economies. However, further discussion of foreign waterways will largely be confined to industrialised countries, whose economies and communications systems are more closely comparable to those of Britain.

5.2 The European waterway system

Clearly, topography has done a great deal to shape the development of Europe's transport networks and the location of the industrial, commercial and residential centres that these serve. The map of Europe's waterways (Fig.30) shows the dominance of the great rivers - Danube, Elbe, Rhine, Rhone and Seine - in the existing pattern, but important developments currently planned are aimed at improving the canal links between the river navigations rather than at extending the river navigations themselves. The growth of co-operation between European nations is one reason for these inter-basin plans which often either cross international boundaries or have effects which are more than national in scale. In this chapter the advances in transport planning and law in the post-war period are discussed after a brief examination of the waterway infrastructure and use in various European countries.

The European waterway network

by David Edwards-May

	Class 0	less than 250 t
	Class I	250 - 399 t
	Class II	400 - 649 t
	Class III	650 - 999 t
	Class IV	1000 - 1499 t
	Class V	1500 t or more
	under construction (or upgrading work in progress)	
■	key inland ports	
□	secondary inland ports	

The map shows the situation of the West European waterway network in 1977. The waterways are broadly classified according to the six categories of capacity (in terms of self-propelled barges rather than push-tows) defined by the European Conference of Ministers of Transport and the sub-committee on inland water transport set up by the Economic Commission for Europe.

In the German Federal Republic, the Elbe Lateral Canal is open to traffic, while the Italians have opened their new canal to the inland port of Padua. Construction work proceeds on the Main-Danube canal (which in the early 1980s will make the Rhine and Danube basins accessible to each others' inland shipping fleets) and on the river Saar.

This is the second edition of a map originally published by the Inland Shipping Group of the Inland Waterways Association in its *Report on Continental Waterways* (June 1975). Copies of the report, or of this new map, may be purchased from the Association's General Office at 114 Regent's Park Road, London NW1 8UQ.

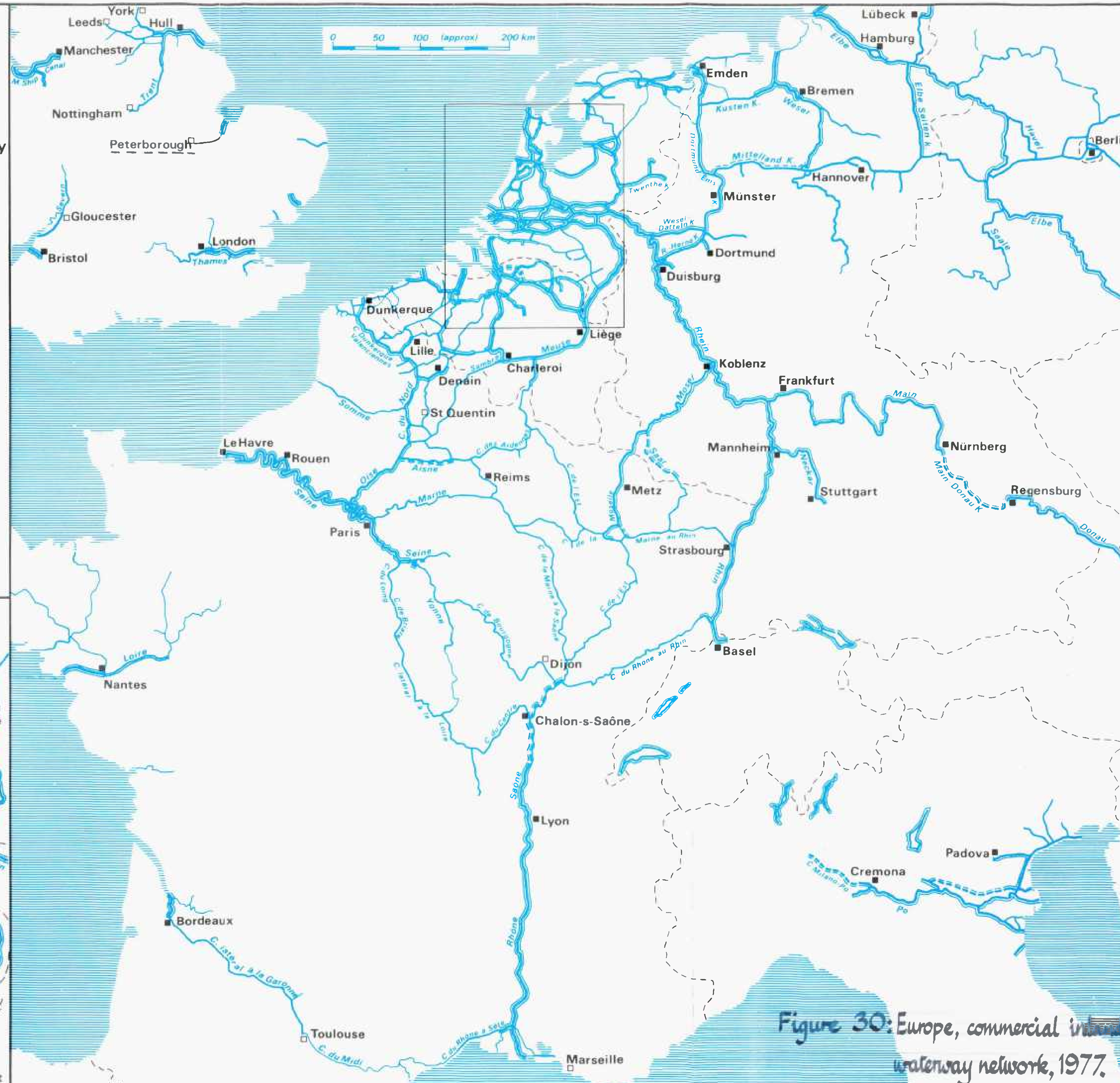


Figure 30: Europe, commercial inland waterway network, 1977.

5.2.1 Belgium

Although after the First World War it was thought that waterway traffic would decline in the face of competition from road and rail, the Belgians felt themselves obliged to enlarge the Albert Canal following the Dutch decision to build the Juliana Canal (opened 1935). The success of the Albert Canal showed that if suitable track were provided, inland waterway transport could effectively compete with other modes. Thus the Ministry of Public Works decided to continue modernising Belgium's waterway system after the Second World War. With larger craft in operation, the freight charges were significantly lower than for other modes (see Table 27).

MODE	AVERAGE FREIGHT RATE PER T-KM
Inland waterway	0.38 BF
Rail	0.90 BF
10-tonne lorry	2.2 BF

Table 27: Belgium, inland freight rates, by mode, 1955 (5).

The continued resolve of the Belgians in this field may be judged by their allocation of about £200M to waterway improvements in the Six-Year Plan of 1970-1975.[6] Belgium now has a network of 1537 km of which 606 km (39%) are of Europa standard (ie Class IV in Table 28) or larger.[7] The former total includes that part of the Lys which forms part of the border with France.

CLASS	CRAFT DIMENSIONS (m)				APPROX CRAFT CAPACITY (t)
	LENGTH	BEAM	LADEN DRAFT	UNLADEN AIR DRAFT	
0	— none specified —				below 250
I	38.50	5.00	2.20	3.55	300
II	50.00	6.60	2.50	4.20	600
III	67.00	8.20	2.50	3.95	1,000
IV	80.00	9.50	2.50	4.40	1,350
V	95.00	11.50	2.70	6.70	2,000

Table 28: Europe, dimensions of inland waterway craft types (8).

The administration of these waterways is split between the Office de la Navigation (ON) and the State, though a few short lengths are under separate control.[9] A comparison of the waterways of the O.N. and those of the State is given in Table 29.

	O.N. WATERWAYS	OTHER BELGIAN WATERWAYS
Length	332 km	1,237 km
Traffic	$2,463\times10^6$ t-km	$4,390\times10^6$ t-km

Table 29: Belgium, comparison of waterway systems, by owner, 1974 (10).

No detailed statistics are available for the non-O.N. waterways, but Tables 30 and 31 give some indication of the commodities transported on Belgian waterways.

COMMODITY	INTERNAL TRAFFIC	IMPORTS	EXPORTS	TRANSIT	TOTAL
	(MILLION TONNES)				
Solid fuels	4.6	3.1	0.7	0.5	8.9
Petroleum etc	6.8	5.1	4.0	0.0	15.9
Steel Products	1.5	3.7	2.8	0.5	8.5
Minerals and Building materials	9.3	14.4	8.1	0.7	32.6
Chemicals	2.1	3.0	1.1	0.4	6.7

Table 30: Belgium, waterway traffic in certain commodities, by movement type, 1967 (11).

COMMODITY	CARRYINGS (TONNES x 10^6)
Solid fuels	3.6
Liquid fuels	3.0
Minerals	1.8
Metals and metal products	2.2
Building materials	12.1
Clay and glass materials and products	2.1
Grains	1.2
Agricultural products	1.2
Industrial materials	2.8
Refuse and fertilizers	0.2
Other	0.1
	Total 30.3

Table 31: Belgium, traffic on O.N. waterways, by commodity, 1975[12]

5.2.2. France

France, fifteen times the area of Belgium but with less than six times the population, has a waterway network which is, however, largely based on the needs of the nineteenth century, in particular on the Freycinet plan. Charles de Freycinet, Minister of Public Works, drew up a plan in 1879 for enlarging canals to 350-tonne capacity - the so-called Freycinet standard. This far-sighted move did much to stimulate waterway transport in France at a time before most Governments were so actively involved in this field.

Large though the Freycinet standard undoubtedly was for its time, those canals which have not been enlarged since are by no means major commercial routes today. However, France has two large river systems, the Rhine and the Seine, which have been important routes for centuries, and still remain so as they are open to craft of considerably greater size than the 350-tonne peniches. The Seine is Class V (see Table 28) to well above Paris, as is the Rhine to Basle. The Rhone, although a river of comparable size, did not lend itself to extensive navigation use until major improvement works (locks and dams) were put in hand in 1934. Since then there has been an almost continuous programme of constructing major new works to regulate the flow of this hitherto dangerous and changeable river. This regulation is designed not only to make all-year-round navigation possible, but also to provide irrigation water and hydro-power.

The state control of waterways dates from well before 1900, but the details of the exercise of this control have, not unnaturally, changed from time to time. The duties of provision of track and control of traffic were vested in separate Ministries until 1974, when the new Ministry of Equipment and Area Planning absorbed the old Ministry of Equipment and Ministry of Transport.[13] To assist the central Government there is also a co-ordinating body, the Office National de la Navigation, which was founded in 1912. This operates in several ways: collecting and transmitting information both to Government and to waterway users, levying tolls, supervising freight contracts, operating some ports and craft, and co-operating with the international authorities controlling the Rhine and Moselle.[14]

It is clear that inland shipping in France has not been accorded the status it has long enjoyed in Belgium, Germany and Holland, and even as late as 1973, an official French publication stated 'This form of transport has long been considered outmoded'.[15] Nevertheless, the important effect of major waterways on regional economy, and the need for competitiveness between French industry and those of other EEC countries, have not gone unrecognised. Recent years have seen moves both to expand and to improve the existing network, and important budget allocations have been made in the Sixth Five-Year Plan (1971-1975) and the Seventh (1976-1980). The network currently stands at 7192 km of which 1819 km (25%) are of Europa standard (ie Class IV in Table 28) or larger.[7] These totals include waterways forming parts of France's borders: the Rhine, Lys and Moselle. A breakdown of commodities carried on the French inland waterways is given in Table 32.

COMMODITY	CARRYINGS (TONNES x 10^6)
Agricultural products and foods	13.0
Mineral fuels	8.3
Refined petroleum products	18.7
Steel products	1.4
Non-ferrous metals	0.9
Minerals and building materials	56.2
Fertilizers	2.2
Chemicals	1.3
Other	8.2
	TOTAL 110.2
(Total t-km: 14.6 x 10^9)	

Table 32: France, inland waterway traffic, by commodity, 1969[16]

5.2.3 Germany (West)

In Germany, although there is a long history of waterway building and use, the present administrative structure (and, to some extent, the network itself) is a post-war phenomenon. All navigable waterways, whether maritime or inland, are national (Federal) property. The maritime waterways comprise essentially the dredged channels in the outer estuaries of the Rivers Elbe, Ems, Jade and Weser. There are thus many other stretches of inland waterway which are open to sea-going vessels (eg the Weser to Bremen, and the Elbe to Hamburg). These are called Seeschiffahrtstrassen to distinguish them from the waterways accessible only to inland craft - the Binnenschiffahrtstrassen.[17]

There is a clear political distinction, reflecting an equally clear functional distinction, between the waterways and the ports which lie upon them. Whereas all the routes, being considered part of a network of national importance, are under the direct control of the Federal Government, the ports are controlled by the Lander.[18] Thus transport is a national responsibility, trans-shipment a local one. The Lander may not control water routes giving access to the ports, nor may they levy dues on craft which pass through port areas without making other use of the port facilities.[18] In such cases the port authority's powers are reduced to those of traffic control.

It is worth noting that this logical division of powers, based on the different functions of ports and waterways, avoids the confusions and possible conflicts of the type which have arisen in Britain (as discussed in section 4.3).

The major river navigations of Germany are the Elbe, the Weser, and the Rhine with its tributaries the Main, Moselle and Neckar. The Rhine system serves the southern and western parts of the country including the highly important industrial area of the Ruhr. In the central and northern parts of the country the rivers tend to run from south to north; to supplement these, the Mittelland Canal (opened 1938) was built between the Wars as an east-west route between the Elbe (west of Berlin) and the Dortmund - Ems Canal (a lateral canal paralleling the south-north River Ems). Following the creation of the new international frontier between East and West Germany, access from Hamburg and the Elbe to the Mittelland Canal and hence to the rest of of the German inland waterway system could only be gained by crossing into East Germany. To bypass this obviously difficult transit, the Elbe Seiten Kanal was initiated in 1965. Running almost due north-south, this now joins the Elbe near Hamburg to the Mittelland Canal by an artificial waterway 115 km long. Although given the name 'lateral' (Seiten), in reality this owes its existence and location more to the political situation in the area than to civil engineering principles. The canal was opened in 1976 but almost immediately suffered a catastrophic failure, when an embankment breach flooded over 4,000 hectares.[19] Following extensive survey and reconstruction, the canal was re-opened in mid-1977.[20]

The other major waterway project in Germany is the uniting of the Rivers Main and Danube. Although a canal joining these two rivers was opened by King Ludwig I of Bavaria in 1846, it was both small (100-120 tonnes) and heavily locked (c 100 in 120km).[21] It fell into disuse between the Wars but is now being replaced by a new canal of Europa standard. Although lying totally within Germany and financed by the Germans, this canal is of immense importance to Europe as it will connect the continent's two largest rivers (see section 5.3.1.1).

The total West German network stands at 4369 km of which 2843 km (65%) are of Europa standard (ie Class IV in Table 28) or larger.[7] These totals include waterways forming parts of Germany's borders: the Rhine, Saar and Moselle. A breakdown of commodities carried on the German inland waterways is given in Table 33.

COMMODITY	CARRYINGS (TONNES x 10^6)
Agricultural products and foods	15.2
Solid fuels	63.2
Ores	33.6
Metal products	13.6
Minerals and building materials	86.3
Fertilizers	6.2
Chemicals	9.9
Other	2.0
TOTAL	230.0

(Total t-km: 45.0×10^9)

Table 33: Germany, inland waterway traffic, by commodity, 1971.[22]

5.2.4 Netherlands

The Netherlands are, by any standards, a special case. The attitudes of the Dutch towards water has no parallel in Europe. Their flat alluvial country is virtually the delta-land of the Rhine, and it is upon the Rhine that the Dutch depend for much of their water supply as upland catchments are denied them, and ground-water pumping can be threatened by salt intrusion.

This flat country, traversed by the massive distributaries of the Rhine and Maas, and home of a maritime nation, lends itself to the use of inland water transport. Thus it is not surprising that (as shown in Table 26) inland shipping's contribution to total freight transport is, in the Netherlands, nearly twice that in any other European country. Most of the dense network of Dutch canals is, however, used for the control and distribution of water, and even on navigable canals, water control may be the most important function.

The Dutch have, of course, not only invested a great deal in improving existing watercourses, but have also built new artificial waterways to join the various river navigations. The controlling body responsible for transport waterways is the Rijkswaterstaat, a directorate within the transport ministry. The Rijkswaterstaat is also responsible for roads and for the Zuiderzee reclamation and the Delta Plan.[23] However, the great importance of waterways may be judged from the proportion of expenditure this mode receives; of the total transport infrastructure budget of the Ministry of Transport and Water Control (ie for road, rail and waterway) for the period 1970-1974, waterways received 41% of the capital and 23% of the maintenance expenditure.[24] The Dutch waterway network stands at 5589 km of which 2487 km (44%) are of Europa standard (ie Class IV in Table 28) or larger.[7] A breakdown of commodities carried on the Dutch waterways, and an indication of the importance of international traffic, is given in Table 34.

COMMODITY	CARRYINGS	
	TONNES x 10^6	T-KM x 10^9
Agricultural products and foods	10.9	1.0
Solid fuels	1.2	0.2
Petroleum and products	11.2	0.9
Ores and metal products	1.2	0.1
Minerals and building materials	62.9	6.0
Fertilizers	2.4	0.4
Chemicals	1.6	0.1
Other	2.3	0.2
TOTAL INTERNAL	93.7	8.9
TOTAL INTERNATIONAL	121.3	(in 1969)

Table 34: Netherlands, inland waterway traffic, by commodity, 1970.[25]

5.2.5 Italy

Italy offers an interesting contrast to the four other European countries examined above. It is not connected to any of the major European river systems, and has a very high coastline length/land area ratio. In many ways it resembles Britain in its topography.

Despite the contribution of the Italians to canal engineering in the fifteenth century (mentioned in Chapter 1), inland shipping has not played a significant part in Italy's freight transport system for many years. Nevertheless in 1919 improvements to the River Po were initiated[26] and it is within this river basin that most subsequent developments have taken place. In 1962 a 'vast programme of modernization' was announced,[27] but it has neither taken place as quickly nor been as successful as was originally envisaged. The 68-km Milan-Cremona canal was started in 1959,[27] but a report in 1973 indicated that, except for the construction of one lock, little of the work had been carried out, even though completion was still scheduled for 1975.[28] In 1974 a similar situation had been reached on the 27-km Venice-Padua Canal.[29] An ambitious plan to connect some of the lakes in Lombardy and even possibly those in Switzerland to the Adriatic has been under study for some years.[30] As the surface levels of these lakes are typically 100 - 200m above sea level, the project would be on a greater scale than any other recent Italian waterway scheme.

It appears that the construction of each new canal is entrusted to a consortium which is vested with appropriate legal powers relating to acquisition of land and building of bridges.[29]

The length of waterways in use in Italy is 1956 km; no size classification breakdown is available,[31] nor has the author located any information on commodities carried.

5.3 International co-operation in Europe

As was indicated above, the international importance of European waterways is increasingly recognised; not only are many of the current plans or works concerned with waterways which either form or cross international boundaries, but also the twentieth century has been marked by the establishment of mechanisms designed to promote co-operation on major transport issues to maximise the benefits to all participating nations. The oldest international organisation was actually instituted well before this; the Congress of Vienna in 1815 led to the formation of the Central Commission for the Navigation of the Rhine. Various treaties have modified its composition and powers but it is now composed of representatives of six states: Belgium, France, Germany, Great Britain, Netherlands and Switzerland. Despite the antiquity of this Commission, it remains true that the important steps towards international co-operation on transport in general and waterways in particular all date from the post-war period. Thus the United Nations' Economic and Social Council established a Transport and Communications Commission which in 1947 advised that the work of the UN's Economic Commission for Europe should be further assisted by the creation of an Inland Transport Committee.[32] 18 countries, including the USSR and Eastern European countries, nominate members of this Committee, which, of course, has only advisory, not legal powers.

The European Coal and Steel Community (ECSC) followed next, being established by the Treaty of Paris in 1951. Although not primarily concerned with transport per se, the ECSC was nevertheless obliged to make rulings on transport matters, as the costs of moving the very large volumes of materials involved (eg coal, coke and ore) contribute significantly to the cost of the products. The member nations (Belgium, France, Germany, Italy, Luxembourg, Netherlands) were free to pursue their own transport policies as long as all comparable coal and steel customers enjoyed comparable transport charges, and all coal and steel transport charges were notified to the ECSC Executive.[33]

The European Conference of Ministers of Transport (ECMT) was founded in 1953 with 18 members, and has been conspicuously successful in promoting agreement on technical matters relating to transport, thus enabling the network benefits to be developed. In particular, the ECMT drew up the now widely accepted size classifications for waterways, and accepted that all future waterway projects of international standard should be designed to Europa size (ie Class IV in Table 28).

Lastly came the European Economic Community (EEC) which was created by the six ECSC members in 1957 and has subsequently been enlarged to its present membership of nine. Transport is clearly of great significance to an economic alliance of this sort, partly because of its very size and partly because its aims include the complete abolition of tariffs between member countries. This latter renders the relative costs of transport (and of manufacture) in the member countries more important than they would otherwise be. The transport policy and legislation, and their relevance to the UK will be discussed in section 5.5.

It is, however, appropriate to point out that although the existence of these various bodies is an indication of Europe's awareness of the importance of transport, especially internationally, problems have arisen from their differing compositions. The most notable instance of this is that although the Rhine is of immense significance to the EEC, it is controlled by a long-established Commission of which one member (Switzerland) is neither a member of the EEC, nor likely to become one, Great Britain having been in a comparable position until her belated entry to the EEC.

5.3.1 Current European waterway projects

Although in sections 5.2.1 - 5.2.5 some reference was made to current infrastructure developments, further examples of international significance will be discussed below. The ECMT has been influential in promoting co-operation over many of these schemes.

5.3.1.1 Main-Danube Canal

Possibly the most important scheme under construction is the canal being built to link the Main to the Danube. Lying totally within West Germany, this canal is being financed by the Rhein-Main-Donau AG, a public company established in 1921 jointly by the Reich and the provinces of Bavaria and Baden. This company was charged with the responsibility of building a 1500-tonne waterway between Aschaffenburg and Passau on the Austrian border, and also of exploiting the upper Danube below Ulm, and the Lech below Augsburg for hydro-power.[34] Work is now in progress on the closing sections of the Main-Danube canal.

The possible results of establishing this link are two-fold. Firstly, and most importantly for the canal's builders, there is the predicted traffic on the canal itself; this is put at around 14 million tonnes by 1989, and would be approximately balanced in direction.[35] Secondly, this link will bring the fleets of eastern and western Europe into closer contact. There are of course already two such east-west links in use - the Mittelland Canal and the Elbe - but as the international traffic on these is not extensive and as additionally the waterways involved were originally part of the same (German) system anyway, the political and technical problems are not great. It is expected that these problems on the Main-Danube Canal will be more severe.

On the technical side, there has been little common development on the Main and Danube, despite the existence of Ludwig's Canal (see 5.2.3). On the Danube, the structures and fleets are largely of post-war construction,[36] and although the vagaries of centrally-planned economies may produce uneven technical developments, it must be remembered that in 1930 the Danube became the first European river* on which push-towing was practised.[37]

On the political side, it is expected that there will be some encroachment by fleets belonging to communist countries into transport markets now serviced by Western European firms. Certainly the combined strength of the Western fleets (those of Austria and Germany) on the Danube has fallen considerably in the last twenty years compared to the combined strength of the six communist fleets (those of Bulgaria, Czechoslovakia, Hungary, Romania, USSR and Yugoslavia). In 1962 the former amounted to 18.3% of capacity (tonnes) and 16.4% of power (HP). By 1973 these had fallen to 9.1% and 12.4% respectively.

---

* ie on the continent of Europe. Push-towing was introduced on the Aire & Calder Navigation in the last century.

Their market share is considerably lower - only 7% of tonne-km in 1972. This relatively poor performance is attributed to the decidedly low freight rates and wages of the eastern fleets and has resulted in Austrian subsidy for its national fleet.[38] Recent years have seen a substantial growth of communist deep-sea shipping activities, with attendant allegations of 'dumped' capacity, and there is every reason to predict that the Main-Danube Canal will enable a similar situation to develop in inland shipping in central Europe.

5.3.1.2 Rhone-Rhine Canal

The history of this link is not dissimilar to that of the Main-Danube Canal in that a canal linking the Rhone (or, more properly, one one it its tributaries, the Saone) to the Rhine was built during the first half of the last century. Again it is heavily locked (125 in 229 km) and is of low capacity, though at 350-tonnes it is larger than the old Ludwig's Canal. This difference in size is one reason why the present Rhone-Rhine Canal is still in use, though in 1974 traffic was only 485,000 tonnes.[39]

Schemes for its enlargement to Europa gauge have been actively promoted for twenty years, and finally in 1975 President Giscard d'Estaing announced Government support for the project.[40] Work is planned to start in 1978 under the (present) Seventh Five-Year Plan, but most will be carried out during the operation of the Eighth Plan (1981-1985).[39] The new route will largely follow the existing one, though the number of locks will be reduced to 24, and these will be usable by 3000-tonne push-tows.

The significance of this new canal will be felt at both the national and international levels. Nationally, it will have a structuring effect in that the traffic is predicted to rise to 10 million tonnes within ten years of operation,[39] a 20-fold increase on its present performance, and this will both reflect and foster relocation of industry along the route. Internationally its effects will be more widespread as it will be the closing section in a Europa-gauge route joining the Mediterranean (the importance of which has been materially increased by the re-opening of the Suez Canal in 1975) and the industrial zone of Marseilles-Fos on the lower Rhone to the Rhine and Germany's industrial core in the Ruhr valley and beyond to the North Sea ports of Rotterdam and Amsterdam. When completed, this north-south route will be in some competition with the north-west - south-east route offered by the Rhine-Main-Danube waterway. However, proponents of the Rhone-Rhine Canal argue that their route offers greater security as it will lie totally within the EEC, thus avoiding the hazard dependent upon a transit of communist territory.[39]

5.3.1.3 The Moselle

The Moselle, a tributary of the Rhine, was another continental waterway on which navigation had ceased due to railway competition and inadequate maintenance. However, its present vigour as a major Class IV waterway is a tribute to international co-operation and to France's determination to provide the steel works of Lorraine with cheap transport for bulk materials.

The lower 210 km of the river are in Germany, the next 37 km form Germany's border with Luxembourg, and the rest of the river to its source is in France. The need for international co-operation is thus clear; this could hardly have been achieved until well after the Second World War. Earlier proposals to restore navigation had been thwarted by German steel and railway interests; later agreement was only possible through the offices of the European Coal and Steel Community.[41] As the scheme would, initially at least, benefit France more than, or even at the expense of, Germany, it was seen as a test of the new European solidarity. The French Parliament ratified the ECSC treaty in 1952, but it was four years before details were worked out which were acceptable to all three nations.[42] In fact, German lack of enthusiasm can be gauged from their estimate of the traffic potential; in 1955 they were predicting 1.5 million tonnes/annum in contrast to France's assertion that 10 million tonnes would be a realistic figure.[43]

The construction and operation of the waterway was entrusted to the Moselle Commission - a body in some ways comparable to the Rhine Commission though differing from it in its ability to levy tolls. These take the form of lock dues[43] and were fixed in 1964 by comparison to dues then applying on two other tributaries of the Rhine - the Main and the Neckar.[44]

The Commission enlarged the waterway from Koblenz (at the Moselle/Rhine confluence) to Metz, 27 km inside the French border. This section was financed jointly by France, Germany and Luxembourg in the proportion 124:60:1 and includes 14 dams and locks, 11 of which are combined with hydro-power installations.[41] The navigation was opened in 1964, and has proved as successful as the French had predicted. By 1970, traffic had risen to 11.3 million tonnes of which 0.7 million was 'local' French traffic paying no dues.[43]

Since 1964, the French have continued to extend the navigation upstream of Metz with the intention of reaching Neuves Maisons by 1975.[45]

This waterway has thus enhanced the competitive position of the traditional industry of Lorraine - steel-making - which has generated some 90% of the international traffic on the French section. It has also provided an export route for French grain, of which 430,000 tonnes were shipped out in 1970.[46] One interesting export development has been the creation of a new market (in Germany) for a million tonnes per year of blast furnace slag, previously regarded as an unsaleable waste material.[46] But most importantly, the availability of low-cost bulk waterway transport has led to a concomitant reduction in rail freight rates so that, at least in the first years of operation of the new waterway, it could fairly be claimed that its opening had made

> 'the corridor from the Ruhr to Thionville a privileged axis on which all transport costs, both rail and water, were reduced.' (47)

Further extension of this waterway will allow other steel firms, at present unserved by the Moselle Commission's track, to take advantage of cheap transport and thus improve the pattern of supply of their raw materials, especially iron ore.[46]

Thus the canalisation of the Moselle demonstrates that international co-operation can be harnessed to execute major new waterway works. It can be seen that a new route so created can stimulate existing industry and extend the range of markets in which local industry can compete. The effects of these improvements can have beneficial ramifications for other industries and can modify the local transport market extensively, producing lower rates all round.

5.4 EEC transport policy and legislation

The EEC has as its avowed goal the fusion of its members into a 'common market'. Its basic aims were outlined in the 'Treaty of Rome'. This treaty together with others founding Euratom and the ECSC plus some related documents are the primary legislation whose role is to provide a policy framework and to empower Community institutions to draw up further legislation to implement this policy. This implementing legislation is referred to as secondary legislation. In 1973, the accumulated secondary legislation up to the end of 1972 was published in English in a series of 41 volumes, each of which dealt with a single subject, plus one index volume. Further legislation is, of course, forthcoming continually.

The key-phrase used in trying to describe a 'common market' is that it should be 'free from distortion'. In other words, any tariff, tax, subsidy, grant, or other financial intervention by any one member state which distorts the market by changing or seeking to change the balance in that market from the balance which would otherwise be struck by market forces, is, by definition, prohibited. Although the most important practices which are thus outlawed are those which favour the producers in one member state in comparison with those in another, the legislation also seeks to eliminate discrimination within national markets as well. Another important task for the EEC is the introduction of common standards to enable full and free exchanges of goods and services between members.

Transport is of course one service for which a market exists and is therefore subject to both primary and secondary legislation. The Treaty of Rome contains a section on transport[48] which lays upon member states the specific duties of adopting a common transport policy,[49] abolishing discrimination[50] and abolishing subsidies.[51] Stemming from the provisions of the Treaty are (up to 1972) 27 Regulations, 5 Agreements or Recommendations, and 19 Decisions or Directives which together constitute the secondary legislation on transport.[52]

Nevertheless, despite a long and growing list of regulations and other legislation, the implementation of a common transport policy and the establishment of a free market in transport are still a long way off. A cautious observer has rightly remarked that progress towards the

> 'common transport policy is behindhand in comparison with the integration process in other sectors' (53).

A less restrained commentator asserted that the EEC had no transport policy, merely 'a motley ragbag of disjointed regulations'.[54] There have been undoubted obstacles to the adoption of a common transport policy; amongst these are the very different transport markets within the different member states, the changes in attitude to the proper balancing of financial and social costs, and the changes brought about by the entry to the EEC of the three newest members. (Previous to this, transport considerations had largely revolved around competition between road, rail and inland waterway, as indicated by the Treaty of Rome.[55] The entry of three members without common land frontiers raised the question as to whether to invoke the powers to extend consideration to sea and air.[56]) There are nevertheless several important regulations which are relevant to inland shipping in Britain. These are subject to revision and clarification of detail by subsequent amending legislation; completely new legislation is also being added continually. Therefore what follows is an identification of the principles involved and the means so far existing (to 1972) whereby these principles are to be applied.

5.4.1 Abolition of discrimination by carriers

One of the earliest relevant steps taken by the EEC was to make a regulation[57] forbidding carriers to discriminate against or in favour of clients on the grounds of the country of origin or destination of the freight carried, provided both origin and destination lie within the EEC. Any such discrimination is illegal, whether it takes the form of a difference in rates charged or a difference in conditions imposed on the clients. To enable the authorised representatives of the Commission to adjudge whether the law is being observed, carriers have to prepare certain documents for inspection,[58] though short hauls and small loads are exempt.[59]

This regulation is important not only in establishing the principle of non-discrimination on grounds of nationality, but also clearly extending this principle to domestic as well as international traffic.

5.4.2 Establishment of free competition

The consumer's best interest can only be served if he has access to a competitive transport market whose supply is not restricted by any monopolistic or cartel arrangements by the suppliers. A regulation[60] was passed in 1968 forbidding the exercise of any such powers by large transport undertakings or by groups of undertakings. Specifically, rate-fixing, restriction of supply, sharing of markets, and discrimination in dealings with other parties are all prohibited.[61] Public undertakings are not exempt[62] though any small road or waterway carriers are.[63] The Commission is given wide powers to initiate inquiries to discover whether any abuses are being practised, and if any circumstance suggests that competition is being distorted or restricted on particular routes or in a particular area, the Commission may conduct a general inquiry to establish the facts and may call for evidence from the transport undertakings concerned.[64]

This regulation is designed to protect industrial clients from practices adopted collectively by carriers with the aim of raising charges above those which might otherwise evolve in a free market. However, there are other ways in which competition may be restricted. For example, in Britain, the control exercised over waterways by port authorities can be used to restrict the competitive position of waterway carriers and inland ports and wharves (see section 4.3). The powers given to the Commission by this regulation could be invoked to establish an inquiry into such alleged unfair interference.

5.4.3 Transport as a public service

In that public service obligations laid upon transport undertakings by member states interfere with a free market, they are forbidden by the legislation described in section 5.4.2. However, it was clear that the termination of some public service obligations would be politically and socially undesirable. Therefore a realistic regulation[65] was passed in 1969 which starts off by stating

> 'Member States shall terminate all obligations inherent in the concept of a public service...(66)

immediately following this with

> 'Nevertheless such obligations may be maintained in so far as they are essential in order to ensure the provision of adequate transport services' (67)

Thus this regulation can be seen as a compromise between the rather austere 'free market' ideas of the Treaty of Rome and the later recognition of the importance of less rigorously financial social factors. Because the preamble to the regulation makes it clear that it is designed specifically to apply to rail transport, and because the regulation itself excludes transport services of a local or regional character,[68] it is the principle which is of greatest interest here, not the practice.

5.4.4 Normalisation of accounts

In order to measure the cost of, inter alia, the public service obligations of the railway as permitted by the legislation discussed in section 5.4.3, the EEC simultaneously drew up a regulation[69] compelling the member states to 'normalise' their railway accounts, ie to identify and pay separately any costs the railway authorities were bearing which were essentially unrelated to the provision of a railway service itself. Such costs include, for example, inherited pension liabilities, costs of arrears of maintenance, costs attributable to delays in decision-making outside the railway organisations, and capital and interest burdens borne as a result of lack of normalisation in the past. In all, fifteen classes of costs are identified; these are either to be terminated or to be normalised. Thus the railways are finally to be relieved of their 'special' costs, which are instead to be met by direct Government funding which is distinguishable from subsidy both in principle and in practice (in the accounts).

This is a highly important piece of legislation and one of great potential significance to inland waterways in the UK. Its significance lies in the comparative histories of railway and waterways in the UK and in our EEC partners.

As has already been indicated (sections 5.2.1 to 5.2.4) Government control of waterways in several EEC countries dates from the last century, whereas comparable involvement in railways is more recent, being essentially a development of the last fifty years. This meant that merely through the history of the modes, they were being treated differently. For example, there were extant pension obligations to ex-railway staff or their dependants (originally contracted by private railway companies) which were simply charged against railway income, whereas any such pension due to workers in road or water transport were counted as part of the general social benefit budget. However, in the UK alone, the administrative history of waterways follows more closely the pattern of, say, the French or German railways than that of the corresponding waterway systems. Indeed, not only was it the same Act in the UK which nationalised both water and rail,[70] but as has been shown, the administration of water routes is still far from centralised.

This being so, there is a prima facie argument for considering the extension of the normalisation legislation to UK waterways. This matter was raised with the EEC Commission (Transport Directorate) in May 1975 by the author.[71] The opinion then given was that the UK situation sounded like a special case, that in principle a later regulation allowed the granting of aids to rail, road or water transport undertakings, and that further clarification would depend upon a more detailed case being made.[72] Accordingly, the author prepared from published sources a short paper[73] outlining the historical argument, examining the fifteen classes of costs to see (a) if they could apply in principle to BWB (or other British waterways) and (b) if there were any identifiable financial burdens similar in principle to those imposed on railways, but specific to waterways. The conclusions are tabulated below. The 'Articles' referred to are those in the regulation.[69]

Art. 4.1(a) to (d): to be normalised

Class I: 'Payments which railway undertakings are obliged to make but which, for the rest of the economy, including other modes of transport, are borne by the State'

Comment: Possibly relevant in relation to Parliamentary costs. All waterway authorities need Parliamentary sanction (by Act) for certain enlargements, closures, changing of water rights, and new works. This involves costs of a type not incurred by highway authorities, who are rarely required to obtain a specific Act for a specific project.

Class II: re family allowances - no apparent relevance.

Class III: 'payments in respect of retirement and other pensions borne by railway undertakings on terms different from those applicable to other transport undertakings'

Comment: Some relevance with regard to BWB's inherited liability for the retirement pension schemes of its predecessors (74).

Class IV: 'the bearing by railway undertakings of the costs of crossing facilities'

Comment: Highly relevant - currently the Transport Act 1968 requires BWB to meet all the maintenance costs of road bridges over waterways except for the costs of surfacing (75). A recent road-bridge strengthening programme, 'Operation Bridgeguard', was totally funded by direct Government grant, but this only covered capital costs and not maintenance costs either now or in the future. The Board are also required to maintain road bridges in good condition (76) but have complained of insufficient funds to enable them to meet this obligation (77).

Art. 4.2(a) to (c): to be terminated

Class V: re compulsory over-manning - no apparent relevance.

Class VI: re wages and salaries - no apparent relevance.

Class VII: 'delay imposed by the competent authorities with regard to renewals and maintenance'

Comment: A survey on arrears of maintenance on BWB track was recently completed by independent consulting civil engineers, though this has not yet been published. Arrears costs were assessed in 1970 at £21.8M and in 1973 at £30M (78). It would appear that delay by the DOE has occasioned rises in cost, and that further deferring would be prohibited.

Art. 4.3: burden to be abolished, capital and interest costs to be normalised

Class VIII: re war damage - no apparent relevance

Art. 4.4 (a) to (f): for possible normalisation

Classes IX to XII:

re various staffing and social matters - no apparent relevance.

Class XIII: 'financial burdens devolving upon railway undertakings in consequence of their being required by the State to keep in operation works or other establishments in circumstances inconsistent with operation on a commercial basis'

Comment: As was shown in Chapter 3, the Transport Act 1968 specified certain BWB waterways to be maintained for amenity purposes which are therefore eligible for grant support (79). However, there are two canals - the Caledonian and the Crinan - which have never made an operating profit for over 50 years yet which against advice, were defined as 'commercial' by the Transport Act (80). Thus the predictable and inevitable losses these canals make have to be offset against profits earned on other waterways. This is 'inconsistent with operation on a commercial basis'.

Class XIV: re placing of contracts - no apparent relevance.

Class XV: 'capital and interest burden borne as a result of lack of normalisation in the past'

Comment: Although the Transport Act 1968 included a reconstruction of BWB capital, it did not write this off, but reduced it to £3.75M (81). The Government has now requested that this capital be repaid, also that interest at 6% be paid on the outstanding debt (82). In addition, any other loans made subsequently must be repaid, and interest at 5.5% to 10.25% is due on outstanding debts (83). Thus the BWB face capital and interest costs unparalleled by any calls made on highway authorities, and normalisation under this section would be possible.

There are additionally other categories of cost specific to waterways which would possibly be suitable for inclusion in any new regulation covering normalisation of waterway accounts. These would include costs arising from the use made of BWB waterways in water conservation, flood control, agricultural water supply and land drainage.

It is of course true that the Government grant to BWB does cover most of the costs identified in the various Classes above. However, one essential feature of the normalisation procedure is that non-transport, anomalous, or social service costs should be identified separately from transport costs. In any published accounts, normalisation payments should be so described as to render them clearly distinguishable from normal operating costs and from operating subsidy. This is not done at present; the DOE description of the BWB's revenue shortfall as 'subsidy' shows that no distinction is currently made.[84] (See section 4.7.1.)

The author's original paper, referred to above, was circulated to various BWB officers and others, but was never in fact sent to Brussels. It was, however, submitted as written evidence to the Select Committee on Nationalised Industries in June 1977.

5.4.5 Aid for transport

In a regulation[85] of 1970, the Council specified how those articles in the Treaty of Rome permitting the granting of aids[86] should be interpreted with respect to transport. Although in general terms any such aid is not compatible with a common market, the Treaty recognised that social reasons should be allowed to override economic reasons in special circumstances.

The regulation only allows aids to be given in respect of normalisation, anomalous costs, research and development for the benefit of the community, elimination of serious excess capacity and as reimbursement for public service obligations. This last category is an extension of the powers discussed in section 5.4.3.

5.4.6 Statistics and Accounting

To be able to monitor the utility, contribution and cost-effectiveness of each mode, and to be able to establish that infrastructure costs of each mode are being allocated comparably between users and Governments, it is essential to have comprehensive and unified financial and operating statistics centrally compiled. A regulation[87] of 1970 specifies exactly the requirements for such statistical data including sample pro formas for traffic returns for road, rail and inland waterway. Waterways only accessible to craft of less than 250 tonnes dwt are excluded, as are maritime waterways (see below).

There is apparently no obligation on the Commission to publish any collected information except that relating to steel prices. However, the official Communities publishing office does produce a range of statistical information including an annual volume covering transport.[88] This contains data on waterway infrastructures, fleets and output, but not on expenditure and revenue. The majority of entries for the UK read 'not available'; in fact only three inland waterway items of data are given out of a possible total of 584. The data has 'been supplied either by the national statistical institutes or by the competent ministries'.[89]

The Commission does, however, submit an annual report to the Council containing much of the information collected as a result of the regulation. This is published,[90] but not widely available. In addition to utilization statistics, it contains much valuable information on transport infrastructure expenditure. For UK waterways, some expenditure is given, but it is clear that both this and the data on utilization only relate to BWB track.

It would seem, therefore, that the UK is not currently complying with the regulation (and the Commission's report points out that even the UK railway information is not complete).[91] Although the information required under the regulation is not identical in form to that published in the publishing office's annual volume referred to above, had the UK complied with the regulation it would also be in a good position to fill many of the gaps. The regulation was signed on behalf of the UK in 1974 and thus the first annual return should have been submitted in December 1975.[92] This would have allowed time for inclusion in the latest statistical yearbook, which was published in July 1976. It must, however, be pointed out that other member states have also failed to submit complete transport data; no information was submitted to the Commission on Italian waterways[93] nor on Irish roads.[94]

There are a number of other regulations which modify or clarify the original regulation on accounting. Of these, two are relevant to inland waterways: one interpreting the term <u>transport infrastructure</u>,[95] the other, the term <u>maritime waterways</u>.[96]

This latter term is defined neither in the original nor in the subsequent regulation. It is, however, clear that the Commission recognises the essentially different transport roles of different types of waterway. In drawing up the list of maritime waterways, account was to be taken

> 'of the proportion of the traffic on waterways of maritime character accounted for by inland waterway traffic, or of the desirability of introducing an accounting system for infrastructure expenditure in respect of such waterways in the light of the institution of a system of charging for the use of infrastructure.' (97)

Accordingly, a list of maritime waterways was drawn up and this forms an annex to the regulation. The following waterways are listed: the Lower Elbe, Ems, Garonne (with the Gironde), Loire, Scheldt, Seine and Weser, the Ghent-Terneuzen, North Sea and Keil Canals and the Rotterdamse Waterweg and the Nieuwe Maas. It seems clear that the member States involved have interpreted the term as describing waterways on which inland craft may ply, but which are essentially used to give larger deep-sea craft access to port facilities. Smaller sea-going craft can of course range much more widely.

In the case of the UK, an Adaptation amends the Annex to include the Weaver Navigation and the Gloucester & Sharpness Canal. Their inclusion is totally anomalous; although small sea-going craft can and do travel on them, their scale and function are not comparable to the other EEC maritime waterways. Moreover, instead of giving access to the sea, they are separated from it by respectively two (Manchester Ship Canal and River Mersey) and one (River Severn) other waterways which have themselves existing navigation authorities. There are, however, certain UK waterways which are truly comparable; a suitable list might be the Lower Clyde, Mersey, Severn, and Thames, the Humber, and the Manchester Ship Canal. Once again it appears that only the BWB track, a restricted part of the British total, has been considered, and the largest waterways chosen.

This matter was raised with the DOE by the author in 1975. A somewhat oblique denial was given to the assertion that only BWB track was considered,[98] and the Humber, Thames and Manchester Ship Canal were considered to be outside the scope of the regulation as 'they do not rank as inland waterways but as ports'[99] (see discussion on this point in section 4.3). This attitude is totally inconsistent with the interpretation of the term maritime waterway by Belgium, France, Germany and the Netherlands.

5.5 Conclusion

This brief survey of European practice shows that, in general, other European countries are taking positive national and international action to encourage inland water transport on new and old routes. This action follows a recognition of the role which inland waterways can play in contributing to a comprehensive range of transport services, necessary for continued industrial growth. Additionally it has been shown that the EEC transport policy embodies some highly important principles.

These include

- the EEC has the right to regulate a member State's internal transport matters;
- social, as well as financial, factors must be considered in formulating transport policy;
- comparable financial bases, essential for true inter-modal competition, must be established;
- social or anomalous costs falling on one particular mode must be identified and met by Government.

From the analyses in this chapter and in Chapter 4 it would appear that, in respect of British inland waterways, the last three principles are not being followed. If the EEC legislation were applied, as it should be, in Britain, a fairer basis for competition would be provided for our waterways. The next chapter will show that physical factors, often invoked to defend entrenched attitudes to waterways, are no barrier to the profitable expansion of inland waterway use in Britain.

CHAPTER 6: TOPOGRAPHY, INDUSTRY AND TRANSPORT IN GREAT BRITAIN

6.1 Introduction

The previous chapter has identified some of the leading features of European waterway practice and some of the more important principles embodied in current EEC legislation. Together with Chapter 4, it has also shown that British practice is barely influenced by either.

It is tempting to assume that if EEC practices were adopted by the UK Government, then the use of waterways in this country would expand to a scale comparable to that in, say, France or Germany. However, before any such conclusion can be drawn, it is essential to examine what effect the topography of Britain could have on the suitability of waterway transport as a means of meeting real transport needs, and whether the present state and distribution of existing transport services in any way prejudice the wider use of inland shipping.

6.2 Basic topographical features

Frequently, even experienced observers of British inland waterways have asserted that the steepness of our terrain makes this an unsuitable country for the development of inland shipping. Typical of such comments are that a '5 mile (8 km) level would be difficult to find',[1] that the British canals have far more locks/km than those on the continent,[2] and that the average gradient of UK waterways is 10ft/mile (1 in 528) as opposed to continental gradients of 1.8ft/mile (1 in 2933).[3]

Before examining the actual gradients on particular waterways, the flaws in these comments should be pointed out. Not only are there many pounds well over 8 km in length (eg the Paddington Branch of the Grand Union Canal, plus the Slough Branch and parts of the main line and the Regents Canal form a level of over 40 km) but also the ingenious J.F. Pownall produced a plan for 1390 km of canal at a single level, without excessive reliance on earthworks.[4] Secondly, English writers are all too prone to compare the incidence of locks/km on various routes;

this overlooks the fact that the ratio of locks/km is not merely proportional to the gradient, but also proportional to the inverse of average lock rise. It is true that British canals are heavily locked, but the same is true of 18th- and 19th-century construction on the Continent and in the USA, as was noted in respect of Ludwig's and the Rhone-Rhine Canals discussed in sections 5.2.3 and 5.3.1.2 respectively. In most countries using inland waterways, 20th-century canal and river engineering is marked by frequent lock reconstruction in which large numbers of small-rise locks are rebuilt to form small numbers of large-rise locks. UK commentators seem unaware that new Continental canal locks often exceed 15m in rise (the world's largest being 23m at Uelzen, Germany, on the Elbe Lateral Canal[5]) and there are three planned for the Main-Danube Canal at 24.67m each.[6] River locks are even higher, the John Day Lock on the Columbia River, USA, has a rise of 34.4m,[7] and the world's highest is the Ust-Kamenorgorskiy Lock, USSR, at 42m.[8] Clearly such massive rises are only possible or necessary where the terrain is comparatively steep. The average British lock is only of 2 to 3m rise; the highest is less than 5m.

Various gradients of river navigations and canals are tabulated below. Note that for summit level canals the gradient has been calculated as the sum of the rises from each end divided by the total length.

WATERWAY	AVERAGE GRADIENT 1 in	REMARKS	REF
Belgium			
Charleroi - Brussels Canal	560	after reconstruction	9
Danube			
German section	4320	navigable length only	6
Regensburg - Passau	2000 - 5000		12
Passau - Bratislava	2500		12
Bratislava - Komarom	2500 - 10000		12
Komarom - Belgrade	16700		12
'Cataracts'	500 - 25000		12
Lower Reaches	> 20000		12
France			
Marne-Rhine Canal	680		9
Rhone: above Orange	often < 1000		13
Orange - Le Pontet	2000		13
Below Le Pontet	> 2000		13
Seine: Paris - sea	6830		9
Germany			
Main	2580	whole navigation	6
Main-Danube Canal	650	under construction	6
Weser: Minden - sea	5130		9
Rhine			
Basle - Brisach	1000	little commercial use until 20th century	11
Strasburg	1670		11
Mainz	10000		11
Bingen	120	max. gradient (over 17m)	11
	1790	average	11
Cologne	5000		11
Lower reaches	> 5000		11
Sweden			
Trolhatten and Gota Canals	1030		9
USA			
Ohio River	11860		15
USSR			
Moskva Canal	1270	built 1937	10
Volga - Baltic Canal	3820		14
Volga - Baltic Waterway	6970	series of canals and river navigations	10
Volga - Don Canal	800	built 1952	10
White Sea - Baltic Canal	1230	built 1933	10
UK			
Caledonian Canal	1640		9
Manchester Ship Canal	3140	whole canal	17
	1310	non-tidal section	17
Thames: Reading - sea	5510		16
Reading - Teddington	2540	locked section	16
Trent: Nottingham - sea	4920		16
Nottingham - Cromwell	2170	locked section	16
Yorkshire Ouse: York - sea	16800		16

Table 35: Europe, USA and USSR, gradients of various waterways

From the above table various conclusions may be drawn. Firstly, there is a wide range of gradients, and to speak of an average gradient of Continental waterways disguises this wide variation. A better assessment of current practice might be to refer to maximum gradients of new construction, for this would give some indication of the limiting gradients. As can be seen, many of the steepest gradients are found on waterways built this century, and these frequently exceed 1 in 1000 (5.3 ft/mile).

Secondly, river navigations tend to have shallower gradients than the canals which connect them. This is in part a result of basic topography (viz that the easiest gradient up from sea level tends to be along a river) and partly a result of modern engineering practice. Speed of transit has become more important than previously and this has justified shorter steeper canal routes rather than longer 'contour' canals. Technology has made this possible; large-rise locks, water-saving devices and heavy earth-moving plant are all features of modern canal building. This is not to say that all new canal routes must be steep; the Mittelland Canal, built in Germany between the Wars, has a pound over 200 km long.

Thirdly, major waterways in Britain have gradients comparable with the general run found elsewhere. It is clear that new and existing commercial routes can be found with reasonable working gradients and there is no reason to write off Britain solely on the basis of steepness. It is true that some very steep canals were built in the UK in the 18th century (eg over the Pennines) but these are no longer used commercially. Figure 31 shows that although northern Scotland, the Pennines, Wales and the West Country offer few suitable routes for waterway construction, the area east of a line between, say, London and Doncaster and south of the Tees has little ground over 100m above sea level. In addition, routes below 100m can easily be found for connexion with the Rivers Severn and Mersey, and for penetration to much of the Midlands.

Therefore, although the steepness of a possible waterway route (or, for that matter, of any transport mode) must influence its cost and

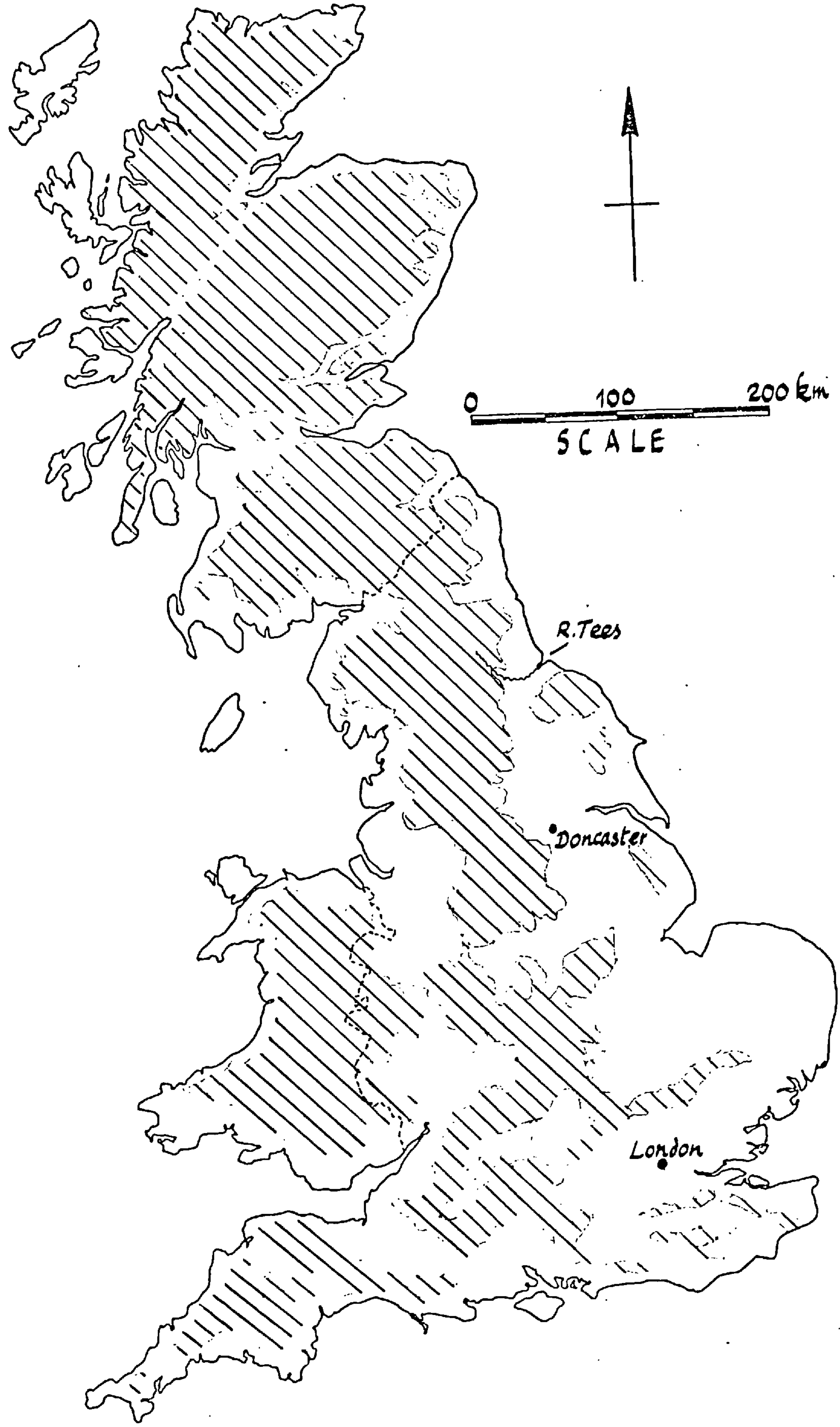


Figure 31: Great Britain, mainland ground above 100m above sea level.

hence its economic viability, Britain is not sufficiently steep of terrain for this alone to render inland waterways of no value.

6.3 The influence of port distribution on the need for inland freight transport

A popular, simple, and not altogether inaccurate analysis of freight transport is that bulk trunking is the province of rail, pipeline and waterway, and that the remainder is properly performed by road. As the UK is self-sufficient in very few raw materials (notably aggregates, china clay, cement, coal and salt) and has to export manufactured goods in exchange for imported raw materials, freight flows are dominated by the movement of imports and exports. This would suggest that the use of well-distributed ports round the coastline would reduce the importance of internal bulk trunking and thus increase the market share of the best distributive mode, road. If this proposition were correct, it would show in two ways: in road accounting for a higher proportion of UK internal freight movements than in comparable countries with inferior port facilities, and also in a correspondingly lower total use of freight transport. This latter is an inescapable corollary as the choice of port of discharge for, say, imported timber will be influenced by the location of the destination of that cargo. Thus the fact that a wide range of ports exists should reduce the UK's total measured demand for internal freight movements.

Firstly then we can examine the freight modal split in a number of European countries.

	% OF FREIGHT TONNE-KILOMETRES				YEAR	NOTES
	RAIL	WATERWAY	ROAD	PIPELINE		
AUSTRIA	52	6	11	31	1972	
BELGIUM	25	22	50	3	1972	
BULGARIA	68	6	26	-	1966	
CZECHOSLOVAKIA	72	3	16	9	1973	
FRANCE	36	6	40	18	1973	
GERMANY - E	70	3	22	5	1973	
- W	40	31	27	2	1960	
HUNGARY	66	5	23	6	1973	
ITALY	20	1	67	12	1972	excludes coastal shipping
NETHERLANDS	6	57	27	10	1973	
POLAND	76	1	16	7	1973	
ROMANIA	81	2	14	3	1966	
SWITZERLAND	n.a.	n.a.	n.a.	n.a.	-	
USSR	77	5	7	11	1973	
YUGOSLAVIA	35	11	54	0	1973	
UK	24	0	73	3	1973	from same source as above
'official'	18	0	65	2	1973	(plus 15% coastal (shipping: see (Table 20
actual	18	2	64	2	1973	(plus 14% coastal (shipping: see (Table 21

Table 36: Europe, estimated internal freight modal split, 1973[18]

Notes (1) n.a. indicates not available
(2) 0 indicates between 0 and 0.5%
(3) The original text further qualifies as to accuracy and comparability

Although the above table is undoubtedly not accurate to ± 1%, it does suggest that the UK uses road haulage more than any other European country. Italy comes nearest to the UK figure, but just as the UK road share falls by nearly 10% if coastal shipping is included, so the Italian figure would also fall. No estimate of Italian coastal shipping use can be made, but it has been described as 'important.'[19]

To examine the corollary of the proposition, it is necessary to define more closely how the relative levels of freight transport use in different countries may be compared. Clearly, some account must be taken of the various factors which will influence the demand for freight transport. These will include the size of the country, its population and the level of economic activity of its inhabitants. The simplest realistic model of freight transport use would be

$$F = f(A,E,P,X) \qquad - 6.1$$

where F = total internal freight transport use in tonne-kms/annum,

A = area of the country in km^2,

E = economic activity,

P = population,

and X = any other influences.

Considering each of the variables A,E,P, in turn, and assuming the others to be constant, we can predict, the following relationships

$$F \propto \sqrt{A} \qquad - 6.2$$

$$F \propto E \qquad - 6.3$$

$$F \propto P \qquad - 6.4$$

$$\therefore \quad F \propto \sqrt{A}.E.P \qquad - 6.5$$

(In respect of eq. 6.3 it is interesting to note that one study on the relationship between Gross National Product and transport demand showed that a 1% rise in GNP produces a 1.07% rise in national transport tonne-km.[20]). Let E be represented by the annual Gross Domestic Product per inhabitant

ie $E = \frac{G}{P}$ where G = annual GDP $\qquad - 6.6$

$$\therefore \quad F \propto \sqrt{A}.\frac{G}{P}.P$$

$$\propto \sqrt{A}.G$$

or $$F = kG\sqrt{A} \qquad - 6.7$$

where k is the freight transport demand factor reflecting, amongst other things,

the spatial distribution of industry within a country,
the spatial distribution of its population,
the nature of its most commonly used fuels,
the nature of the employment of its population,
its shape and topography,
the number and location of its ports, and
its transport policy.

Values of k for a number of European countries (including all those listed in Table 36) are derived in Table 37 and compared graphically in Figure 32.

	A AREA: 10^3 KM^2	G GROSS DOMESTIC PRODUCT: 10^9 US$/ANNUM	F INLAND FREIGHT TONNE-KM X 10^9	$k = F/G\sqrt{A}$ FREIGHT TRANSPORT DEMAND FACTOR
AUSTRIA	83.8	17.8	20.7	0.0040
BELGIUM	30.5	30.8	22.8	0.0042
BULGARIA	110.9	9.4	29.2	0.0093
CZECHOSLOVAKIA	127.9	28.7	84.9	0.0083
DENMARK	43.1	18.1	14.7	0.0039
FINLAND	337.0	12.5	20.9	0.0029
FRANCE	547.0	178.2	218.3	0.0017
GERMANY, E	108.2	37.3	70.5	0.0057
" W	248.5	211.5	197.9	0.0019
HUNGARY	93.0	15.2	35.0	0.0075
ITALY	301.2	106.8	35.0	0.0006
NETHERLANDS	40.8	37.1	51.6	0.0075
NORWAY	324.2	13.2	6.1	0.0008
POLAND	312.7	43.2	167.3	0.0069
ROMANIA	237.5	16.3	65.2	0.0082
SPAIN	507.8	41.7	86.7	0.0029
SWEDEN	449.8	36.6	41.0	0.0017
USSR	22,402.2	324.7	4,155.7	0.0027
YUGOSLAVIA	255.8	16.2	72.3	0.0088
UK (excluding coastal shipping)	244.0	135.2	116.4	0.0017
GB (excluding coastal shipping)	229.9	135.2(?)	117.4	0.0018
GB (including coastal shipping)	229.9	135.2(?)	137.8	0.0021

Table 37: Europe, derivation of freight transport demand factor, by country, 1974[21]

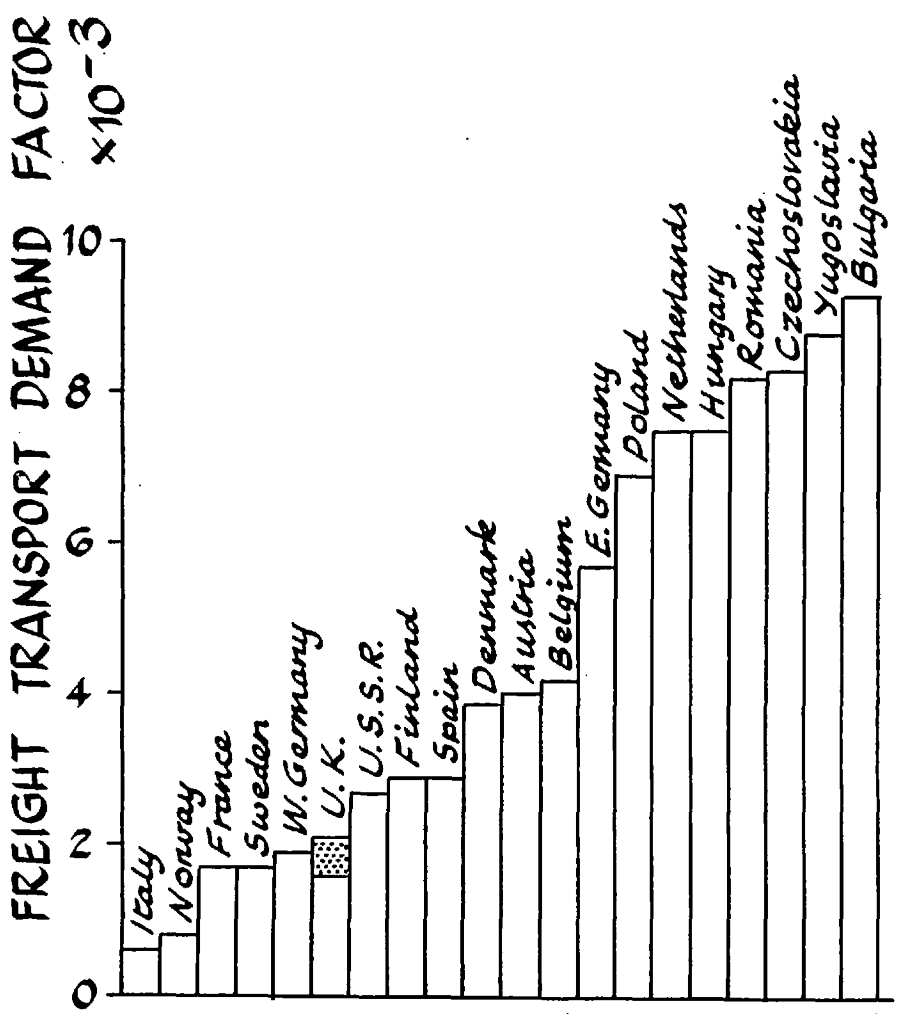


Figure 32: Europe, freight transport demand factors, by country, 1974.
(Source: Table 37)

Several points of interest emerge from Figure 32. First and foremost, the Uk does not have the lowest transport demand factor. Secondly, as would be expected, the land-locked countries tend to have higher transport demand factors (average 0.0066) than the others (average 0.0042). Thirdly, those countries with conspicuously high coastline/area ratios (Italy, Norway, UK) have predictably lower demands than average. Fourthly, and less easy to explain, of those countries with the highest transport demand factors, seven out of eight are communist.

It may be that the sharing of basic productive tasks between COMECON countries means that the resultant necessary distribution of the products contributes to a higher freight transport demand. Whether this is true or not, the inclusion of the whole area of the USSR, rather than just that of its densely populated and industrial European part, has reduced its calculated freight transport demand factor considerably. If only the smaller area were counted, the USSR would be well over to the right of Figure 32, along with the other communist countries. It is therefore likely that COMECON organisation, together with the communist countries' location at the broader end of the continent, produces high levels of inland transit traffic and thus high freight transport demand factors.

In conclusion, the proposition that the long coastline of the UK explains our high dependence on road transport is not supported when comparisons with other European countries are made. Our widespread port facilities do reduce our internal freight trunking demands, but there appear to be other reasons for our present freight modal split.

6.4 Coastal shipping as a distributor

Britain's coastline not only allows a well-distributed siting of port facilities, but also itself provides a circumferential freight route. It is often asserted that this can be regarded as a transport route of equivalent value to the major inland water routes of continental countries, and, moreover one which has cost nothing to build. There are three reasons why this assertion is, at best, only partially valid.

(i) The density of the man-made water network in the industrial areas of France, Germany, Belgium and the Netherlands is such that virtually nowhere within north-west Europe is more than 50 km from a 1000-tonne capacity waterway (see Figure 30). This compares favourably with the claim that nowhere within the UK is more than 100 km from the sea. It has therefore been considered worthwhile in Europe to divide the continent into 'islands' smaller than our own.

(ii) Following on from the first point, the mere presence of the sea 100 km or less from any location does not itself mean that trans-shipment facilities may be found there. The provision of such facilities on our coast is in general a more difficult and costly operation than the provision of a new quay or wharf on a canal or river.

(iii) Lastly, transport of freight on inland waterways is easier and safer than on coastal routes. The inland waterway offers along its length virtually continuous protection, continuous potential for mooring and assistance in case of mechanical or other accident, less hazard from adverse weather (although ice can be a problem) and virtual freedom from heavy seas, dangerous rocks and other underwater obstructions. The result of this greater safety is the reduction of mechanical power required, reduction of hull strength and weight, reduction of manning levels and finally a reduction of cost of transport. This resulting difference in cost for the transport of oil can be seen in Figures 35 and 36.

Thus although the coast does allow some internal trunking in the UK (see section 4.5), not only does this provide a less convenient and more expensive route than do the European waterways, but also UK use of coastal and inland shipping together is still less than inland shipping use in Belgium, W. Germany and the Netherlands (see Table 26), all of which have in addition some coastal traffic. It is clear then that our coastline can never be more than a partial substitute for a waterway network.

6.5 Inland demand for bulk trunking

As has been touched upon in section 2.4, post-war changes in industrial practice have eliminated some ideal waterway traffics, notably coal to factories, gas works and power stations. The relocation of previously inland industries (eg steel) on estuarial sites has had a similar effect. It is therefore necessary to consider what commodities might be carried on any new waterways.

6.5.1 Coal, coke and other solid fuels

Although there has been a decline in recent years, annual production of coal is still over 100 million tonnes and may well rise again. About two thirds of this is consumed in power-stations. As there are limitations to the mobility of both mining operations and power stations, and the optimum locations of the two do not coincide, it may be concluded that there will continue to be a demand for bulk trunking between them. Figure 33 shows Britain's presently worked coal fields and coal-fired power-stations.

The second largest use of coal is for coking. This is localised and hence may give rise to demand for bulk transport facilities. Remaining uses of solid fuels are widespread and unlikely to give rise to significant new traffics suitable for waterways.

6.5.2 Petroleum and petroleum products

The refining of petroleum is a good example of an industry which has gathered itself into a few very large units situated alongside deepwater facilities in estuaries. This supply is almost exclusively via large tankers, or in the case of the North Sea wells, via pipe lines. Conversely, the consumption of refinery products, notably petrol and other fuels, is very widespread. Thus the concentration of refinery resources tends to increase the demand for distribution. Table 22 shows that this distribution is currently the mainstay of the coasting trade, and substantial tonnages are moved inland on the Humber waterways, the Thames and the Gloucester & Sharpness Canal.

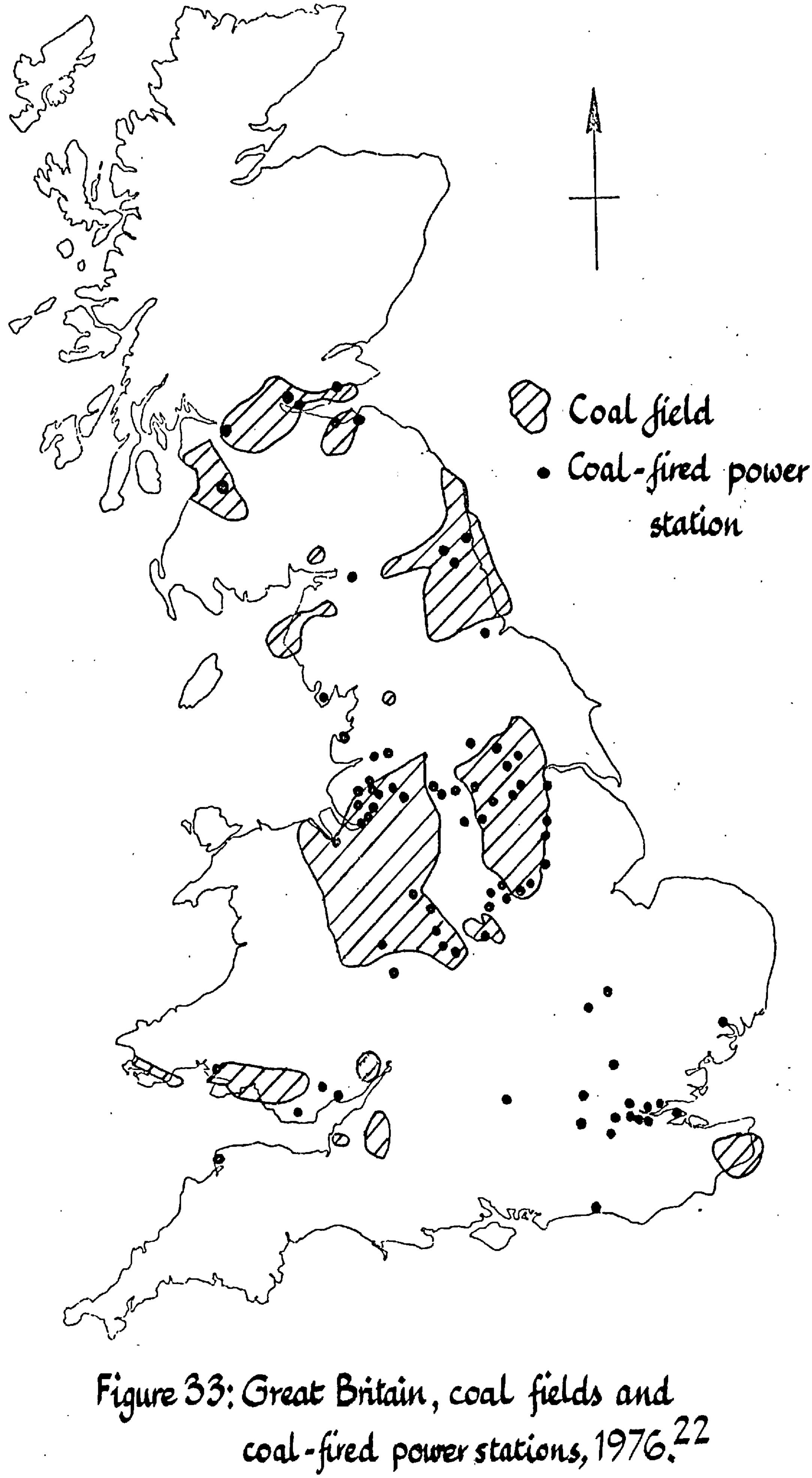


Figure 33: Great Britain, coal fields and coal-fired power stations, 1976.[22]

An important rival to inland waterway for the distribution of refinery products is the pipeline, its use also being indicated by the comparatively small number of refineries. Figure 34 shows the British pipeline network for petroleum and petroleum products. The results of a very detailed study on the economics of oil transport in Europe are presented in Figures 35 and 36. These show the range of competition between pipeline and inland and coastal shipping, though it should be noted that for oils of higher viscosity, pipeline transport is made relatively more expensive by increased pumping costs.[26]

6.5.3 Steel-making materials and products

Steelworks demand great volumes of imported materials, but as they are now frequently sited alongside deep-water berthing facilities, the need for inland transport of ores is eliminated. In fact, although ores are moved in large quantities on European and USA waterways, the author has not found any British waterway with ore traffics. There is a more realistic potential for the carriage of steel scrap to steelworks, as a substitute for ores. 6 to 7 million tonnes of steel scrap are used annually in the UK, excluding any re-use of materials arising in the steel-works themselves. As steel scrap arises in commercial quantities virtually throughout the UK, this is a promising traffic, though price differentials may attract it to European rather than UK foundries. Scrap is currently loaded for movement in small craft (less than 1000-tonne capacity) at, for example, Norwich (on the R. Wensum), Colchester (on the R. Colne) and in the Regent's Canal Dock (R. Thames). The only steel-works in south-eastern England, that at Sheerness, relies totally on scrap for its raw material.

There is also some scope for the transport of steel products by waterways. There are two distinct categories - normal and outsize. Normal products in bar or strip form may be moved by waterway for export, as has been done for instance on the R. Dee from Shotton, and by BACAT barges from Yorkshire. Indeed, one of the traffics identified for movement on an enlarged Sheffield & South Yorkshire Navigation is

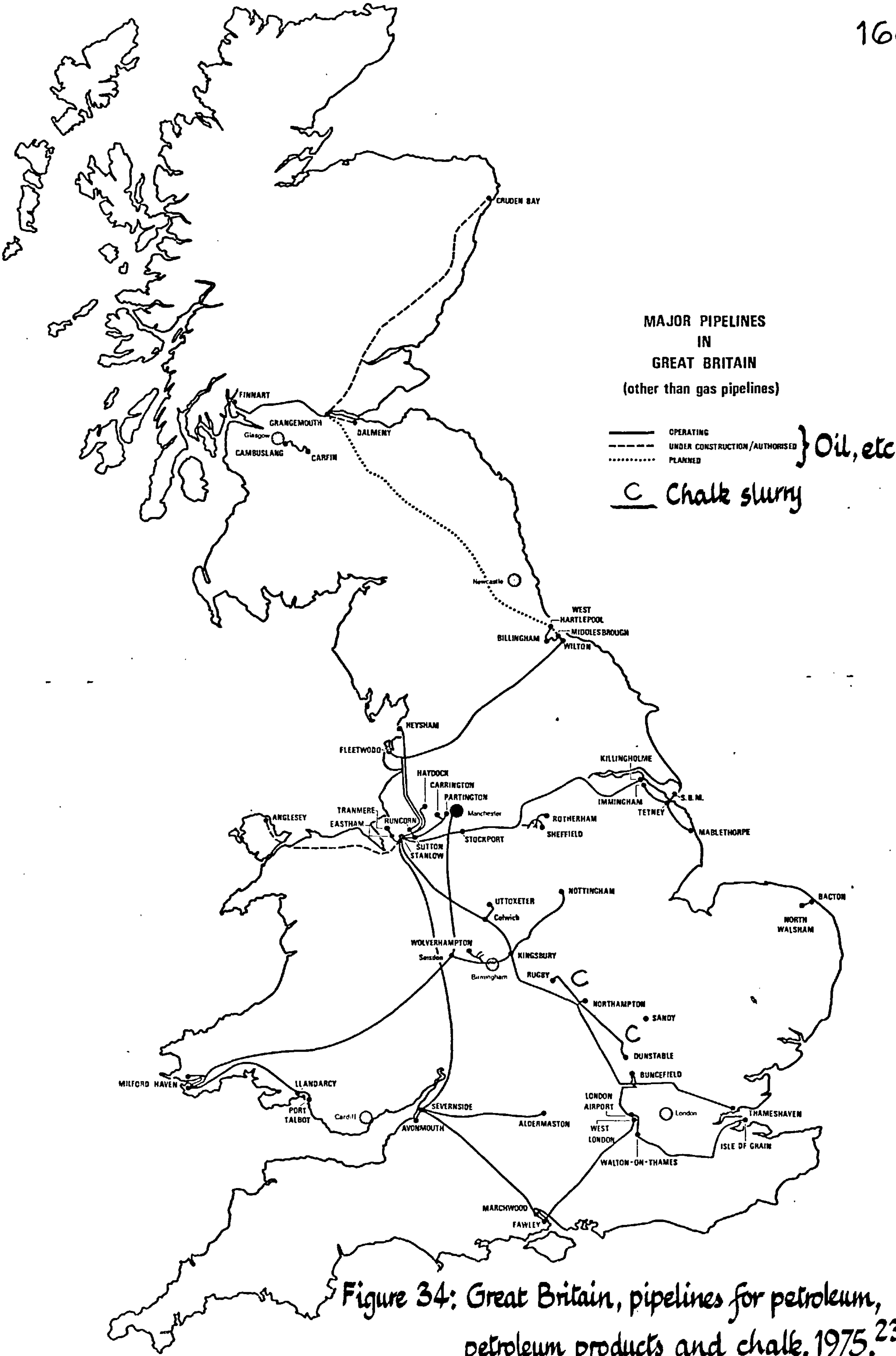


Figure 34: Great Britain, pipelines for petroleum, petroleum products and chalk, 1975.[23]

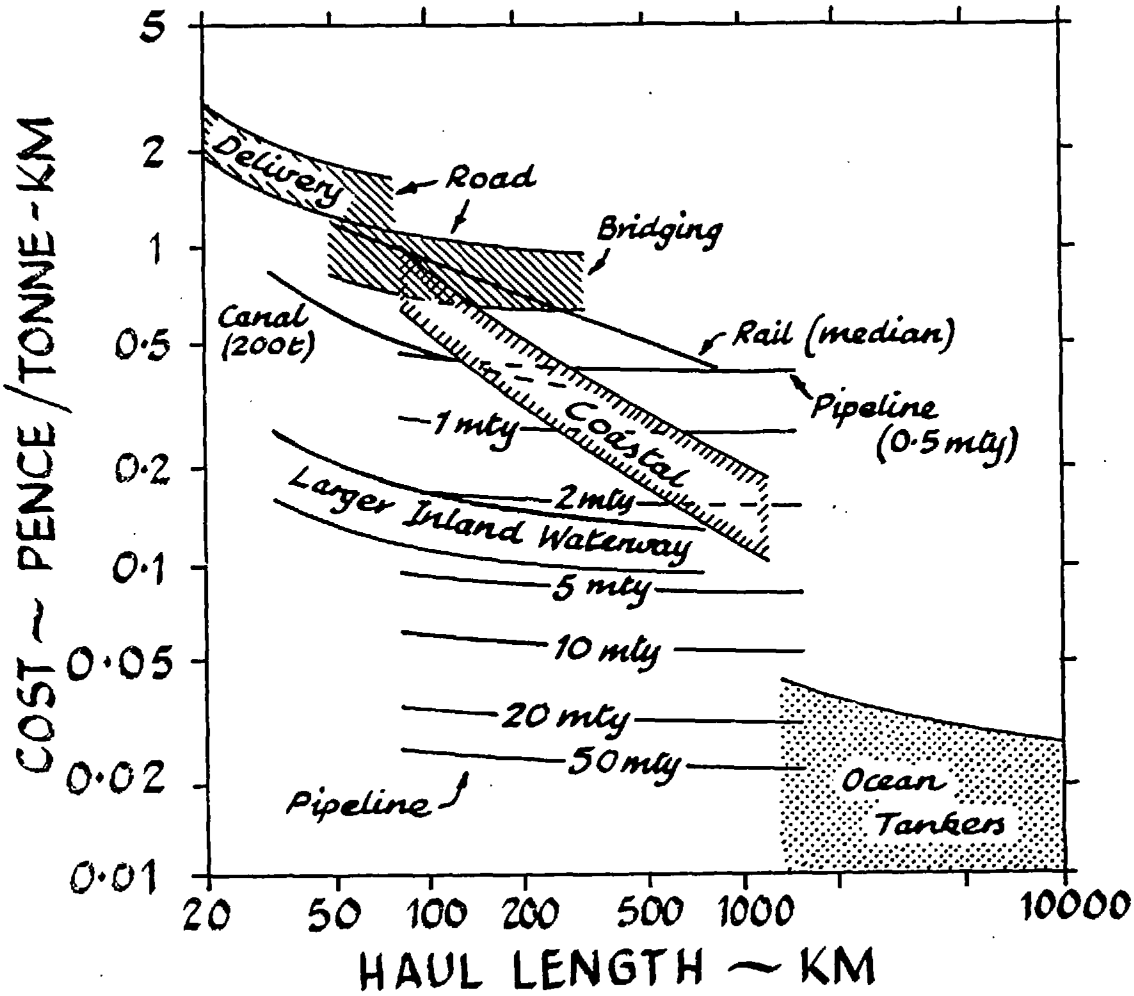


Figure 35: Europe, cost of oil transport relative to haul length, by mode, 1967.[24]

Note: mty = million tonnes/year

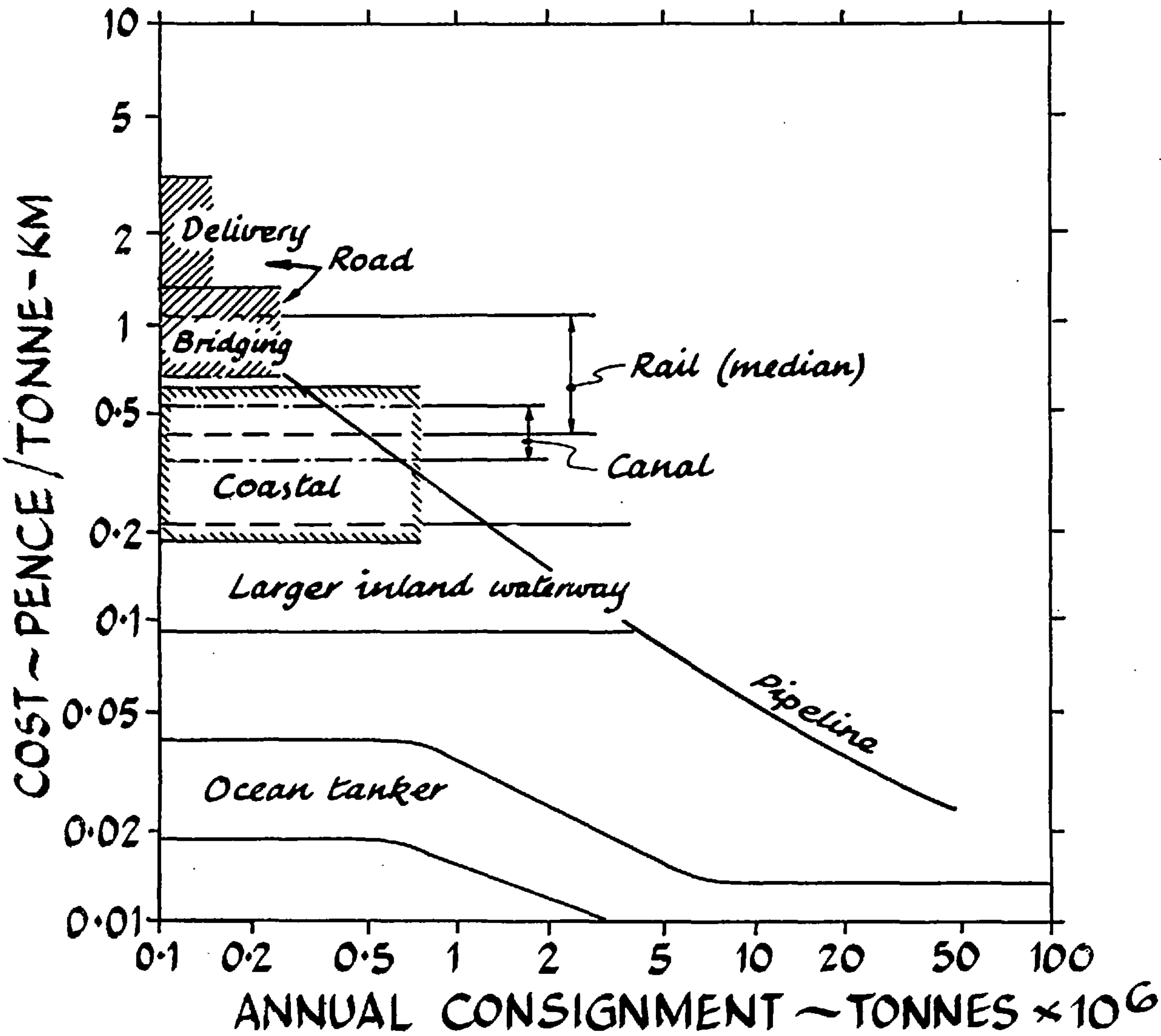


Figure 36 : Europe, cost of oil transport relative to consignment quantity, by mode, 1967.[25] (based on typical practice)

100,000 tonnes per year of steel bar for export to Germany.[27] Steel-mill products are also imported from Europe; the UK's first covered wharf was built on the Thames to handle steel coil from Germany, and its design follows Rhine practice.[28] Although this is sited 5 km downstream from Tower Bridge, the craft which serve it are small enough to serve points higher up the river.

Outsize fabrications are unlikely to account for significant tonnages, but there are many examples of waterway transport of large sections of bridges, dock gates, pressure vessels, and so on.

6.5.4 Import/export traffics

Traffics in imports and exports are vital to the UK, and much of our national freight transport effort is devoted to the movement of goods into or out of port areas. As these areas often lie on rivers or estuaries there is in many cases a ready-made waterway connection to the hinterland. However, the mere volume of port cargo is not a sufficient guide to potential inland waterway traffic; the nature of the cargo and its mode of packing are highly important.

Certain bulk commodities have already been dealt with above. Many of the other cargoes imported or exported are capable of 'unitisation' into easily handled units eg on pallets, in bundles, or in containers. This last form has made great inroads into certain categories of cargo which had for many years been lightered to or from berthed ships. Most container-handling installations in Britain are designed for service by road vehicles with some back-up provided by rail. With the inland craft now in service in Britain, size becomes a problem in that one container represents a sufficiently large fraction of the total load to alter seriously the craft's equilibrium when it is lifted or lowered. The lifting gear is also very expensive, which makes the transfer of containers from one mode to another a costly operation; studies on the potential use of an enlarged Grand Union Canal for containers showed that the extra lift might account for 12% of the whole cost of movement by water. In total, the water carriage of containers between west London and Tilbury was estimated to cost about 30% to 100% more than road.[29] It is also significant that there are no regular coastwise movements of containers in the UK.

Even on the largest waterways of Europe, container traffics are not extensive. Some scepticism surrounded the introduction of a Rhine service from Amsterdam to Basle in 1968,[30] but container-carrying has nevertheless become established and there is competition between Amsterdam, Rotterdam and Antwerp for serving the Rhine hinterland. There is also some container traffic on the Danube.[31]

However, although containerisation may have led to some diversion of traffic from water, there has been a complementary waterway development in the shape of the barge-carrying ship (BCS). This in essence replaces the standard road/rail container by a larger one which can float, and can thus move between ocean terminal and origin/destination by waterway. Several systems have been put into service, of which LASH is the most successful, and SEABEE with its 840-tonne capacity barges the largest.

The LASH system was devised by a USA naval architect, Goldman, and is remarkable for the speed at which it was developed from a mere concept to a fleet of 24 vessels in international service; this only took ten years.[32] The ocean-going mother-ships carry between 74 and 89 lighters each and these are loaded and off-loaded by a shipboard gantry crane. This frees the LASH ship from dependence upon shore-based cranes; the LASH lighters can be moved to or from the ship by conventional tug. Actual rates of operation are 3 to 3.5 barges/hour,[33] and as each port of call generally only receives part of the total complement, fast turn-round times are possible, maybe of only a few hours.

Other systems are in use or under development, and it would appear that the barge-carrying ship concept has proved itself and that the present worldwide services will continue or be expanded. The range of commodities for which BCS barges are considered suitable has limited overlap with container traffics. The 370-tonne capacity LASH barge has been used extensively for bulk materials (iron ore, scrap, grain, clay, timber), and semi-bulk or part-manufactured goods (paper pulp, paper board, tinplate, chemicals) and its large size allows the loading of cars, tractors, and other indivisible outsize cargoes, including standard containers themselves.[34]

In the UK, extensive inland penetration by BCS barges is precluded by their size, though LASH units have been worked to Selby (Yorks. Ouse), Aylesford (Medway) and Brentford (Thames) besides other seaboard ports. Nevertheless there is a wider significance to the continued servicing of UK ports by BCS lines. As the trends in inland craft operation and design are towards pushtowing of rigid rafts, it would be realistic to use the existing barge-carrying systems (probably LASH) to provide a module for the planning of any UK enlargements. This does not presuppose that, on any new waterway, traffic of this sort would predominate, but it would enable the best service to be given to existing proven systems, and would possibly set a useful precedent for sizes of new craft to be built for internal operation, but which might occasionally be carried via a BCS. The relevance to London of BCS operations has already been mentioned (Section 3.3 and Fig. 22).

Apart from BCS cargoes there will continue to be certain imports and exports for which conventional self-propelled or dumb craft are well suited. These would include hardwood logs (eg on the Thames and Lee, and on the Severn and Lydney Canal), and grains (as on the Thames). One great advantage offered by transferring ship cargoes to barges is that both sides of the ship may be served simultaneously. To the shipper the method has an added attraction in that wharfage and similar dues may be reduced. (The influence of the 'Free Water Clause' in London and Hull has been discussed in section 4.3)

6.5.5 Offshore traffics and refuse

The extent of offshore traffics in aggregates and materials for dumping has already been shown to be around 20 million tonnes per annum (see Table 22). The demand for marine-dredged aggregates is likely to be widespread and to increase, as pressures from environmental protection bodies reduce the number of new inland sites available either for the quarrying of rocks or for the extraction of alluvial sands and gravels. As marine-dredged materials are only accessible to ships, the inland movement of these means that only waterway transport offers no trans-shipment. This in contrast to many purely inland movements where use of waterways may well require an extra trans-shipment. Although at present the craft used frequently act both as dredger and as transport, a more intensive use could be made of capital if the dredger were stationed permanently on the dredging ground. This could then be used to feed large dumb barges, possibly via a floating screening plant. A push-tug would shuttle barges between the inland waterside depots and the dredging ground. This would allow maximum use of the (costly) dredging plant and propulsion system; the current system only allows one or other to be used at any time.

Environmental pressures may also contribute to an increase in marine dumping. The same argument re trans-shipment also applies as in the case of marine-dredged aggregates. The wastes so disposed of at present include solids (eg power station ash, coal mining spoil) and liquids (eg sewage sludge). As the filling of vessels used may take some time, the attraction of the push-tug and barge still holds; the tug can take half the barge stock offshore for emptying while the other half is being filled.

Domestic and industrial refuse is also handled by waterway, the largest user being the Greater London Council, which contracts out the barge transport of over 600,000 tonnes of domestic refuse annually.[35] This is moved from five GLC-owned refuse transfer stations in London to three disposal sites in the Thames estuary, with an average journey length of over 50 km. The refuse is used for landfill, which means that destinations as well as origins are waterside. No trans-shipment is therefore required, nor, on the other hand is there the advantage over land transport which arises in the case of offshore disposal.

It is of interest to note that the traffic study for the lower Grand Union Canal enlargement scheme identified refuse and aggregates as likely to be the most significant 'local' traffics (ie not imports or exports).[36]

6.6 Transit use of waterways

In addition to the bulk freight which might travel on any new or enlarged waterways, there are two other classes of traffic which, although not freight, could be significant in both financial and economic terms. The first of these depends on the waterway as a route giving access to shipbuilding or repair facilities or providing a short cut or other connection; the second is passenger traffic, either tourist traffic on the waterway itself (see section 8.8.2) or tourist traffic starting on the waterway but travelling further afield (eg London to Zeebrugge, Belgium). No estimate of either use has been made, but those waterways known to provide access for fishing craft or ship-yards are indicated in Appendices 4 and 5.

6.7 Coastal craft and sea-going barges

The connections between the coasting trade and inland shipping were discussed in sections 4.4 and 4.5. It is clear that some traffics can be won by coastal shipping only because of the many inland ports and wharves which can provide loading and discharge points for coastal craft. Tables 18 and 19 show that much of today's inland waterway traffic is of this type. Therefore it is likely that any new waterway will be used by coastal craft, provided that the gauge is sufficient. There are no standard coastal craft sizes, but it is probably fair to say that the parameter likely to be most important is air-draught. Inland craft have traditionally much lower air-draughts than coastal craft of similar capacity. Although, therefore, the potential of coaster penetration must be borne in mind as early as at the design stage, this does offer a real, and possibly extensive, traffic.

The air-draught problem can be partly resolved by the use of the 'sea-going barge'. This ambiguous phrase is generally taken to describe a self-powered vessel whose hull and fittings are adequate for it to go to sea (generally, in the British context, the North Sea, or UK coastal waters) but whose superstructure is designed to minimise air-draught thus giving maximum inland penetration. The use of these craft is not yet widespread but could increase, and would be encouraged by the possibility of further access to inland destinations.

A German company has already launched two craft of this type and plans to expand their fleet to ten.[37] The craft have bows and wheel-houses which can be lowered for inland use and raised for sea journeys. Overall length and beam are 80m and 9m respectively, roughly equivalent to a European Class IV waterway. Capacity is 650 tonnes on a draught of 1.90m and 2100 tonnes on 4.20m. Freeboard considerations limit sea capacity to 1400 tonnes on a draught of 3.00m.

Craft of the 'coaster' and 'sea-going barge' types are likely to continue to trade both coastwise and across the North Sea. Their utility is related to the number of locations they can serve and they could prove significant users of any new or improved waterway built to sufficient size.

6.8 Conclusion

It is often asserted that topographical factors alone preclude the possibility of any extensive inland waterway use in Britain. However, examination shows that, compared with Europe, neither the steepness of the terrain nor the long coastline are sufficient to explain the restricted nature of the waterway network. The multiplicity of British ports available to shippers is not itself an adequate explanation for the low level of internal trunking by water and rail nor thus for the high level of use of roads for freight carriage in Britain, a level apparently higher than any other European country.

Although coastal shipping does perform an internal trunking role in Britain, it is not a direct substitute for an inland waterway system, being more restricted and more expensive.

If more large-scale inland waterways were built, they would be capable of securing, as demonstrated above, substantial traffics in coal, oil, aggregates, imports and exports (especially via barge-carrying ships) and wastes, though probably not much in crude petroleum or ores. If an appropriate gauge were adopted, new track could well attract other traffics in coastal or short-sea craft, and possibly in sea-going barges. The following chapters examine the costs of construction and operation of waterways, and the non-transport uses to which such waterways could additionally be put.

CHAPTER 7: COSTS OF WATERWAY CONSTRUCTION AND OPERATION

7.1 Introduction

Having in the previous chapter shown that there are possibilities of expanding the existing British waterway system and that suitable cargoes could be found, it is now necessary to consider the costs involved in any expansion. This chapter will cover the costs and benefits solely attributable to the use of waterways for freight transport; the following chapter will consider wider issues such as recreation, amenity and water transfer. Where appropriate, comparisons will be made with other modes of transport.

7.2 Land-take and severance

The land-take of a waterway cannot be generalised, as it is obviously related to, amongst other things, the size of craft expected to navigate upon it. Up to the second World War, waterways in Europe were largely built to nationally adopted gauges, but the growing importance of international traffic led the European Conference of Ministers of Transport (established in 1953) to propose international standards. The ECMT based their classification (see Table 28) on existing 'type-craft' in service in the 1950s. To incorporate the results of more recent technical changes, especially the adoption of push-towing, extensions to the ECMT classificiation have been proposed.[1]

Although the gauges of the various classes of continental waterway are thus precisely specified, these relate to craft dimensions and therefore govern fixed structure dimensions directly only at those points on a waterway where minimum clearance is provided, ie at locks and anywhere else where one-way working is necessary, which can include some bridges, tunnels and aqueducts.

However, the land-take for an inland waterway is related more closely to the normal cross-section, and this is considerably larger than the vessel cross-section. It is customary to express the channel cross-sectional area as a multiple of the submerged cross-sectional area of the boat, this multiple being known as the area ratio, n.

$$n = \frac{B.D}{A} \qquad \text{(see Fig. 37a)} \qquad 7.1$$

Sometimes the inverse of this, the blockage factor, S, is used.

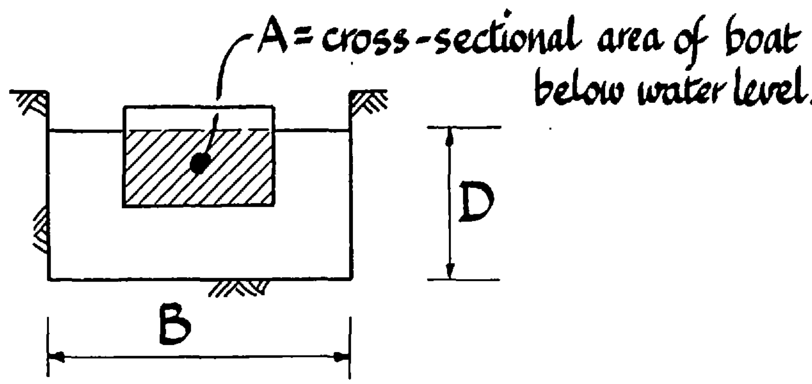
$$S = \frac{1}{n} = \frac{A}{B.D} \qquad 7.2$$

On any particular project, n is usually assigned a minimum value, often between 5 and 7. It is found that if n falls below about 5, the increased resistance offered to the boat's passage more than offsets any gain in reduced construction or land costs. This does not imply that increasing n above 5 has no benefit; the effects of channel restriction are still appreciable[2] when n is as high as 10. The exact variation of channel resistance with n is also a function of the shape of the cross-section as well as its size.

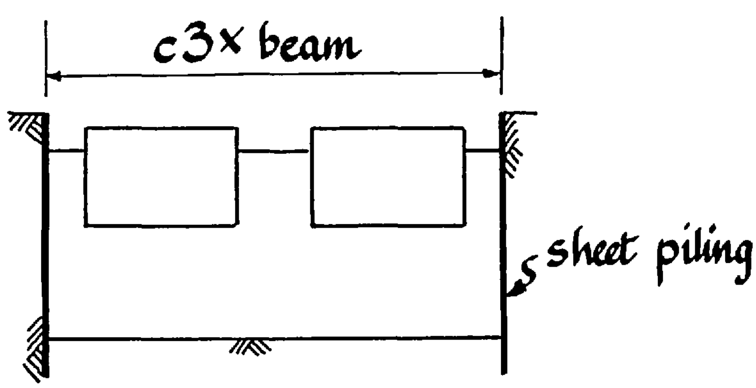
There are other limits to the dimensions of B and D. Clearly, if double-way working is to be permitted, B must be more than twice the beam. Typically B might be about three to four times the beam to allow sufficient clearance for manoeuvring and passing. This still allows some variety in choice of cross-section (see Figs. 37b and c). In areas where land costs are very high it is worth minimising the water surface and producing a rectangular cross-section by use of sheet piling. Where land costs are lower it is cheaper to increase the water surface width but eliminate the need for piling by excavating to a trapezoidal cross-section. The limiting factor then becomes the depth, or, more precisely, the clearance between canal bed and the underside of a laden vessel. To avoid problems with fluctuating water levels, fouling by debris on the bed, resistance to forward motion, and squat*, a clearance of 1.5m is advisable for new Class IV waterways.

---

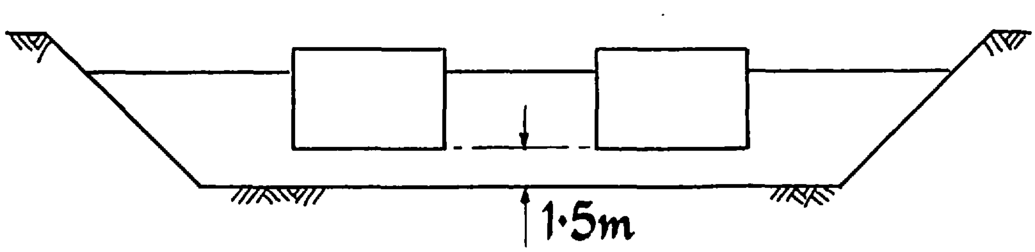
*Squat is the decrease in bed/boat clearance observed when a boat moves with increasing speed in a confined channel.



(a) defining parameters.



(b) n = 7·5, minimum width to minimise land take.



(c) n = 7·5, minimum depth to minimise construction costs.

Figure 37: Diagrammatic waterway cross-sections.

The above remarks apply to straight parallel-sided sections of canals. On bends, greater width must be provided if adequate clearances and ease of operation are to be maintained. Canalised rivers and river navigations will also tend to have larger sections to allow water to flow without interruption to navigation. Even so, navigation may occasionally be suspended during periods of exceptionally high levels or flow rates.

Some widths of typical new canals are tabulated below.

CANAL	NORMAL SURFACE WIDTH (METRES)	BEAM OF LARGEST CRAFT/TOW (METRES)	REF
Tennessee - Tombigbee, USA	113.4 (a)	32.0	3
	100.0 (b)	32.0	3
Elbe Lateral, Germany	53.0	9.5 (Class IV)	4
Main - Danube, Germany	55.0 (c)	"	5
	43.1 (d)	"	5

Table 38: Europe and USA, widths of various new canals.
Notes: (a) maximum on 'canal' section allowing 1:3 slopes to a 91.4m channel, 3.66m deep
(b) minimum on 'divide' (summit) section, allowing 1:2 slopes to a 85.3m channel, 3.66m deep
(c) normal section
(d) rocky cuttings

As might be expected the width of the waterway is a function of both boat size and the nature of the terrain. However, it can be said that a Class IV waterway in level terrain might typically have a construction width of around 60m when allowance is made for the freeboard of the canal banks and for the provision of an access road or track along one side.

Widths of major road and rail formations are given below.

MODE		WIDTH (METRES)
Road:	dual 2-lane carriageway	28.2
	dual 3-lane carriageway	35.6
	dual 4-lane carriageway	46.2
Rail:	4-track	17.2

Table 39: UK, widths of major road and rail formations (6).

Thus it can be seen that a Class IV waterway occupies about 3.5 times as much land as a four-track railway, and about 1.3 to 2.1 times as much as a major road. These ratios are not based on comparable capacities as the mix of passenger and freight traffic will vary according to each mode. In fact it is not possible to derive exact values for areas of land used per unit volume of freight capacity for different modes. Nevertheless an approximate assessment may be made. The capacity of the Luneburg lift, and hence of the Elbe Lateral Canal, is 10.1 million tonnes annually in each direction per caisson, giving 40 million tonnes total.[4] In the UK, the dual 3-lane carriageway road is prescribed for traffic flows of 35,000 to 85,000 vehicles per 16-hour day, the lower flow rates within this range being handled by all-purpose roads, the higher rates by motorways. Taking one heavy lorry as equivalent to three cars, this gives a capacity of about 150 million tonnes/annum if the traffic consists entirely of fully-laden 20-tonne lorries. However, the Luneburg lift capacity was based on 310 16-hour days/annum with vessels loaded to 70%. Applying similar reduction factors to the road capacity brings it down to around 90 million tonnes/annum. Thus the Class IV waterway can be said to have roughly half the capacity of the dual 3-lane road.

There is another problem attendant upon establishing linear transport structures and that is severance. Points either side of the new structure, previously directly inter-accessible, become separated by it. However numerous the crossing points provided, inter-accessibility is reduced. This effect is appreciable over a zone whose total width is of the order of four times the average spacing of the crossing points. It affects major conurbations least of all, as the crossing points tend to be placed on the lines of greatest desired traffic movements, which are likely to pass through the conurbations. Smaller towns and villages will be less well provided for, and their denser distribution will mean they have to 'share' crossing points. Most seriously affected are isolated houses, especially farms, very close to the new route. On farms, where inter-accessibility of fields may normally be virtually 100%, severance may make communications and the movement of machinery, labour and stock very much more difficult, involving considerably longer routes and a greater need for planning the business of the farm. Accommodation bridges can be, and are, provided for landowners and farmers but these are costly and therefore can only be used to reduce, rather than to eliminate, severance problems.

In recent years, rural motorways have created the most conspicuous severance problems in the UK, although the restriction of pedestrian access to our increasingly wide urban major roads demonstrates that severance can affect urban as well as rural areas. However, the effects of severance diminish with time; new communication patterns develop to compensate for the added restriction of the new structure. Much of the severing effects of the railways built in the last century have been absorbed by both urban and rural areas. In the latter, the pattern of farm ownership often changes with time to make the new structure a farm boundary. Eventually a number of the farm accommodation bridges thus become redundant, and many such rail (and canal) overbridges have been demolished since the last War.

Any scheme involving the widening of a waterway is unlikely to produce major severance effects. There will probably be some effect as it is likely that the number of bridges will be reduced, reflecting the fact that waterways need longer bridges than do roads, and the cost of a bridge in general rises rapidly with increasing span. However, the result will be very much less serious than if a completely new waterway route is built. In this regard, any existing watercourse bigger than a stream, even if not navigable, offers an attractive route for new navigation works, as watercourses frequently act as boundaries and are furnished with limited numbers of crossing points.

The existing watercourse and existing road networks are both dense. However, the former are generally lines of severance and the latter are not. Therefore if new waterway construction in Britain were to be based on existing watercourse routes (rivers and streams as well as canals) as much as possible, this could proceed without producing the same severance problems as generally accompany major new roads, whether these are enlargements or not.

7.3 Construction costs

In broad terms, the processes involved in designing and constructing roads, railways and waterways are very similar. They all require traffic studies, route surveys and geotechnical surveys before routes are finalised and construction begins. The most expensive part of the construction is the earth-shifting that all require, and therefore selection of route, grade and level will be influenced by the desire to minimise haul lengths for earth-moving plant, and difficult excavation. This phase is followed by the more carefully controlled preparation of formation and pavement (road), waterproofing and bank protection (where necessary on waterway), or formation, rail bed and track (rail). These processes are all carried out by sophisticated continuous-process machines. For example, on the Elbe Lateral Canal, the canal bed was asphalted by conventional road machines, which were followed by purpose-built slope-finishing machines which trimmed the side slopes to $\pm$ 2 cm before sealing them with 6 cm of asphalt. This sealing was in fact only necessary on 78% of the canal's length.[7]

The track for all three modes is punctuated by more complex structures at regular intervals. These will include intersectional structures (eg over- and under-bridges, pipe crossings) in all cases, plus roundabouts and multilevel junctions (for roads), junctions, sidings, passing loops (rail) and locks or other fall structures (waterway). All three may require extra access points for maintenance, traffic control systems, fencing, signs and slope treatment to cuttings and embankments.

In view of these strong similarities, it is not surprising that the costs of all three modes are influenced by the same factors. Apart from the costs of materials and labour, the strongest influences are the cost of the land required, the nature of the soil and subsoil and the topography of the route. It is, of course, impossible to quote any 'average' cost of waterway construction. Instead, Table 40 shows the actual costs of a number of recent European waterway projects, both planned and realised. From this it may be seen that the costs vary quite widely, but as no attempt has been made to reduce the costs to a common base year, and as exchange rates are not necessarily indicative of true equivalence, the tabulated costs must be taken as a guide only. It should be remembered that the costs of river navigations are, in general, less than those for totally new canals, because costs of the channel and of the land will usually be lower.

English motorway costs in 1974/5 of course also varied quite widely; the average for 525 km of motorway outside the GLC area was £1.11 M/km with a minimum of £0.48 M/km. Within the GLC area, costs were significantly higher, averaging £3.75 M/km (minimum £2.26 M/km).[9]

Costs of land are included in Table 40, but will not in general bear any fixed relation to the total costs; in the case of the Elbe Lateral Canal, a cost breakdown is available and is shown in Table 41.

	YEAR COMPLETED OR ESTIMATE MADE	LENGTH (KM)	COST £M/KM
Completed Projects:			
Main canalisation	1962	297	0.27
Moselle canalisation	1964	270	0.32
Dunkirk-Denain Canal	1969	165	0.33
Elbe Lateral canal (at opening)	1976	117	2.46
(after repair)	1977	117	2.56
Planned Projects:			
Saar canalisation	1972	91	1.28
Main-Danube Canal (Nuremburg to Kelheim)	1972	133	1.33
Seine - Est waterway	1973	380	0.69
Saint Quentin Canal	1973	113	0.78

Table 40: Europe, costs of recent or planned waterway projects.[8]

ITEM	% OF TOTAL COST
Land	8
Channel construction	41
Fall structures	17
Intersectional structures	31
Other	3
TOTAL	100
(Repairs	+4)

Table 41: Elbe Lateral Canal, itemised costs (10).

It is interesting to note that the two fall structures only required one sixth of the total cost, even though they are both of record-breaking size. The lift, at Luneburg, is the highest lift ever built (38m) and the Uelzen lock (23m) overcomes a greater change of level than any other canal lock. Despite their size, these works demonstrate that the cost of fall structures is unlikely to be critical on a canal: on a river, the reverse may well be true.

The results of a recent study on lock costs[11] are shown in Figures 38 and 39. These relate to simple locks without side ponds. Figure 38 shows how the costs of various sizes of lock vary with fall, and indicates that for the range of sizes considered, the most economical locks (in terms of lock construction costs per metre of fall, *ceteris paribus*) all have falls of about 13 - 17 metres irrespective of plan dimensions.

Taking a realistic future lock size of 185m by 12m (for 3000-tonne push-tows), Figure 39 shows the total costs for construction and operation with (line AA) or without (line BB) backpumping. If backpumping is necessary, the most economical fall is around 15m; otherwise, the most economical fall is in excess of 25m. In either case 10-20m falls are considerably cheaper than falls less than 10m.

7.4 Operation and maintenance costs of waterways

In common with all structures and transport systems, waterways have inescapable costs attributable to continuing operation and maintenance. In the case of the BWB waterways these are separately identifiable in published accounts (see Table 42), but it is impossible to relate these to the capital costs of the waterways involved, as they were built so long ago. Indeed, one of the claims made for waterways is that the

ITEM	1973 £000	1974 £000
Operating	393.0	473.0
Dredging	410.9	484.6
Maintenance of buildings and structures	875.4	1077.6
Administration etc	302.1	381.7
Total expenditure:	1981.4	2416.9

Table 42: British Waterways Board, itemised annual expenditure on commercial waterways, 1973 and 1974 (16).

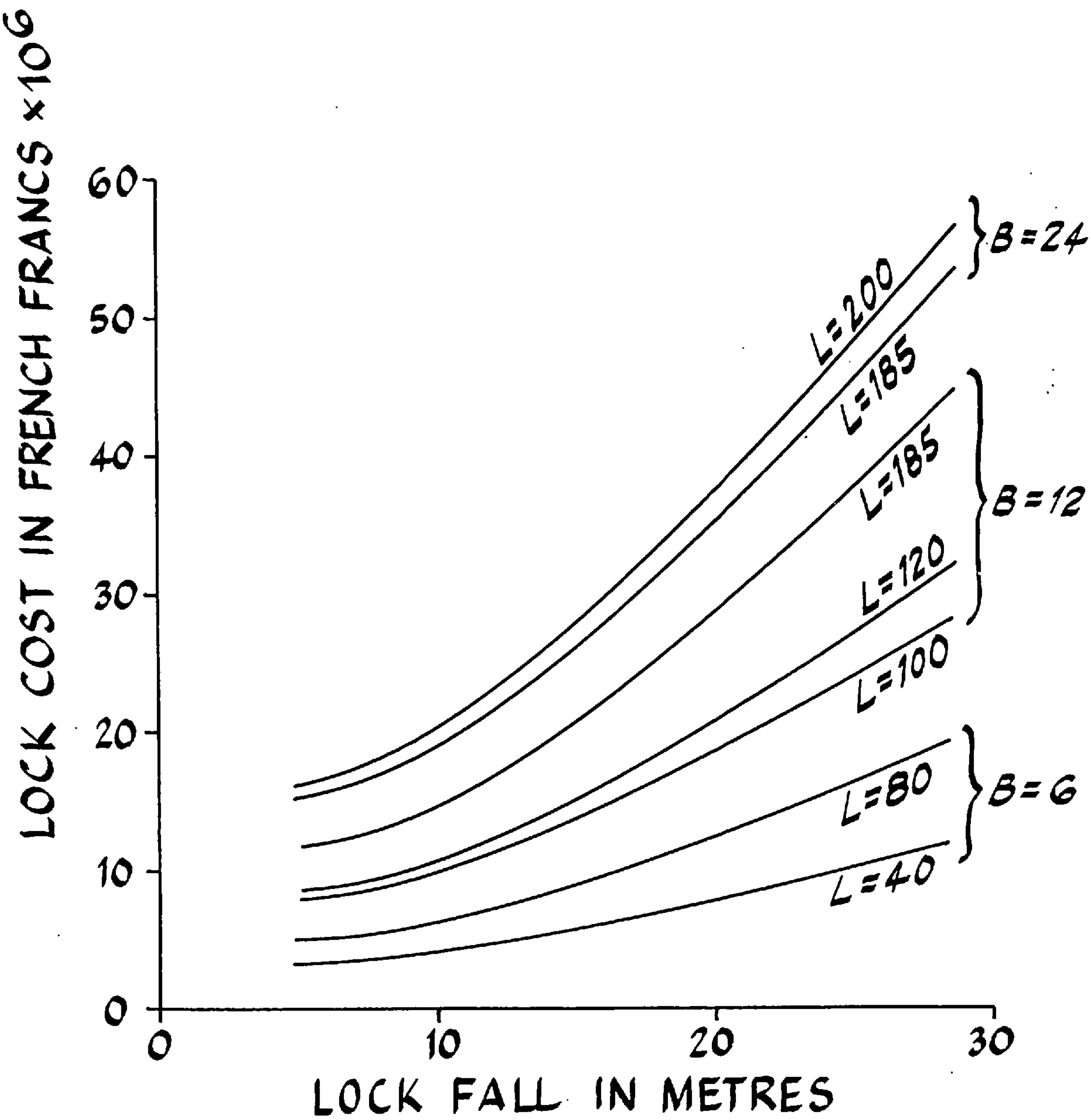


Figure 38: France, construction costs of locks of various sizes, 1969.[12]
L = lock length in metres
B = lock width in metres

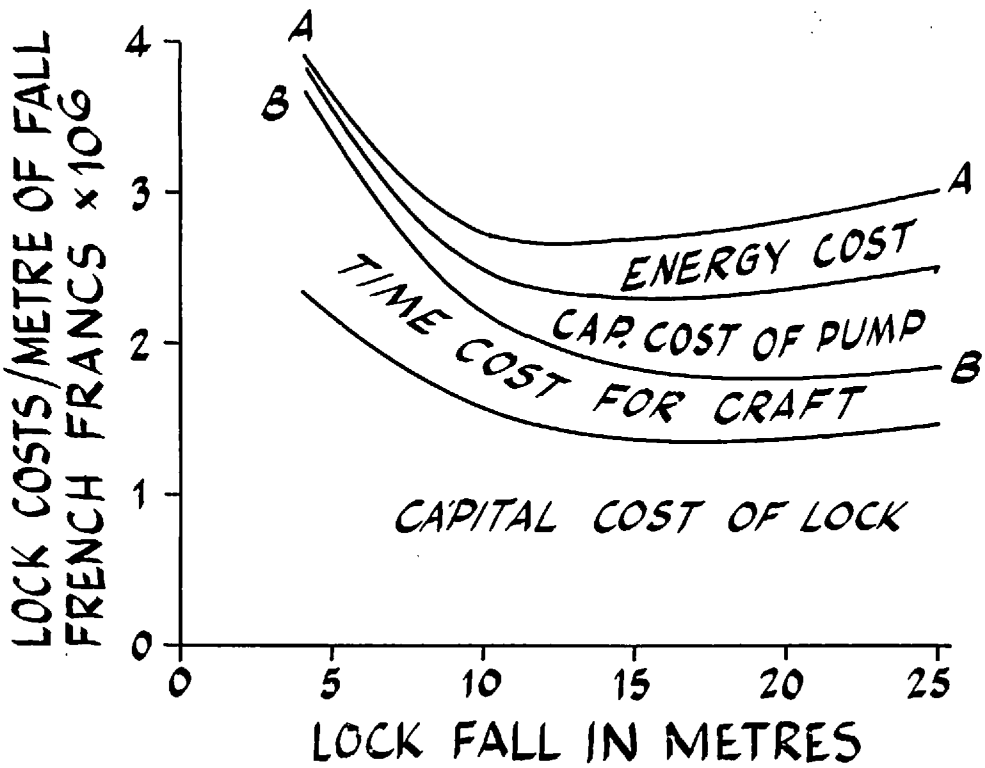


Figure 39: France, total costs of locks of 185m by 12m, 1969.[13]

Note: Time and energy costs are discounted to base year.

structures have an inherently long life. In some respects this is true, and is attributable to the fact that structures built to control or contain water (eg dams, reservoirs, weirs, channels) are largely free from the impact loads, fatigue and abrasion to which road and rail structures are invariably subject. This being so, it is possible and desirable for the designer to adopt materials and constructional details with long life in mind. Thus there are many examples of dams which are still in use after several centuries, and England's oldest working dam was built in 1189 to improve navigation on the River Itchen.[14] At least seven of the eleven oldest surviving dams contained in the British section of the world list[15] were built for navigation purposes, and six are still so used.

On the other hand, there are some waterway structures, or parts thereof, which are subject to impact, fatigue and abrasion. Typically these are structures on the navigable route itself, which are struck by craft. Included in this category are bank protection works, piling to quays, fendering to bridges, locks and jetties, and, most importantly, lock gates themselves. Lock gates are especially prone to damage from craft unable to stop, and from the high hydrostatic loads they have to withstand. They are also especially vital as a damaged lock gate can completely close a navigation (if parallel locks are not provided) or even produce serious flooding and/or possible overloading and subsequent failure of lock gates lower down the canal. An example of the vulnerability of canal operations to lock gate accidents is provided by the Manchester Ship Canal. Since its opening in 1894, 15 ships have rammed lock gates causing damage serious enough to close the Canal.[17] The latest and worst incident when Manchester Courage breached the lock gates at Irlam causing £400,000 worth of damage and closing the Canal for five weeks. Since then, arresting devices have been fitted to prevent accidents of this nature. Similar devices are widely used elsewhere, eg on the St. Lawrence Seaway[17] and on the Danube.[18]

An instance of the failure of one set of gates leading to damage to locks lower down occurred at Muirtown on the Caledonian Canal in 1976. A pair of gates failed to mitre and one leaf collapsed producing serious damage to the upper gates of the next lock.[19]

On BWB's commercial waterways there are approximately 150 locks. Table 43 shows the rate of renewal of the gates to these locks in recent years. As 150 locks have around 600 gates between them, this

YEAR	NO OF GATES
1970	9
1971	4
1972	3
1973	7
1974	6
1975	11
1976	11
TOTAL	51
(Average per annum = 7.3)	

Table 43: BWB, lock gate renewals on commercial waterways 1970-1976 (20).

rate of renewal would indicate an average gate life of about 80 years. This is well in excess of actual life and therefore one can conclude that the current renewal programme is not keeping pace with deterioration, and that in the near future the rate of replacement will need to be significantly increased.

The individual maintenance costs of BWB's commercial waterways vary widely and are shown in Table 44.

WATERWAY	MAINTENANCE COST - £/KM/ANNUM
Gloucester & Sharpness Canal	9153
Crinan Canal	5295
Weaver Navigation	4946
Aire & Calder Navigation	4228
Lee Navigation	3565
New Junction Canal	3225
Caledonian Canal (excluding lochs)	2931
Sheffield & S. Yorks Navigation	2659
Calder & Hebble Navigation	2653
Trent Navigation	2427
Severn Navigation	1333
Average for all commercial waterways	3416

Table 44: BWB, maintenance cost of commercial waterways, 1973[21]

The bigger river navigations are shown to be cheaper to maintain, by and large, than the (artificial) canals. The annual maintenance cost of motorways and other trunk roads in 1972/3 was £3,118/km (£3,901/km in 1973/4); if lighting is also included, this cost rises to £3,302/km (£4,299/km).[22]

Operating costs of BWB's commercial waterways can also be calculated on the same basis of annual cost per kilometre. Taking the totals for all commercial waterways from Table 42, operating costs were £721/km and £868/km in 1973 and 1974 respectively.

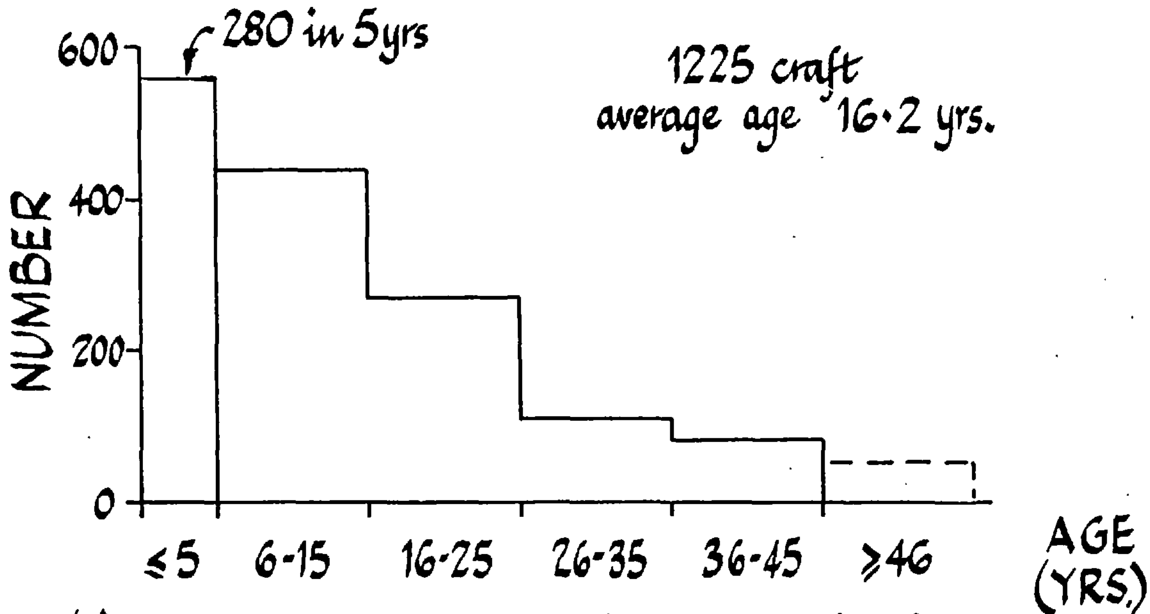
The feasibility study on the Grand Union Canal enlargement predicted that the combined annual operating and maintenance costs of a BACAT-sized canal between the Thames and a depot on the Slough arm would be £5,190/km in 1980 rising to £7,953/km in 2000; for a LASH-sized canal these costs would be £7,207 and £11,749/km (all figures in 1973£).[23] These estimates for new works are thus clearly higher than the costs of BWB's existing track. In building up the estimates, certain assumptions were made as to the ratio of maintenance to capital costs for different elements of the enlarged canal.[24] Locks (excluding lock gates) were assessed at 0.5%, as were bridges, aqueducts and culverts; bank protection was put at 0.25%. Lock gate replacements were estimated at one leaf per year; as there are eight locks planned this implies a leaf life of 32 years, a much more realistic assessment than the 80 years suggested by the replacements tabulated in Table 43.

Published data for the Sheffield & South Yorkshire Navigation improvement scheme is not so detailed. The only figures available suggest that the extra maintenance cost resulting from the incremental capital expenditure required for enlargement will be £47,000/annum, which is equivalent to 0.78% of the capital value of the new works.[25]

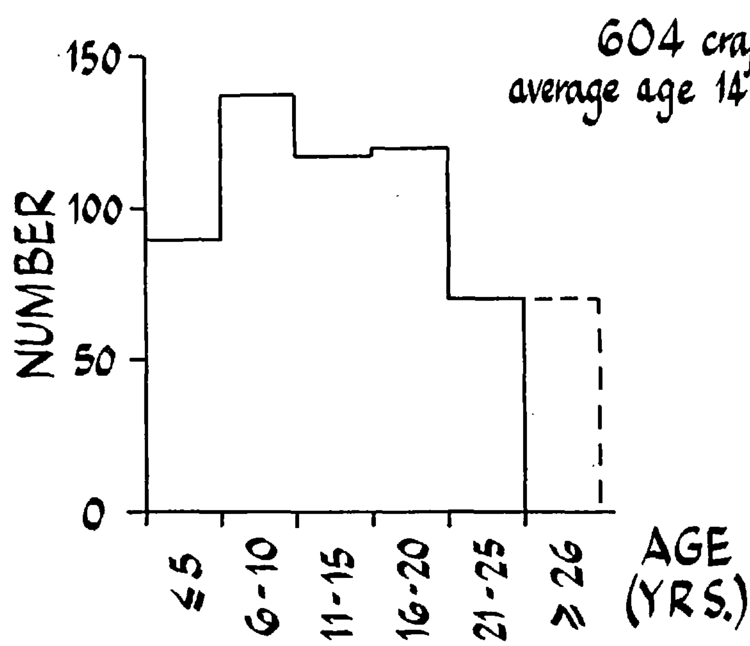
7.5 Operating and maintenance cost of inland craft

Actual costs and charges are, of course, closely guarded commercial information, and, in Britain, there are no published freight rates from which some idea of costs may be gained. Nevertheless there are certain cost components which can be examined; these include costs of servicing the capital invested in the craft, and fuel costs.

Like the waterway structures themselves, the craft are renowned for long life. For dumb craft this can exceed 60 years,[26] and powered craft can survive for over a century, but generally require several sets of new engines and possibly a rebuild during this period. Details of British inland craft ages are not available (see section 4.6.2) but Figure 40 shows the age profiles of UK coastal and short-sea craft, including many estuarial tankers, aggregate carriers and other powered cargo craft used in inland trades, but excluding dumb craft and tugs. Thus the average coastal craft age is around 15 years. The inland craft average age would be expected to be somewhat longer as (a) conditions are less severe (b) sinking rarely results in total loss, and (c) in the UK at least, there has been more innovation in the short-sea trades (eg RoRo, container carriers) than in the inland trades. The Irish fleet of 44 powered craft, excluding tugs, has an average age of 14.7 years.[28]



(a) all powered 'coastal' craft (excluding tugs), 1975.



(b) coasting & home trade liners, tankers and tramps, 1974.

Figure 40: UK, age distribution of coastal craft, 1974/5.[27]

Details of the dates of building of continental inland craft are available.[29] Belgium, France, Germany and the Netherlands have a combined fleet of 3156 inland vessels whose year of construction is known. This total includes all cargo craft whether dumb or powered, but excludes tugs. The average age of this fleet is 24.4 years, providing some confirmation of the longer life enjoyed by inland, as opposed to coastal, craft. Within this fleet, though, different national policies have produced different age structures. For example, the average age of the Dutch fleet is 26.1 years, nearly 40% greater than the German fleet's 19.0 years.

Inland waterway craft may thus be expected to have a life of 30 to 40 years. Long life will in general allow the capital cost be be written off over a longer period, and hence reduce the operator's overheads. As this long life can be combined with very high utilization (up to 7,000 hours per year for radar-equipped Rhine craft)[30] the burden of capital servicing can be very light for inland craft compared with road or rail vehicles. However, there have been suggestions that this long life works to the disadvantage of the craft operator, if he relates his operating charges to the building cost of his craft, not to their replacement cost.[31] The latter may of course rise very considerably during a life-time of 30 to 40 years; in 20 years the cost of Thames dumb lighters was reckoned to have risen from £5/tonne to £25/tonne.[31] Nevertheless this observation is in fact indicative of bad business sense on the part of the operator and is not an indictment of longevity of capital goods.

Fuel costs have received considerable publicity in the wake of recent rapid rises in oil prices. In 1973, a study of USA transport revealed that barges were far more economical of fuel than lorries, the ratio being better than 4:1 (see Table 45).

MODE	KJ/TONNE-KM	INDEX
Pipeline	325	0.66
Rail	484	0.99
Waterway	491	1.00
Road	2,023	4.12
Air	30,353	61.8

Table 45: USA, fuel consumption in inter-city freight transport, 1970 (32).

Other American studies have since confirmed these figures. For example, the Association of American Railroads reported in 1972 rail and road figures of 361 and 1301 kJ/t-km respectively,[33] and an individual railway company quoted rail energy use as 387 to 572 kJ/t-km, waterway 390 to 491 and road 1820 to 2023.[34] A French study in 1974 produced generally similar results, though estimated that oil pipelines consume 1.4 times as much energy as rail for the same output.[35]

Later British research not only supports the general conclusions of the USA and French studies, but in fact confirms that British waterway infrastructure and operation produce results in broad agreement with the earlier work (see Table 46 and Fig. 41).

MODE	RELATIVE ENERGY CONSUMPTION PER TONNE-KM
Sea transport	1
Railways	2.4
Waterways	5.7
Road	44
Air	500

Table 46: World, fuel consumption in freight transport (36).

British proponents of waterway transport were quick to seize on the findings of these studies, especially in the form adopted in a popular article[37] which showed water significantly more economical of fuel than rail (although apparently claiming derivation from the first USA study quoted above). Their main concern was to demonstrate the vast gap in performance between road and waterway, and therefore rail's comparable or even superior performance was presumably deemed irrelevant. The predictable counter to this argument was that the fuel economy achieved by barges in the USA could not be matched by British operations, as the scale is so different.

In 1975, a BWB study on fuel use by barges was published.[38] The great merit of this study is that it is based on returns from 26 actual journeys performed by loaded craft. The results are presented in Figure 41. Although there is considerable scatter of the results, the trend is clear. To compare this with the previous studies, we can take the equation of the line relating t-km/litre (y) to tonnes carried (x):

$$y = 0.091\ x + 67.6 \qquad (7.3)$$

or in energy terms,

$$s = (2.51\ x + 1870)\text{x}10^{-6}\ \text{t-km/kJ} \qquad (7.4)$$

where the calorific value of the fuel[39] is assessed at 36,209 kJ/litre. For a cargo of 500 tonnes, Equation 7.4 gives $s=3.125\text{x}10^{-3}$ t-km/kJ ie fuel consumption $= \frac{1}{s} = 320$ kJ/t-km.

This result shows that the waterway figures derived from the USA studies are therefore roughly appropriate to the British waterways. It must not be thought, however, that the difference between the figures prove that the 500-tonne British vessel is more economical than, say, a 10,000-tonne tow on the Mississippi. On the US rivers, water currents and craft speeds are often high and both will increase average fuel consumption. Also, the British study is based on full-capacity working, whereas any conclusions about the fuel use of a system must include some below-capacity or empty working, both of which will increase fuel consumption per tonne-km actually transported. Nevertheless, it can be said that, as British lorries are unlikely to be more economical of fuel than those in the USA, the relative fuel efficiencies of water and road in Britain are likely to be around 4 to 1.

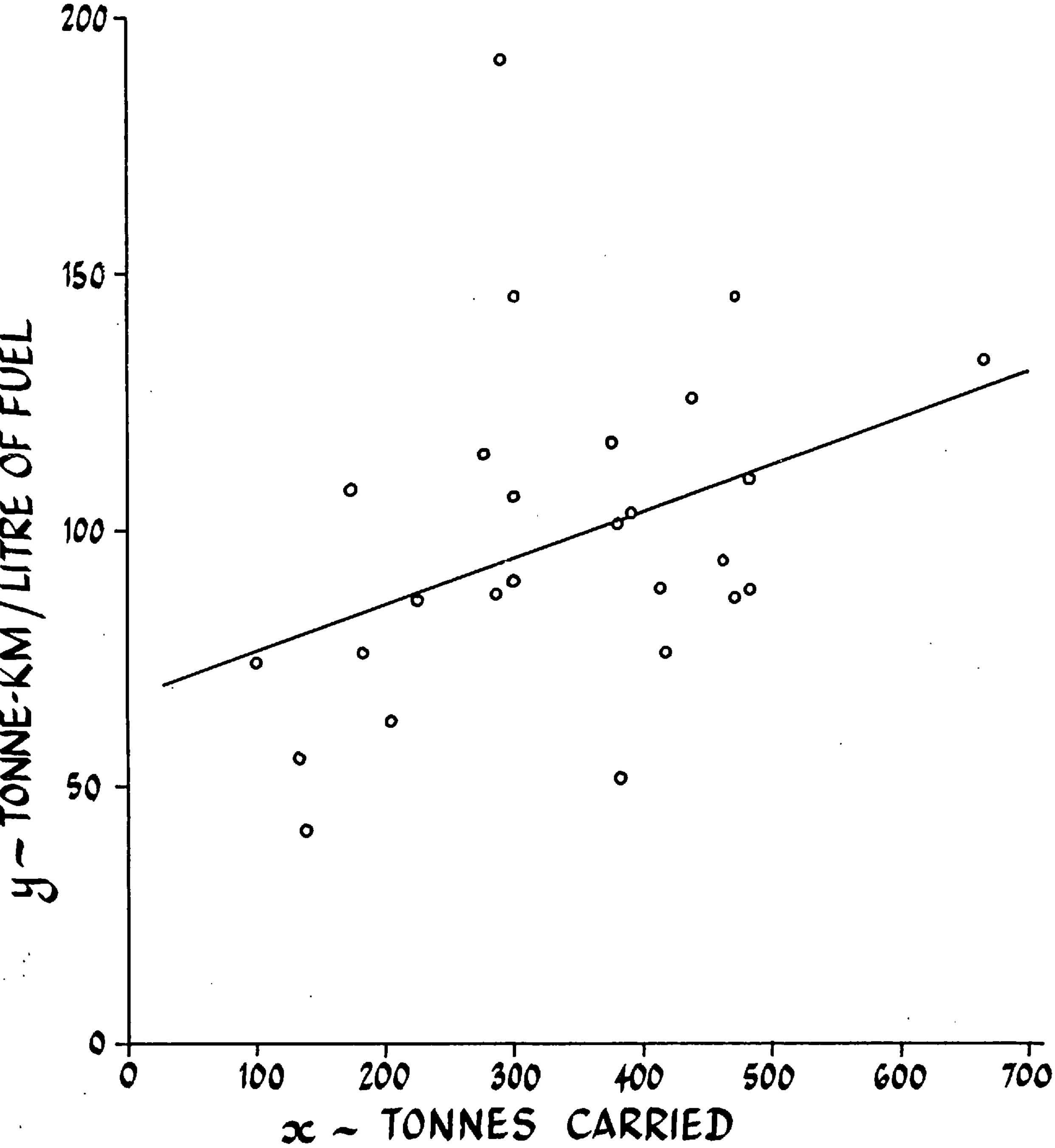


Figure 41: Great Britain, inland waterway craft transport output per unit fuel consumption versus size of cargo carried, 1975.[38]

Although fuel efficiency is an increasingly important consideration in transport, it must be remembered that fuel costs are only one component of the total cost of transport. For waterway tugs of 150 to 1100 HP, fuel costs were estimated in 1974 to be between 10.1% and 19.2% of total tug operating costs.[40] However, when lighter costs were added, the proportions fell substantially. An estimate of 1.9% was quoted,[41] but as this was based on one tug servicing 6 sets of lighters, it is possibly on the low side. Allowing 3 sets of lighters per tug would raise this figure to around 4.1%. Nevertheless fuel costs are still only a small component of water freight costs. For road haulage, a comparable figure would be 15 to 20%,[41] thus demonstrating the greater sensitivity of road haulage to fuel price rises. Indeed, this figure may well already be higher than 20% as the 1974 study estimated that for a rise in fuel price of about 10%, road haulage costs would rise by 3.4 to 4.0% whereas waterway costs would rise by only 1%.[42]

Thus long craft life and low fuel consumption are two elements of total operating costs which work in favour of water transport. There are other factors which can work the other way, eg slow speed and adverse weather. In the event, the cost of a transport mode is judged by the customer in terms of freight charges. These may well not in fact reflect relative resource costs of competing modes, as Government measures and attitudes may discriminate between modes and therefore influence the freight charges. Typical influences of this type are provided by fuel duties (which may be different for different modes), licensing fees, tolls, operating regulations, and most importantly, the criteria used for assessing investment in track improvements (see section 4.7.2).

In the early months of 1974, estimated freight rates in Britain were shown in Table 47.

MODE	PENCE/TONNE-KM
Rail - national average	0.87
- roadstone	0.61
- steel billets	1.35
- bulk grain	1.62
Road - long distance (160 km)	1.50
- across London	1.60 - 2.67
- very short haul	12.23 (minimum)
Water - Brentford to docks(?)	3.79

Table 47: Britain, freight rates by mode, 1974 (43).

Thus the waterway freight rate is seen to provide competition with road, although rail freights are apparently very low. However, the authors of the study on which Table 47 is based recorded their difficulties in obtaining details of rail freight charges. The rate for new traffics between the enlarged Grand Union Canal and Tilbury or the Royal Docks was calculated at 1.64 to 4.65 p/t-km, and the movements of aggregates and refuse would have been even cheaper.[44]

These waterway freight rates reflect in part the comparatively short hauls involved (77 and 56 km respectively). Typical continental barge rates for longer distances were, later in the same year, considerably lower: 0.23 p/ t-km for iron ore over 220 km, or for oil over 750 km, and 0.14 p/t-km for aggregates over 700 km.[45] It is far easier to obtain information on continental freight rates as, in many cases, publication of freight rates is required by law. In the Netherlands the rates are in fact fixed by a State Commission.

A comparison between road and waterway costs in Europe is shown in Figure 42. This can not be taken as absolute as the exact costs of each mode will vary with type of cargo, points of origin and destination, method of loading and discharge, and the local road and shipping

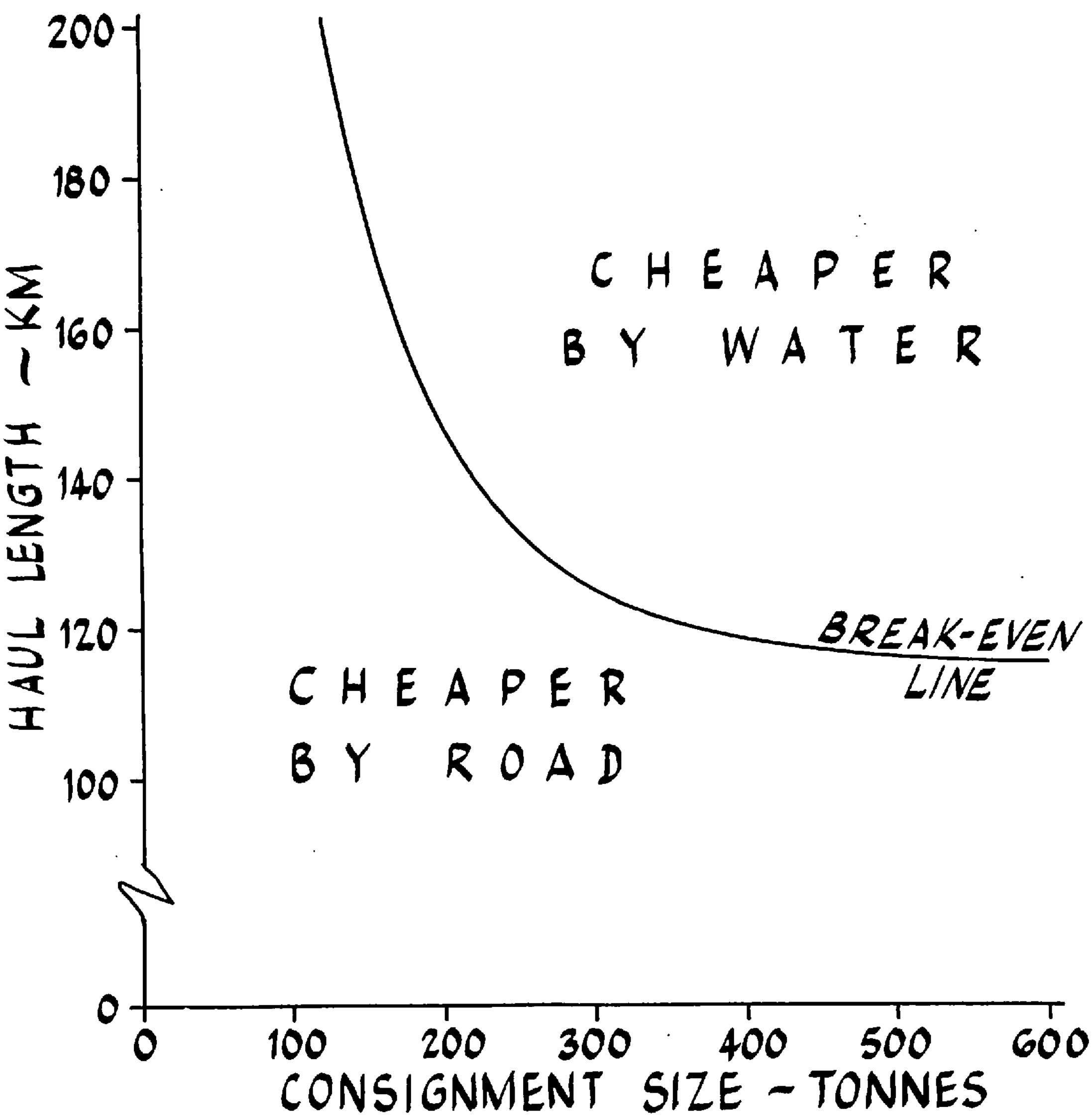


Figure 42: Europe, estimated break-even point between road and inland waterway transport, 1972.[46]

conditions and markets at the time. Certainly there are, both in Britain and Europe, many barge traffics of less than 600 tonnes and 120 kms, although the Figure would suggest that these would all go by road.

The cost of loading and unloading is an especially important factor and may often, for barges, outweigh the economy of transport. Lorries can generally be loaded with bulk materials by simple gravity installations, and can then tip at their destination. Barges can be similarly loaded, but discharge may present a problem. For regular traffics, mechanical handling plant can be installed, but infrequent traffics need either a mobile crane on the wharf or a self-discharging barge. The former is the generally accepted method in Britain, but self-discharging craft are in operation in several parts of the world, notably on the Great Lakes in the USA, and on the Rhine.

7.6 Conclusion

This chapter has set out to explore some aspects of waterway costs, relying largely on existing information.

A Class IV waterway can be considered as having a capacity approximately half that of a dual 3-lane motorway, but the waterway will occupy more land than the road, possibly up to 70% more. Severance is likely to be less of a problem for the waterway as the high density of existing watercourses gives scope for using these as routes for new construction.

Construction costs of new canals are roughly the same as for new motorways, though river navigations can be much cheaper. Maintenance costs of major waterways are comparable to those of trunk roads. Taking construction and operation into account, lock falls should be at least 10m, preferably greater. As this is considerably in excess of falls of British locks, it demonstrates that British waterway engineering is, or possibly is constrained to be, old-fashioned.

Inland waterway craft have a long life, typically up to 40 years. Long life and low fuel costs (one quarter as much as for lorries) are factors contributing to low operator's costs. Freight charges, however, reflect Government policies as well as operator's costs. Not enough is known of market freight rates but barge rates appear to be roughly competitive with road in Britain, but higher than rail. The use of larger craft over longer distances reduces the rates below those of road. As commercial craft are currently confined to limited areas of operation, both craft size and haul length should be increased by building larger more extensive waterways if the full benefits of water transport are to be produced.

CHAPTER 8: NON-TRANSPORT BENEFITS AND COSTS OF WATERWAYS

8.1 Introduction

The previous chapter has examined some of the quantifiable aspects of the use of waterways as systems for the transport of freight. There are, however, other uses to which waterways can be put without undue interference with their freight transport role. Amongst these are water control and distribution, land drainage, water supply, recreation and amenity. Some of these uses have readily identifiable financial benefits; for others, the benefits may be real but difficult to cost. Nevertheless, both types should be considered in the evaluation of any waterway scheme, as should any costs or environmental or social disbenefits which may be generated by the scheme.

8.2 Water supply

Although no waterway, artificial or otherwise, can serve as a source for the unlimited extraction of water without jeopardizing its transport function, there are nevertheless numerous occasions when canals and river navigations can usefully augment water supplies from other sources. In the case of the river navigations, little extra credit can be given for water supply as the abilities of the river to supply water are not likely to be significantly improved by increasing its navigability. There may be some small mutual benefit in deepening and/or widening natural channels, which will increase both storage capacity and navigability. However, if the storage capacity is called upon fully, navigational difficulties are likely to result.

Canals are even more susceptible to water shortage or excessive abstraction. This might appear to render them unsuited to function as suppliers of water, but they can and do perform the useful and special function of making available large volumes of water for industries which can return this water to the canal after use. Leaking and waste apart, the canal thus suffers no net debit. The majority of BWB water sales are of this use-and-return type (see Table 48). The Board's revenue from this source is shown in Table 49.

USER TYPE	VOLUME ABSTRACTED 10^6 LITRES	VOLUME RETURNED 10^6 LITRES	% RETURNED
Public water supply and agriculture	41,200	68	0.2
Electricity generation (cooling water)	39,046	34,081	87.2
Other industrial	109,822	87,715	79.9
TOTAL	190,068	121,864	64.1

Table 48: BWB, water sales and returns, by volume, 1975[1]

YEAR	REVENUE FROM WATER CHARGES
1970	£898,000
1971	£953,000
1972	£976,300
1973	£1,071,200
1974	£1,234,200
1975	£1,454,700

Table 49: BWB, annual revenue from water charges, 1970-1975 (2)

Thus water sales are an important part of the Board's income (their total turnover in 1975, for instance, being £8,522,300.[2]) The rate of growth of water charge revenue over the five years 1970-1975 is just over 10% p.a., but this rate is increasing. Given the long-term nature of many of the water supply agreements, the results are indicative of a real growth of sales, over and above any effect of inflation.

The BWB is the only British water undertaking with a virtually nationwide coverage. This is achieved via its network of 3000 kilometres of waterway which are fed from 89 reservoirs (some of which are very small) whose total storage capacity has been estimated at 59,000 million litres.[3] A recent assessment (1975) of the reliable annual yield of these reservoirs was twice the storage capacity,[3] in contrast to a ratio of three to four suggested by an earlier writer (1962).[4]

This reservoir and canal system enables the Board to offer water supplies over a wide area, although the actual volume which can be passed along a narrow channel may limit the size of supply which can be offered at any one point.[5]

Although the principle of the use-and-return system seems attractive to a navigation authority, there is some conflict between the use of water for industry and for navigation. The only reason that an industry will want to abstract water from a canal on any scale is to use its properties in some way. The effect of this use must manifest itself in some change in the water, for if no change at all occurs, the user might well opt to recycle his water via a small tank or pool and thus avoid paying water charges. The changes which users induce in the water are either in its composition (by introducing dissolved or suspended materials) or in its temperature. Both types of change may occur simultaneously, and during any use some reduction of volume is likely, through absorption, leakage or evaporation. The user therefore opts for a canal supply to avoid progressive build-up of contaminants and/or temperature, and to compensate for losses.

The changes thus brought about by industrial use may be deleterious to navigation in two ways; dissolved materials may increase corrosion of steel structures and vessels, and suspended solids may settle out on the bed of the waterway, reducing its depth. Additionally, both dissolved and suspended materials may constitute pollution, leading to a reduction of water quality with an attendant reduction of sale value. Even if re-use of the water is not envisaged, the amenity value of the waterway will fall as pollution increases. Although temperature rises may at first sight not appear to damage water quality, they can have a profound effect on the bacterial activity in the waterway, on which any 'self-cleansing' ability ultimately depends. This is a result of the decrease of solubility of oxygen in water with increasing temperature. Therefore as temperatures rise, the water quality will in general fall.

This conflict between industrial and other (navigation and amenity) uses does not mean that the two are incompatible. Both uses can be entertained provided controls are maintained to avoid excessive damage to water quality, losses are minimised, and any sediments produced are removed at intervals by dredging. Therefore although use-and-return is undoubtedly a better basis for abstraction from canals than simple consumption, it does not offer the opportunity for unlimited use at no cost. The changes induced by the use mean that marginal costs of providing for or compensating for each additional user will be successively higher. As the BWB water supply is limited, increasing the number of industrial abstractions, even on a use-and-return basis, will eventually lead to the costs reaching the level of the charges levied by statutory water undertakings. In the absence of other constraints, this will set a limit to the industrial demand which the BWB (or any other navigation authority) can meet. There is no indication that industrial use is at all near to this limit.

In general, it can be said that artificial canals can have an economically useful role as suppliers of water to industry on a use-and-return basis, and a more limited role as suppliers to public water undertakings and agriculture. If, by discharging effluent of adequate quality into the canal, the public water undertakings can convert their consumption to a use-and-return basis, the role of canals as water suppliers can be extended. In all cases, careful monitoring of quality and evaluation of possible effects of pollution must be carried out. Some examples of existing use of waterways for supply are given below.

8.2.1 Examples of water supply from canals

The Birmingham Canal Navigations (BCN) form a dense network of narrow canals criss-crossing Birmingham and the area to the north and west of the city. Of 168 km, 129 km were classed as 'Remainder Waterways' by the Transport Act 1968. A working party was set up in 1969 to consider the future of these remainder waterways and their report was published in the following year.[6]

The study idenitified 80 abstraction points on the 129-km remainder network, affording water supply to 50 industrial concerns.[7] The total supply was estimated at 22,700 million litres annually (62 Mld), most of it cooling water on a use-and return basis. The income received by the BWB for providing these supplies was £74,568 in 1969. This is equivalent to £578/km and was, at 77% of the total income, by far the greatest source of revenue from the BCN remainder waterways.[8] In fact, even on the 39 km of cruising waterways in the BCN system, water supply was the biggest revenue earner, at £1,055/km and 85% of total.

By drawing on the results of a similar study on Merseyside, the working party estimated that to replace the water supply functions of the BCN remainder system in 1970 would have cost £2.4M (£18,640/km) with an associated maintenance, operating and interest cost of £1,240/km.[9] This is considerably in excess of the system's actual maintenance cost of £550/km.[8]

A widespread but intermittent use of canals as water suppliers is to provide water for fire-fighting purposes. Arrangements with the BWB for this purpose are made by private industries and the fire-fighting services, the latter for practice as well. The BCN study showed that in the areas of three of the eight local authorities in the vicinity, the fire-fighting services had used canal water on 121 occasions in 5 years.[10] The working party's experience was that demand from this source was decreasing. This may have been true in that area at that time, but over the BWB system as a whole, arrangements for fire-fighting abstraction have increased recently.[11] The financial value of these arrangements is not known.

These abstractions of canal water were not planned when the canals were first built (although some canals were used for water supply at a very early date[12]). However, one of the planned uses of the Nethe Canal was to supply water to Antwerp.[13] The canal, some 15 km in length, was designed, not only to enable 2000-tonne capacity craft to bypass Antwerp, but also to convey lockage water from the Albert Canal to intakes for the city's water supply. The canal was completed in about 1956.

Concern has been expressed as to whether a high enough water quality can be maintained in waterways used both for abstractions for public supply and for navigation. Although the examples cited above show that it can, perhaps the Thames demonstrates the point most convincingly. Serving as source for several towns along its banks (eg Oxford, Staines and Chertsey), it also serves as sink for all of them. In addition to accepting this effluent, it is also a very heavily (pleasure) trafficked waterway, yet still provides London with about three quarters of its public supply.[14] Only simple treatment is required before admitting it to the mains, and the resultant quality of London's water is invariably excellent.

8.3 Water transfer

Canals can have another closely related but distinct role in water supply, and that is as channels along which water not drawn from canal reservoirs may flow. In other words, the canal is effectively rented to a water user as a conduit for the user's own water. The revenues arising from such operations on the BWB system are included in Table 49, but the volumes so transferred are not included in Table 48. In 1975, 14,802 million litres were transferred for public water supply, and a further 22,730 million litres for cooling-water for power-stations.[6] When a canal is used for water transfer, the volume handled can be significantly greater than when the canal is merely used for supply. However, a hydraulic gradient is necessary in all cases; if a substantial flow is handled in a narrow channel, the induced velocity and hydraulic gradient may be appreciable. The high velocity may interfere with navigation. The high hydraulic gradient will mean that 'level' pound will not remain level and therefore depths of water and freeboards must be checked as adequate. One of the major technical flaws in Pownall's

Grand Contour Canal scheme was its failure to take account of the inescapable inclination of the water surface which would have been attendant upon the use of the canal to deliver huge volumes (5000 Mld) of water.[15]

8.3.1 Examples of canals as water transfer routes

The Llangollen Canal owes its continued retention at least partially to its current use as a water channel. In 1955 an agreement was negotiated between the British Transport Commission and what is now the Welsh National Water Development Authority to allow the latter to use the canal as a water channel.[16] Under this arrangement the water authority may put into the canal at Llangollen up to 50 Mld[17] and extract the same quantity at Hurleston, 75 km further along the canal. Had a pipeline instead been used, this would have cost over £1M.[18] The water passes 17 locks with a total fall of about 38m, and it has been claimed that the aeration produced improves the quality of the water during its passage.[18] The current induced in the canal is less than 1 kph and therefore does not impede navigation. The length of channel means that some buffer storage is possible; for 0.1m fluctuation of level, the storage available is about 40 million litres, or nearly one day's supply.

The Gloucester & Sharpness Canal, a major commercial waterway belonging to BWB, bypasses a particularly difficult stretch of the River Severn. Most of the canal's water comes from the river, being pumped into the canal at Gloucester. In 1962, an agreement was made between the Bristol Waterworks Company and the Board which allows the former to abstract 168 Mld at Purton, 26 km further along the canal.[19] Of this, about two thirds is purified for public consumption in the Bristol area, the remainder being supplied as non-potable process water for industrial users.[20]

Again, for an example of a canal designed and built to act both as freight route and water transfer route, we have to turn to the Continent. The closing section of the Main-Danube Canal is now under construction (see Section 5.3.1.1) and, apart from a 1500-tonne capacity freight route, this will provide a channel for water pumped from the Danube to cross the watershed and thus augment the water supply in Bavaria. The leading details are shown in Fig 43. The pumping rate of 3000Mld is particularly impressive, being nearly five times the total rate of abstractions plus transfers accommodated by the entire BWB network. Of this pumped water, 60% is for public water supply, and 40% for canal operation - lockage, leakage and evaporation. The annual benefit from thus using the canal is estimated at about £1.5M annually.[22]

A last example will be given to show that even in Britain, the cost of pumping uphill round locks is not necessarily prohibitive. The drought of 1976 was severe enough to reduce the flow of the Great Ouse at Denver Sluice to zero in June, and there was no flow through the sluice for the next four months, despite considerable flows in the tributaries Cam, Lark, Little Ouse and Wissey.[23] To replenish its reservoir, Grafham Water, the Anglian Water Authority obtained a Drought Order enabling them to reverse the direction of flow in 64 km of the river channel by pumping round eight locks between Denver and the Grafham Water intake. The pumping rate was 67.5 Mld and the total cost of two months' operation, including a temporary dam to prevent sea-water from entering the Ouse via the New Bedford River, was estimated at £185,000 ie £22/Ml. The unit rate is based on twice the pumped flow rate as the total new abstraction for the reservoir also included another 67.5 Mld of Ouse flow which would normally have been left in the river as compensation flow. The scheme, known as 'Operation Rodeo' (Reversal of Direction of Ely Ouse), could only have been temporary, as it produced problems of pollution in the estuary and reduction of irrigation water supplies in part of the catchment, but nevertheless compares favourably in price to other supplies. For instance, the BWB charge for water abstracted from their canals may be up to £44/Ml.[24]

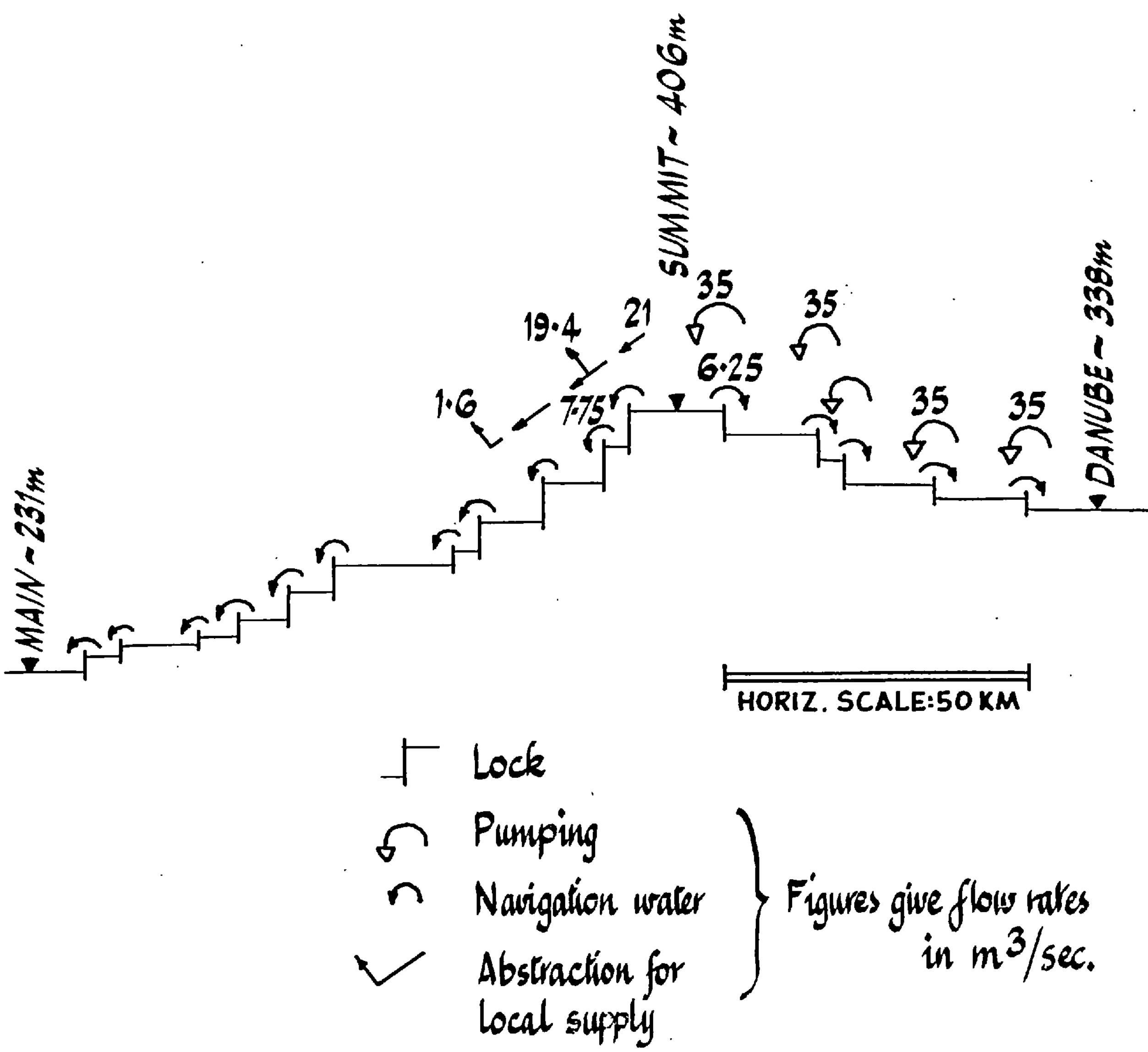


Figure 43: Main-Danube Canal, elevation showing planned water flow rates.[21]

Two other more complex water transfer schemes (the Trent-Witham-Ancholme Scheme and the Ely Ouse-Essex Scheme) involving combinations of pumps, pipes, tunnels, canals and rivers have been described by the author elsewhere.[25] There are now enough instances of the use of waterways as water transfer channels to show that the two purposes of freight and water movement can technically and economically be well served by a single structure. Several schemes, especially the Main-Danube Canal and Operation Rodeo, show that even considerable pumping need not detract from the financial viability of using a waterway for water transfer. The most recent overview of water supply in England and Wales[26] indicated that between £1358M and £1856M will be required to safeguard supplies until the year 2001. Much of this money will be spent on water transfer links. It is therefore clear that, given the increasing use of estuarial sites for reservoirs, many of the links will run from the coast inland and will require pumps in any case. Other links will connect major rivers. As the most promising waterway routes are also likely to run from the sea to inland centres of population or between major rivers, there is a good case for examining water supply and transport proposals to assess whether a dual-purpose channel might not meet both ends by means of a single structure at a lower cost than two parallel structures.[27] Unfortunately, even considering the massive capital expenditure they predicted, the authors of the water supply report made no attempt even to establish whether any such dual-purpose use might be worthwhile.

8.4 Drainage

As well as being channels along which water may flow to a user, canals can also act as drains, removing surplus or waste water and conveying it safely to a larger body of water where it can be safely absorbed. In the simplest case, in any area where a canal is unlined, its water will be in contact with the natural groundwater and therefore it will act as a land drain.

Apart from such use, there are many locations where canals accept normal drainage or storm-water run-off, especially from roads. Much of this drainage is casual and merely reflects the canal's being lower than its surroundings. However, on the BCN remainder system, there are about 800 recorded drain connections in 129 km of waterway,[28] ie ten times the number of abstraction points (see section 8.2.1). Some income is generated by charging the dischargers. The volume flow rate accepted during heavy rain is estimated at 3900 Mld, which includes water from both the direct catchment of the BCN system and the 800 drains. This is about 60 times the total water supply abstraction rate and demonstrates that, without massive storage capacity, the canal system cannot automatically be expected to receive run-off water. Indeed, applicants wishing to discharge rain-water to BWB canals frequently mistakenly suppose that the Board will welcome their discharge.[29] Such discharges are, in fact, particularly unwelcome as they are generally maximum when the canal is fullest, and contribute nothing when the canal's needs are greatest.

For the BCN remainder system, the capital cost of replacing its drainage function was, in 1970, put at £20M, with an associated annual cost of £15,500/km.[30] These costs are roughly ten times the comparable costs for replacing the water supply functions. However as the cost to the Board in 1976 was only £18/Mld per annum,[31] compared with the (earlier) replacement estimate of £520/Mld per annum, there is a considerable residual benefit to the community from using the canal as a drain.

As in the case of the return of water by industrial abstractors, the quality of discharged water must be monitored. Both run-off water and industrial process water can contain significant quantities of suspended and dissolved solids, and are therefore subject to the remarks in section 8.2 potential damage, monitoring and remedial work.

8.5 Recreation

The recreational uses of waterways are well known, and there would be no virtue in reciting examples of such uses. Fishing and boating are the most commonly pursued recreations on waterways; others include towpath walking, swimming, water ski-ing, bird-watching and other wildlife studies, photography, industrial archaeology, and boat-spotting. With the exception of water ski-ing, swimming and boating, all are easily compatible with the commercial use of waterways, although there may be some antagonism between certain special interest groups eg between anglers and walkers. No attempt will be made here to evaluate in financial or social terms the benefits arising from leisure uses of waterways, though these are undeniably large, and should be included in any evaluation of a particular waterway proposal.

In any discussion of the recreational use of commercial waterways, or of the enlargement of cruising waterways for commercial use, a key issue is the compatibility or otherwise of commercial and leisure craft. It is this specific issue which will therefore be examined in this section.

Because pleasure-craft and commercial craft share the same track and often compete for the same lock and mooring facilities, there is bound to be some competition between them. However, the conflict arises more frequently not from competition (though locks may pose problems) but from the essential differences between the two types of craft and their modes of use. Commercial craft tend to be larger, sturdier, more powerful and cause more wash (albeit not proportionately). To their owners and crews, time is of prime importance and the functional is regarded with more favour than the picturesque or the tranquil.

Pleasure-craft are generally small, slight, often underpowered ('speedboats' excepted) and poorly handled. Their crews are on holiday and therefore have little regard for time, although are impatient at delay caused by others. Their owners are often apprehensive of the potential damage which may be caused by contact with a commercial vessel, and so the mere presence of the latter is considered a threat, especially in a confined stretch of water. Although pleasure-craft can, and do, damage each other considerably both by wash and by contact, it is these two potential dangers which pleasure-craft owners most fear from commercial craft.

Commercial boatmen argue that leisure users can cause delay to those earning a living on the waterway. They are also apprehensive of the possibility of accidents caused by inexperienced handling of pleasure-craft, which may also be under-insured or not insured at all. Pleasure boatmen retaliate with assertions of damage caused by commercial craft, inconsiderate or threatening manoeuvring, and 'queue-jumping' at locks.

At present there is not a great deal of scope for this type of conflict in Britain as by far the greater part of recreational boating, if done on waterways at all, is done on waterways where there is little or no commercial traffic, ie the non-tidal Thames, the narrow canals and the Norfolk Broads. On those waterways which do carry significant volumes of commercial traffic, pleasure use is considerably lower. The only commercial waterway on which pleasure-craft are actively discouraged is the Manchester Ship Canal. They are not actually forbidden but the Manchester Ship Canal Act 1960 requires that notice be given of intended entry, and that the craft possess a Lloyds Register or equivalent survey certificate, third-party insurance of not less than £50,000, a competent steerer, an adequate anchor and cable, two ropes each not less than 18m in length, navigation lights and sound signalling equipment, two fire-extinguishers, life-saving apparatus, the relevant Admiralty chart (or equivalent), a copy of the Company's Bye-laws and a tidal almanac.[32] As few inland craft would have more than one or two of these items, their owners rarely apply to travel on the canal. Coastal pleasure-craft would generally be better equipped but possibly less inclined to enter the canal.

The problem of conflict between pleasure and commercial craft is largely a new one, as it is only in the last twenty years or so that larger numbers of people have wanted to, or been able to afford to, explore inland waterways by small boat. As their numbers grew, so did the difficulties, and in recognition of this situation, the International Navigation Congress held in Stockholm in 1965 devoted one session to discussing 'Problems arising from the increasing use of yachts and other small boats for sport and recreation.'[33]

Papers from fourteen countries were given on this theme, but as this session was a joint one, covering both the inland and marine sections of the congress, eight of the papers dealt solely with coastal problems. Several of the remainder were devoted to describing the provision of entirely separate facilities for pleasure craft on waters devoid of commercial traffic. However, papers from the Netherlands and the USA did face the issue squarely, probably as both countries, with their extensive recreational and commercial waterway use, had already gained much relevant experience. The former argued that with suitable regulations the two uses are compatible. The latter felt that, in general, insufficient attention had been given to the subject and that the question should be raised again at a future congress.

The conclusions of the congress on this subject[34] did not reflect any intense concern with the conflict between commercial and recreational users, instead concentrating on the technical aspects of the provision of recreational installations (eg marinas, moorings, flumes to bypass dams and weirs) and the arrangements for financing these. Possible incompatibility was only touched upon in the recognition of the need for appropriate safety regulations 'in respect of persons, boats and navigation, particularly in their association with commercial craft.'

Eight years later another International Navigation Congress examined this problem calling for papers on the

'Arrangement of navigable waterways for recreation and preservation of environment (artificial beaches, water sports and fishing, etc) ' (35).

The call was answered with papers from eleven countries, some again concentrating on recreational facilities on waters without commercial traffic. However, about half the authors did tackle the compatibility problem. The session reporter nevertheless felt that

'...the mix of large commercial vessels with pleasure boats is a problem that remains to be answered ' (36).

The conclusions of the Congress were both more sanguine and more practical. The relevant ones were[37]

(a) 'When a waterway is being developed for navigation, energy production or other purposes, it is essential to consider the recreational aspect, including the building of marinas, yachtsmen's villages and small-craft harbours....'

(b) 'There is a need for further study into the reconciliation and priorities of the different commercial, recreational and residential demands. A multi-disciplinary approach is necessary, co-ordinated by the developing agency. Criteria for decision of priorities need to be settled.'

(c) 'The safety of all users must be adequately considered...'

(d) 'More research should be conducted in order to develop methods of assessing and quantifying economic and social benefits or recreational facilities.'

As an example of the practical measures which have been taken on busy waterways carrying both classes of traffic, the Secretary of the United States Army has laid down priorities for passage through locks.[38] These are

1: US military craft
2: Mail boats
3: Commercial passenger craft
4: Commercial tows
5: Commercial fishermen
6: Pleasure boats

However, if such priorities are laid down, some limit may also have to be put on the length of time a pleasure boat may be required to wait at a lock.

It does not appear that conflict between commercial and pleasure use has led to pleasure craft being barred from any commercial waterway anywhere in the world, nor are there any proposals that this should happen. Conversely, although many facilities are designed purely for recreation, there is no ban on commercial craft using any recreational waterway. One mechanism acting to mitigate the conflict is that, in general, recreational use is at a maximum when commercial use is at a minimum, ie at weekends and on public holidays. However, certain navigation works may also cease to operate on Sundays and public holidays, so that pleasure-craft can only use them during working hours.

In conclusion, it may fairly be said that one reason that this conflict has been invested with such importance is that it is a new phenomenon. It is no more severe than many other conflicts which are already recognised and catered for by regulations, rules of conduct, divisions of responsibility, or fiscal or other financial means. In no country where commercial and recreational waterway use co-exist, is there any suggestion that the community might benefit if one type of use were supressed. Thus the only way to maximise social benefits is to plan for, legislate for, and accept the use of waterways for commercial craft and leisure craft.

8.6 Personal accidents

A new canal will obviously bring to the locality through which it passes an extra risk of accidents and death by drowning which did not exist before. This may well not be true for a river navigation. Two types of accident can be distinguished: those involving people who deliberately seek business or pleasure in or on the water and who, it may be assumed, are aware of the risks, and those involving people who happen to be in the vicinity of, or crossing the canal, and who are quite unconsciously at risk.

No comprehensive statistics are available for either of these types of accidents, but there is no reason to suppose the numbers are disproportionately large. As to fatalities, most of deaths arising from both types of accident are from drowning (see Table 50). The total numbers of deaths by drowning in England and Wales in the years 1971 to 1975 varied from 477 to 639, constituting less than 0.1% of all registered deaths. It is not known how many of these occurred on inland waters.

CAUSE OF DEATH	1971	1972	1973	1974	1975
E830-E839: Water transport accidents	138	142	117	98	136
E830: Craft accident causing submersion	74	76	55	38	67
(Of which: small craft					60)
E831: Craft accident - other	2	2	3	1	5
E832: Other water transport drowning	36	39	29	31	41
(Of which: small craft					16)
E833-E835: Falls	9	6	9	9	5
E836-E839: Machinery etc	17	19	21	19	18
E910: Accidental drowning	529	462	480	408	529
(Of which: Children aged 9 or under					135)

Table 50: England and Wales, deaths from water accidents, 1971-1975[39]

In the USA, the total number of registered pleasure boats (inland and coastal) rose from just over 3 million in 1961 to just over 5.5 million in 1971, a growth rate of 6% pa.[40] Boating accidents rose comparably for five years, then fell, giving a growth rate of only 2% pa in the decade.[41] Fatalities rose steadily at 3% pa ending up at about 1550, ie one recreational fatality per year per 3580 boats. The fatality rate for inland water alone would presumably be lower than this, though the accident rate might be higher.

Whereas any fatality arising from a recreational pursuit is completely needless and therefore to be regretted, the fatality rates are not high enough to suggest that boating is a dangerous pastime. Certainly the accident record has done nothing to deter boat ownership; it has presumably done something to increase awareness of the need for care. Active recreational pursuits always carry some risk and the and the boater in the USA might well turn to another equally dangerous activity if he were not afloat. It is therefore not reasonable to argue that the danger of recreational boating is itself any serious indictment of canal construction or use.

The second category of accidents, ie those involving people in the vicinity of the waterway by chance, is less easy to dismiss. Accidents in such cases are liable to be either trivial or fatal; the passer-by has little chance to be involved in a serious non-fatal accident (in contrast to the pedestrian's vulnerability in road accidents). Most fatalities will be drowning from one of three causes: trapping within a road or rail vehicle which has fallen into the waterway, falling into the water through incapability (whether of physiological or psychological origin), or falling into the water through ignorance or disregard of its dangers. The first two of these causes are not significant and can anyway be guarded against with some success. It is the third cause, involving children, which is the most serious.

Children are particularly prone to drowning because the danger of deep water is not immediately apparent to them. Water has, however, a fascination for them, and many children spend many hours playing in and around water in all situations from puddles to beaches. Canals, especially in urban areas, often have vertical sides and little current. Therefore there is little about them to suggest danger, and little opportunity for the gradual transition between shallow water and deep water which itself provides a caution at most sea-, lake- or river-side sites. It is therefore predictable that children will fall into canals. Because of the difficulty of getting out of a vertically-sided canal, whether or not the child drowns will depend largely on the availability of an adult rescuer, irrespective of the child's own swimming ability.

One view is that this inherent danger of canals is too great to be tolerated. This view has not been argued in respect of new canals (this century), but manifests itself in calls for infilling of existing canals. The other view is that the danger arises not merely from the canal, but from the deserted canal. Canals without public access to the towpath, and virtually devoid of boats, will still have fences with small gaps, walls which are climbable and so on. They will thus not be out of reach of the adventurous child, but may easily be beyond easy or quick access for a rescuer and will be devoid of passers-by. Therefore, the argument goes, increased access and increased use is likely to reduce deaths by drowning. In any case, the parents must accept some responsibility.

An example of an exchange of views of this sort occurred in 1972 after the drowning of a five-year old boy in the Leeds & Liverpool Canal at Bootle. This led to the formation of an 'Anti-Canal Marina Committee' demanding that the canal should be closed.[42] The Joint Study Group on this section of canal, consisting of BWB plus the relevant local authorities, agreed that whatever the future of the canal, 'special attention would be given to the problem of ensuring the safety of young children.'[43] In March 1973 a woman rescued a 3-year old who had fallen into the canal at Netherton, 5 km from Bootle.[44] By this time the Bootle Council had decided to press for closure. The IWA's view of these events was that the parents of such children are in some measure to blame. This view was supported by the revelation that a mother, three of whose sons were drowned in the derelict Forth & Clyde Canal in August 1972, had six months previously been convicted of neglect of her children.[45]

This argument is incapable of resolution to the satisfaction of all parties. It is true that the presence of an artificial canal brings a concomitant possibility of deaths by drowning, especially for young children. However, such drownings are probably less likely on a busy rather than on a derelict canal, and parents have a duty to teach their children of this danger just as they do in respect of the dangers of roads.

As to other accidents which occur on waterways, there is no reason to suppose them excessive. The records of the period 1961 to 1971 suggest that the accident rate in the USA is by no means sufficiently high to deter millions of people from deliberately subjecting themselves to the risks involved in boating. In any event, unlike motor-racing or shooting, the victims are rarely non-participants.

8.7 Pollution

Some of the undesirable results which may result from water pollution have been discussed in section 8.2, which dealt with pollution arising from the use of canal water for water supply. However the vessels themselves also pollute the water, mostly from three sources:

(a) spillage or other discharge from chemical or oil tankers,

(b) spillage or discharge of fuels, oily wastes, bilge-pumpings etc.,

and (c) discharge of sewage.

Commercial craft are responsible for all three, pleasure craft for (b) and (c) only.

On busy waterways, and waterways used extensively for water supply, there are regulations on the construction, equipment and operation of craft to minimise pollution from these sources. In general, industrial users of the water and waterside industry are responsible for far more serious pollution, both in nature and volume, than are the craft.

It can be concluded that pleasure craft present no insuperable pollution problems from the almost universal practice of water authorities of allowing pleasure use of reservoirs and rivers from which water for public supply is drawn. Such access may be conditional upon the observation of simple regulations, eg the use of the euphemistically described 'ocean toilet' is forbidden on the Thames above Teddington.

In the case of commercial craft, any pollution caused must be weighed, not against a pollution-free mode of transport, but against the pollution which would be caused if the goods were to travel by an alternative mode. Road and rail accidents involving bulk chemicals can cause pollution of local water courses if and when spilt chemicals are washed away by rain or by hosing. Oil, grease and diesel fuel also reach streams and rivers in rainwater run-off from roads. This is less likely to happen from rail operations as rail formations are almost invariably permeable, in direct contrast to road surfaces. Both air and water pollution arising from the burning of fuels are likely to be, ceteris paribus, proportional to fuel use. As the barge has a fuel efficiency around four times that of the lorry (see section 7.5), pollution from boat engines is likely to be proportionately low, the same being true for rail. In addition, there are two factors which permit easier pollution control in barges than in HGVs; the barge engines are run with a much lower variation of power output, and if any pollution control equipment is to be added to the engine, the barge's carrying capacity will not be so severely affected. Pollution, then, is unlikely to be a serious factor in evaluating waterway schemes, but if anything, consideration of it is likely to marginally enhance the waterway benefits.

8.8 Environment and amenity

Many features of waterways which impinge upon environmental and amenity considerations have already been dealt with, eg recreation (section 8.5), pollution (8.2 and 8.7) and safety (8.6). There nevertheless remain a few features which have not yet been covered, but which properly come within the purview of this chapter.

8.8.1 Noise and vibration

One of the persistent objections to increased road traffic in general and increased heavy goods vehicle (HGV) size in particular has been that of the noise and vibration produced. Noise is frequently cited as the most all-pervading form of environmental degradation, especially in urban areas, and it is certainly the only one against which the individual often takes personal action (by double glazing - but note that double-glazing designed for thermal insulation is not an efficient sound insulator and vice versa). The vibrations emanating from, in particular, HGVs have been blamed both for personal discomfort and structural damage.

The emission of noise from internal combustion engines will tend to vary with their power. Because of the low resistance of water to its forward motion, a boat carrying hundreds of tonnes requires an engine of similar power to that fitted in a lorry with the capability of carrying only twenty or thirty tonnes. Thus the noise arising from a waterway is liable to be less than that arising from a road carrying an equivalent traffic flow. It may nevertheless be that the peak noise levels from the waterway will be higher than those from the road, if the individual craft have very large engines.

Vibration effects are usually ascribed to vibrations transmitted to nearby structures via the ground. Although vibrations can also be transmitted through water, the author has not come across any record of barges causing detectable vibration effects on waterside structures, nor any suggestion of this possibility. The explanation may lie in the way in which the damaging vibrations are produced. They result, not primarily from the mechanical vibrations produced by out-of-balance forces associated with rotating and reciprocating mechanical elements, but from the 'bouncing' of road or rail vehicles running over uneven surfaces. There is no real analogy with the motion of a boat.

8.8.2 Visual amenity

Water is an undoubtedly attractive feature of urban or rural landscape. There are too many instances of the provision of ponds, the creation of ornamental lakes and streams, and the establishment of riverside walks for this to be in question. No pseudo-rustic appeal is necessary as the plans for opening up stretches of the banks of the Thames in London prove. The movements of the water, and of the wind upon it, which alter the reflections from its surface appear to have universal attraction. The addition of water to almost any scene is held to be an improvement.

Even the structures of the waterway are of interest. Although this might be thought to be true only of the older buildings, the attraction of the Ronquieres inclined plane shows otherwise. This was opened in 1968; within a few years 'hundreds of thousands' of visitors had been to see it.[46] Visitors may enter the 150-metre control tower, watch a documentary film about the plane, 'attend an audio-visual spectacle about the Province of Hainaut', and take a boat-trip. Four large car-parks are provided.

Waterways also provide routes for passenger-craft operations. Outside the USSR these are rarely used in developed countries for transport as such, the cruise merely giving the passenger the opportunity to see more of the waterway. Such services are widespread, from the Manchester Ship Canal, where two passenger-craft are in operation,[47] to West Germany, where 248 (German) craft, with accommodation for 80,400, carry several million passengers annually.[48]

Although road and rail undeniably provide the means whereby many people gain access to leisure areas, waterways constitute both a means of transport and the leisure area itself. Simply being on or by water is something consciously sought out by people who have no interest in fishing or boating but merely like the atmosphere. Even on a major new commercial waterway like the Main-Danube Canal, recreational facilities on a great scale are being provided, including waterside picnic and camping sites.[49]

8.9 Conclusion

The most important non-transport benefit which can be provided by new or existing canals arises from their use as water channels. They can be used both as links between water sources and consumers, or as drains to carry away rainwater or other flows. With certain safeguards they can act in both capacities without jeopardizing navigation. Certain water supply needs can also be met, but these are limited unless on a use-and-return basis.

Recreational uses of waterways also generate substantial benefits. Some concern has been expressed over the conflict of interests between commercial and recreational craft. However, nowhere in the world are the costs of allowing both types of use adjudged to outweigh the benefits. It is universal experience that reasonable regulations can ensure compatibility.

Although isolated drownings of children have led to pressure for the closure of canals, such incidents are not common. In any case 'closure' of river navigations is impossible. Good access and intensive use may contribute to lowering of deaths by drowning. On the limited information available it appears that neither waterway transport nor water recreation are unduly hazardous.

Boats cause both air and water pollution but the former is liable to be less than if lorries were used instead to carry the same volume of freight. The latter may be more serious and certainly needs control, but is often overshadowed by the pollution from waterside factories.

Water transport is probably less noisy than road or rail and is free from the vibrations which can damage roadside structures. However, peak noise levels may possibly be greater.

Water has a proven widespread appeal reflected not merely in recreational boating but also in many simpler pursuits, eg walking or sitting by water. Even modern canal structures can attract considerable numbers of tourists. New canals can therefore render useful amenity service if this is properly allowed for in the design.

Thus there are several uses of commercial waterways, other than for freight transport, which can generate substantial social and financial benefits, provided proper provision is made. To evaluate any waterway scheme merely in terms of its freight transport function would therefore be to underestimate its true value.

CHAPTER 9: SUMMARY AND CONCLUSIONS

Although the railways, and later the roads, had contributed to the decline of waterway transport in Britain, the years following the Second World War raised hopes that this trend might be reversed. The Transport Act of 1947 established the British Transport Commission (BTC) which at first seemed to offer the waterways the chance for expansion and rationalisation under unified control. In spite of a promising start, this was thwarted by the legacy of the considerable length of uneconomic narrow canals (many inherited from the railway companies), by the exclusion from the Act of many important commercial waterways for no logical reason, and by changes in industrial practice and domestic habits which led to irreversible changes in the traffics offered for carriage. Although under the BTC some good work was done on the waterways, little of the investment was aimed at more than minor improvements to existing waterways. Well-argued suggestions had been made for extending the major waterways on the one hand, and freeing the profitable waterways from the unfair burden of paying for canals with no transport use on the other, but these were not followed. In fact, the good advice of both a Board of Survey and a Government Committee of Inquiry was largely neglected by the Government. Meanwhile, the record of the independent waterways suggests that, during the period 1948 to 1962, the larger-gauge waterways were holding their own. Thus the unprofitable canals owned by the BTC not only changed the waterways section's profits to losses, but also consumed transport profits which might otherwise have been re-invested in transport improvements on the profitable lengths. Had the BTC's profitable lengths been amalgamated with the (profitable) major independent waterways in a truly national combination, and the redundant waterways passed to a redevelopment agency, the views in Whitehall (and elsewhere) of the value and function of waterways might have been very different.

The 1962 Transport Act set up the British Waterways Board (BWB) as successors to the BTC. Although the Act failed to solve the important problems which had been identified a decade earlier, the new

Board started with a sense of realism. They disbanded the narrowboat fleet, restricting their own carrying to two fleets, one in the South-West, the other in the North-East Midlands. In the BWB's review of their waterways in 1965, the amenity potential of the non-commercial waterways was recognised by their owners for the first time, and indeed this was also rightly seen as the way to overcome the problem of financing them.

This report foreshadowed Government action; a series of White Papers led up to the 1968 Transport Act, although not all the BWB's recommendations were embodied therein. It is this Act which established the current division of BWB waterways into three classes: commercial, amenity and remainder, with those in the amenity class being financed by Government grant. The Board then engaged in significant improvements to some of the waterways in the commercial class, but despite this, freight traffic fell substantially. In the period 1963 to 1974 tonnage carried fell over 50%, tonne-km by over 60%. Smaller independent waterways also lost traffic, as did the Thames lighterage companies. However, both BWB and other waterways which could accept coaster traffic fared well; the major losses were of internal traffics.

The late 1960s and early 1970s saw growing concern for environmental issues with many pressure groups commending inland waterways as an acceptable alternative to further road expansion. The Inland Waterways Association set up a committee to publicise the potential of inland shipping and its first report was widely disseminated. The result of this public interest was that by 1975, the case for inland water transport had been widely heard, even if not widely accepted.

As a mode, waterway transport is still not well understood nor well catered for in transport planning procedures. The views of Government and Civil Service with respect to inland water transport are inconsistent in the definition of water transport, in the evaluation of waterway schemes and in the provision of a planning and financing framework in which waterways can fairly compete with other modes both for business and for funds. Specific recommendations by Parliamentary Committees for improving the situation have been completely ignored. In view of these inconsistencies, it is not surprising that the results of the first ever comprehensive survey of inland shipping reveal two highly significant anomalies:

(a) BWB controls only one third of British commercial waterways, and

(b) actual freight transport by waterway (measured in tonne-kilometres) is one order of magnitude higher than the universally accepted figures published by the Civil Service.

The British situation is in strong contrast to those in other countries in Europe. In Belgium, France, West Germany and the Netherlands, the responsibility for waterways has been national for up to 100 years. Their large but often unnavigable rivers have been steadily improved and new inter-river basin canals built. Waterways are regarded as having a useful role in the twentieth century, and much money is being invested to enable them to fulfil this role. Since the last war, the international significance of the European waterway system has been recognised and so international standards have been accepted and international co-operation shown. Similarly, the European Economic Community has as one of its goals the creation of a 'common market' both in goods and services. Nevertheless, a close scrutiny of the EEC legislation relating to transport shows that the regulations are not being observed in Britain, and that there is no progress towards this goal as far as waterways are concerned.

Topographicalfactors are often invoked to explain differences in transport practice, but although topography will influence the nature and extent of transport systems, neither the steepness nor the extended coastline of Britain are sufficient to account for our restricted use of waterways. There is scope for more use of waterways to complement, not to compete with, coastal shipping, which is itself more dangerous and expensive than inland shipping. A study of the movements of various bulk traffics shows that there are substantial volumes of cargoes available for carriage by waterway, particularly coal, petroleum products, aggregates, steel products and scrap, and refuse. Many of these could be won by waterway if the track gauge, and hence craft size, were larger. Imports and exports, especially those carried in sea-going barges, could be increasingly significant.

New or enlarged waterways would need finance comparable to that provided for new motorways, although costs of construction are so influenced by the nature of the terrain and local land costs that generalisations are impossible. In many respects there are strong parallels with roads but more land is required to build a modern large European canal than a six-lane motorway. River navigations offer the possibilities of reduced costs, reduced land take and almost no severance problems. Lock falls should ideally be above 10m, in contrast to the British average of 2 to 3m.

Operating and maintenance costs of waterways also compare roughly with those of roads, although some factors, especially longevity of both structures and craft, and low fuel consumption, favour waterways. Insufficient information is available to make any detailed comparison of the true costs of different freight modes, but it is clear that increasing consignment size and haul length both favour waterways. Until the EEC's goal of undistorted competition is achieved, freight rates will not be a precise guide to actual system costs, as their reflection of these costs is distorted by Government policies which do not act on each mode equally.

There are, additionally, important factors, other than transport, which should be considered in any evaluation of a waterway project. Water supply from canals has obvious limitations but many canals act as water channels, conveying substantial volumes of water without impeding navigation. Both these and the drainage function of canals can contribute significantly to the benefits to be derived from them.

Recreational use can also be important, though no attempt has been made by the author to evaluate the economic benefits from such use. What is shown, however, is that the often-feared conflict between commercial and pleasure craft is real but not insuperable. No waterway authority has, in recent years, suggested that one or other type of use on any particular waterway should be banned. Instead, precise regulations and appropriately designed equipment and operation are universally seen as the means of maximising general user benefits.

Public safety is unlikely to be significantly reduced by a well-managed waterway, though boating itself is not without risk. In the USA, such risk does not seem to have deterred a steady increase in small boat ownership. Such accidents as do occur to leisure boaters rarely involve non-participants, though the danger of young children drowning can arouse strong feeling.

Thus it can be seen that the low level of use of waterways for freight transport in Britain is not simply a result of technical or economic factors. It is the outcome of both anomalous legislation and a lack of any moves by successive Governments to correct these anomalies. Waterways are systematically under-rated and discriminated against as freight carriers, yet the record of the benefits and costs of waterways both in Britain and elsewhere demonstrates that they have a justifiable place in the spectrum of transport services.

In the immediate future, large sums are going to be spent in Britain on securing water supply and on providing transport services. What the foregoing study has shown is that freight waterways should properly be considered alongside other solutions to our problems, and that they are not being so considered at present. It is important to point out that this consideration would not itself cost anything, except for financing the appropriate cost-benefit analyses. Only if a waterway project were adjudged viable would any major expenditure be required. This would only be necessary if the evaluated return were (at least marginally) higher than those arising from competing projects. Thus, increasing the scope of public investment by including waterways can not reduce the social return, only increase it. To treat transport modes differently is not only contrary to EEC law, but actually works to reduce rather than increase returns from transport investment.

Suitable waterway routes for analysis are likely to be either radial (coast-hinterland link) or to connect major rivers. If the former, existing water-courses offer attractive trial lines as land and construction costs will be lower, and severance less, than for completely new channels. However, the higher cost of a completely new channel might be offset by its superior potential as a link to transfer water inland from a sea-level reservoir. Any river basin links would also probably be new channels with the same water transfer potential.

There is no shortage of evidence that major new waterways are worth considering. There is no scarcity of suitable routes. There is evidence that preconceived views and narrowness of vision have hitherto prevented multi-purpose waterways from receiving serious attention in Britain. They have not been tried and found wanting; they are waiting to be tried.

BIBLIOGRAPHY

(a) Periodicals

The following periodicals regularly contain papers and news items relating to the commercial use of waterways, both in the UK and abroad. They are published in London unless otherwise noted. The abbreviated forms of the titles are as used in the Notes and References section of this thesis, and in section (b) of this bibliography.

Bulletin of the Permanent International Association of Navigation Congresses (Brussels) : PIANC Bull.

Canal Transport - the newsletter of the Canal Transport Marketing Board (Nottingham).

Dock and Harbour Authority : Dock and Harb. Auth.

Inland Waterways Association Bulletin : IWA Bull. Note: this has now been renamed Waterways

Journal of the Chartered Institute of Transport: Jnl. Inst. Transp.

Waterways News - the house magazine of the British Waterways Board.

Waterways World (Burton-on-Trent)

(b) Books and papers

This is a brief list of the more important references used in this study. They are all published in London unless otherwise noted.

AICKMAN, R., 'British inland waterways: today and tomorrow', Jnl. Roy. Soc. Arts, 101, 1953, pp278-290; discussion pp 290-297.

Annual Abstract of Statistics - see CENTRAL STATISTICAL OFFICE.

BAGWELL, P.S.

(1) 'The Railway Clearing House in the British Economy, 1842-1922', 1968.

(2) 'The Transport Revolution from 1770', 1974.

BAXTER, R.E., and WILLIAMS, J.T., 'Maritime transport with particular reference to coastal shipping', a paper delivered to 'Transport for Society', a conference held by the Institution of Civil Engineers, November 1975.

BENN BROTHERS (Publishers), 'Ports of the World'. The 1974 edition has been used.

BIRD, J., 'The Major Seaports of the United Kingdom', 1963.

Bowes Report - see COMMITTEE OF INQUIRY INTO INLAND WATERWAYS.

BRITISH TRANSPORT COMMISSION

(1) 'Annual Report and Accounts', annually 1948-1962 inclusive.

(2) 'Canals and Inland Waterways: Report of the Board of Survey', 1955. Often referred to as the 'Rusholme Report' after the Chairman of the Board of Survey, Lord Rusholme.

BRITISH WATERWAYS BOARD

(1) 'Annual Report and Accounts', annually 1963 to date.

(2) 'The Future of the Waterways', 1964.

(3) 'The Facts about the Waterways', 1965.

CENTRAL STATISTICAL OFFICE, 'Annual Abstract of Statistics', annually.

CHAMBER OF SHIPPING OF THE UNITED KINGDOM, 'British Shipping Statistics', annually.

COMMITTEE OF INQUIRY INTO INLAND WATERWAYS, Report, Cmnd 486, 1958. Often referred to as the 'Bowes Report' after the Committee's Chairman, Mr. Leslie Bowes.

DEPARTMENT OF THE ENVIRONMENT

(1) 'Reorganisation of water and sewage services: Government proposals and arrangements for consultation', Circular 92/71, 1971.

(2) 'The Amenity Use of Water Space and the Reorganisation of the British Waterways Board', Consultation Paper, 1972.

DESPICHT, N.S.

(1) 'Transport and the Common Market, Part 1', Jnl. Inst. Transp., 31, 1966, pp 277-280 and 269.

(2) 'Transport and the Common Market, Part 2', Jnl. Inst. Transp., 31, 1966, pp 322-326.

(3) 'Transport and the Common Market, Part 3', *Jnl. Inst. Transp.*, *31*, 1966, pp 475-478.

(4) 'Transport and the Common Market, Part 4', *Jnl. Inst. Transp.*, *32*, 1966, pp 20-26.

(5) 'Transport and the Common Market, Part 5', *Jnl. Inst. Transp.*, *32*, 1967, pp 282-285.

DREWRY, H.P. (Publisher), *'The Scope for Barge-carrying Systems'*, 1976.

EDWARDS, L.A., *'Inland Waterways of Great Britain'*, St. Ives, Huntingdon, 5th ed 1972.

EEC (1): OFFICE FOR OFFICIAL PUBLICATIONS OF THE EUROPEAN COMMUNITIES, *'Statistical Yearbook of Transport, Communication, Tourism, 1974'*, Luxembourg, 1976.

(2): STATUTORY PUBLICATIONS OFFICE, *'Secondary Legislation of the European Communities: Subject Edition: Vol 13: Transport'*, (English ed), 1973.

(3): COMMISSION OF THE EUROPEAN COMMUNITIES, *'Third Commission Report to the Council on the Results Obtained Using the Accounting System for Expenditure on, and from the Survey of Utilization of, Rail, Road and Inland Waterway Transport Infrastructures'*, COM(76) 53 Final, Brussels, nd but probably 1976.

EXPENDITURE COMMITTEE

(1) *'Public Expenditure on Transport'*, First report, Session 1974, HC 269.

(2) *'Public Expenditure on Transport'*, Fourth special report, Session 1974-75, HC 263.

FORBES, U.A., and ASHFORD, W.H.R., *'Our Waterways: a History of Inland Navigation considered as a Branch of Water Conservancy'*, 1906.

FORD, P., and BOUND, J.A., *'Coastwise Shipping and the Small Ports'*, Oxford, 1951.

FRASER, W., 'Development of inland waterways: need for economic realism', *Dock & Harb. Auth.*, *36*, 1955, pp 181-185. An almost identical paper was published later: *Jnl. Inst. Transp.*, *26*, 1956, pp 325-331.

HADFIELD, C.
(1) 'The Canal Age', Newton Abbot, 1968.

(2) 'British Canals: an Illustrated History', Newton Abbot, 5th ed, 1974.

HENMAN, P.S., 'Lighters and lighterage: with special reference to the Port of London', Jnl. Inst. Transp., 27, 1958, pp 252-258.

HILL, Sir R., 'British inland waterways: review of policy since nationalisation', Dock and Harb. Auth., 34, 1953, pp 45-46. Reprinted from British Transport Review, April 1953.

HOWE, C.W. et al, 'Inland Waterway Transportation: Studies in Public and Private Management and Investment Decisions', Baltimore, 1969.

INBUCON, 'Improvement of the Grand Union Canal: Feasibility Study', 2 vols, 1974. Published by the British Waterways Board.

INLAND WATERWAYS ASSOCIATION
(1) 'Waterways Junction', May 1972.

(2) 'Towards a Future for Inland Shipping' Oct. 1972.

(3) 'Barges or Juggernauts: a National Commercial Waterways Development Projection', 1974.

(4) 'Report on Continental Waterways', 1975.

IVES, W.L.
(1) 'Inland waterways of the United Kingdom: the effect of the Transport Act, 1947', Dock & Harb. Auth., 30, 1949, pp 8-11.

(2) 'The future of our inland waterways', Jnl. Inst. Transp., 29, 1962, pp 317-329.

(3) 'The future of the inland waterways', Jnl. Inst. Transp., 30, 1963, pp 187-191.

IWA - see INLAND WATERWAYS ASSOCIATION.

LYON, G.L., 'Oil handling on inland waterways in the UK', Dock and Harb. Auth., 30, 1950, pp 300-302.

MANCE, H.O.
(1) 'Suggested outline for a canal transport policy', Jnl. Inst. Transp., 23, 1950, pp 238-246.

(2) 'International inland transport in Europe: recent developments in organisation', Jnl. Inst. Transp., 25, 1954, pp 337-342.

MARSH, C.M., 'Acceleration of transport on inland navigable waterways', Proc. 17th Intl. Navig. Cong., Brussels, 1949, Section 1, Question 1, pp 119-125.

MAYES, G.I., 'British Coastal Ships, Tugs & Trawlers', 1975.

MORGAN, B., 'Civil Engineering: Railways', 1971.

NATIONAL PORTS COUNCIL, 'Annual Digest of Port Statistics', annually, 1966 to date.

RICHARDSON, J.J., and KIMBER, R., 'The British Waterways Board: a neglected asset?', Public Admin., 52, 1974, pp 303-318.

RITTER, J.

(1) 'Le Danube', Paris, 1976.

(2) 'Le Rhin', Paris, 2nd ed, 1968.

(3) 'Le Rhone', Paris, 1963.

ROBOTTOM, H.P., 'Lighterage in London', Jnl. Inst. Transp., 29, 1961, pp 124-127.

Rusholme Report - see BRITISH TRANSPORT COMMISSION (2).

SELECT COMMITTEE ON NATIONALISED INDUSTRIES, 'The Ownership, Management and Use of Shipping by Nationalised Industries', Second report, Session 1974-75, 346.

SELECT COMMITTEE ON SCIENCE AND TECHNOLOGY, 'Energy Conservation', First report, Session 1974-75, 487.

UNITED NATIONS ECONOMIC AND SOCIAL COUNCIL, ECONOMIC COMMISSION FOR EUROPE, INLAND TRANSPORT COMMITTEE, 'Prospects for the Development of Inland Water Transport in Europe', TRANS/R.8, Geneva, 1975.

NOTES AND REFERENCES Pages 16-23

References given here in abbreviated form will be found in full in the bibliography.

All references were published in London unless otherwise noted.

CHAPTER 1: Brief history of Inland Waterway Developments in United Kingdom to 1947

1. NEEDHAM, J., 'Science and Civilisation in China', vol 4, pt 3, Oxford, 1971, pp 211-378.

2. SKEMPTON, A.W., 'Canals and River Navigations before 1750', History of Technology, vol 3, pp 438-470, Oxford, 1957.

3. IDEM, 'The Engineers of the English River Navigations, 1620-1760', Trans. Newcomen Soc., 29, 1953, p 33.

4. McCUTCHEON, W.A., 'The Canals of the North of Ireland', Dawlish and London, 1965, pp 17-20.

5. HADFIELD, C. and BIDDLE, G., 'The Canals of North West England', vol 1, Newton Abbot, 1970, p 45.

6. IBID, pp 21-26.

7. HADFIELD (1), App 1.

8. FORBES and ASHFORD, App 2.

9. Data up to 1849 from MORGAN, Fig 8, p 96, data for 1850 to 1910 from BAGWELL (1), App 3.

10. MORGAN, Fig 11, p 138.

11. The role of the Railway Clearing House in improving rail services and profitability is illustrated at length by BAGWELL (1).

12. BAGWELL (1), App 3 and pp 281-284.

13. I am grateful to Charles Hadfield for letting me use his notes from the Coventry Canal Co. Minute Book which refer to this meeting.

14. The Railway and Canal Traffic Act, 1888, see HADFIELD (2), p 254.

15. A more detailed account of these Commissions and Committees is given by HADFIELD (2), Chap 13.

16. HADFIELD, C., 'The Canals of Yorkshire and North East England', vol 2, Newton Abbot, 1973, p 377.

17. Report of the Royal Commission on the Canals and Inland Navigations of the United Kingdom, 12 vols, 1906-1911.

18. A good example of the airing of this conflict can be found in the discussion following a paper delivered at the Institution of Civil Engineers in 1905 by the Engineer to the River Weaver Navigation: SANER, J.A., 'On Waterways in Great Britain', Min. Proc. Inst. Civ. Eng., 163, Pt 1, 1905, pp 21-86, discussion and correspondence pp 87-162.

19. ANON, 'The Canals that nobody wants', Evening News, 4 May 1928.

20. HADFIELD, C., 'The Canals of the East Midlands (including part of London)', Newton Abbot, 2nd ed, 1970, pp 203-205.

21. FRASER, W., The Future of Inland Water Transport', Jnl. Inst. Transp. 22, 1947, p 500.

22. HADFIELD, C., 'The Canals of the East Midlands (including part of London), Newton Abbot, 2nd ed, 1970, pp 240-242.

23. By, eg, The Royal Commission on the Canals and Inland Navigations of the United Kingdom (1906-1911), The Board of Trade's Canal Control Committee (1921), and the Royal Commission on Transport (1930). See HADFIELD (2), pp 295-296.

24. HADFIELD (2), pp 300-302.

25. Figures for 1913 and 1918 from HADFIELD (2), p 295; for later years from MANCE (1), p 239.

Pages 27-35

CHAPTER 2: British Commercial Waterway Policy and Administration, 1948 to 1962

1. BAGWELL (2), pp 305 and 318.

2. LINDSAY, J., 'The Canals of Scotland', Newton Abbot, 1968, pp 139-140.

3. HADFIELD (2), p 304.

4. RUSHOLME REPORT, p 14, para 15 (but cf the total of 3322 km given by HADFIELD (2), p 304).

5. The list in HADFIELD (2), p 304, is incomplete. The length of non-nationalised track was 1828 km (see App 1). Waterways nationalised but treated as docks were the Humber (59 km), lower River Trent (45 km) lower River (Yorks) Ouse (16 km) and Lydney Canal (2 km) thus bringing to 1950 km the length of commercially used track outside the control of the inland waterways section of DIWE. (Lengths from EDWARDS).

6. HADFIELD (2), p 304.

7. Eg BAGWELL (2), Table 20, p 350; RICHARDSON and KIMBER, p 315.

8. Eg McKEE, W., 'Canals: a transport resource?' Built Environment, 3, 1974, p 561.

9. IVES (1). This was not published in the Journal of the Institute of Transport.

10. BRITISH TRANSPORT COMMISSION, 'Annual Reports and Accounts, 1948', p 162, para 399.

11. MANCE (1), at the Midland Section of the Institute of Transport, 6 Dec 1949.

12. Ibid, p 239.

13. Ibid, p 240.

14. Ibid, p 241. A more extensive account of the work carried out under the Ministry of War Transport is given by MARSH.

15. MANCE (1), p 245.

16. Ibid, p 246.

17. BTC, 'Annual Reports and Accounts' 1948 to 1962.

18. BTC, 'Annual Report and Accounts, 1955', Vol 1, p 84, para 245.

19. In earlier years, these figures were generally revised upwards between the publication of one year's report and the next but the discrepancies do not exceed 1%.

20. BTC, 'Annual Report and Accounts, 1957', vol 2, pp 266-267, gives a summary of leading statistics since 1948, in which the recalculated figures are shown.

21. Sources: Rail:

1948-1951,	Annual	Abstract	of	Statistics,	1955
1952-1953,	"	"	"	"	1960
1954-1958,	"	"	"	"	1965
1959-1962,	"	"	"	"	1970

Other: 1952 GLOVER, K.F. and MILLER, D.N., 'The outlines of the Road Goods Transport Industry', Jnl. Royal Statistical Soc., Series A, 117, 1954, p 318.

1954 et Seq, as for Rail.

22. Eg JONES, E.G., 'Development of Inland Waterways: suggested future policy and towage methods', Dock and Harb. Auth., 31, 1950, pp 261-262 (the bathos in the title is explained by the author's being a London barge operator who had recently invented a push-tow system); and
LYON, G.L., Letter 'Inland Waterways', Dock and Harb. Auth., 31, 1950, p 304. Lyon was vice-chairman of a company with carrying subsidiaries, including John Harker, well-known on the north-eastern waterways.

23. HADFIELD (2), p 303.

24. AICKMAN, R.F., Letter 'The Future of Inland Waterways', Dock and Harb. Auth., 30, 1949, p 82.

25. LYON, G.L., Letter 'Canals and Inland Waterways', Dock and Harb., Auth., 30, 1949, p 105.

26. BTC, 'Annual Report and Accounts, 1951', pp 157-158, para 213.

27. ANON (G.H.L.B.), Review of above, Dock and Harb. Auth., 33, 1952, pp 124-125. 'G.H.L.B.' was Gerry Bird, an early IWA member who at one time ran a commercial narrow-boat. His contention that the IWA should take a realist, rather than an idealist, stance on redundant waterways led to his expulsion (along with Hadfield and Rolt) from the IWA at about this time.

28. HILL, p 46.

29. AICKMAN.

30. Ibid, pp 282-283.

31. Ibid, p 282.

32. To this, the DIWE chairman later objected, as the (published) paper received considerable publicity. He put his views in a letter to the Royal Society of Arts: HILL, Sir Reginald, Letter 'British Inland Waterways', Jnl. Roy. Soc. of Arts, 101, 1953, pp 413-414.

33. Discussion following AICKMAN, pp 294-295.

34. Ibid, pp 293-294.

35. BAGWELL (2), pp 328-332.

36. Ibid, p 330.

37. RUSHOLME REPORT, pp 68-71 paras 213 to 217.

38. Ibid, p 66, para 202.

39. Ibid, pp 70-71, paras 216-217.

40. ANON, 'British Waterways Improvement Scheme', Dock and Harb. Auth., 36, 1955, pp 75-76.

41. FRASER, pp 183-184.

42. ANON, 'Inland Waterways Development Scheme', Dock and Harb. Auth., 36, 1956, p 323.

43. BTC, 'Annual Report and Accounts, 1958', vol 1, p 51, para 135.

44. BTC, 'Annual Report and Accounts, 1961', vol 1, p 49, para 225.

45. BTC, 'Annual Reports and Accounts, 1948-1962.

46. RUSHOLME REPORT, App 7, p 128.

47. Ibid, p 44, para 125.

48. Ibid, p 45, para 128.

49. Ibid, App 8, p 129.

50. LYON.

51. BTC, 'Annual Reports and Accounts'.

52. MANCHESTER SHIP CANAL CO., 'Directors' Report, Financial Accounts and Statistical Returns, 1962'., Manchester, p 6.

53. IDEM (BRIDGEWATER DEPT), Personal communications, 21 March 1975 and 18 Nov 1975.

54. COLCHESTER BOROUGH COUNCIL, 'Accounts of Colchester Harbour and Navigation', year ending 31 March 1949 to y.e. 31 March 1963.
The figures plotted are
(a) 1948 to 1954: the sum of 'coal dues','tonnage dues' and 'wharfage dues'
(b) 1955 to 1962: 'Dues etc'.

55. COMMISSIONERS OF THE DARTFORD & CRAYFORD NAVIGATION, Cash Books and Minute Books. I am grateful to Martyn Denney for letting me use his extracts from these Books.

56. COLCHESTER BOROUGH COUNCIL, 'Harbour and Navigation Fund Accounts', years ending 31 March 1946 and 31 March 1965.

57. ROBOTTOM, p 127.

58. HADFIELD (2), p 313.

59. BOWES REPORT, pp 28-29, para 92: p 42, para 139: p 64, para 214; and RUSHOLME REPORT, pp 68-71, paras 213-217.

60. BOWES REPORT, p 33, para 103.

61. Ibid, pp 35-36, para 111.

62 ANON, 'Future Developments of British Inland Waterways', Dock and Harb. Auth., 39, 1959, pp 343-344. This was a report on the Government White Paper, Cmnd 676, Feb 1959. The activities of the Redevelopment Committee are reviewed by HADFIELD (2), pp 313-314.

63. BAGWELL (2), p 338.

64. IVES (2), by now also Deputy Chairman of the Board; delivered to the Western Section of the Institute of Transport, 3 Nov 1961.

65. BAGWELL (2), p 338.

CHAPTER 3: British Commercial Waterway Policy and Administration, 1963 to 1975

1. IVES (3): a paper read to the Sussex Group of the Institute of Transport, 15 Oct 1962.

2. Ibid, p 191 and IVES (2), p 321.

3. BRITISH WATERWAYS BOARD (3), p 1, para 7.

4. Ibid, p 24, para 127.

5. BWB (2).

6. Ibid, pp 19-20, para 84.

7. Ibid, p 22, para 86.

8. Ibid, pp 22-23, para 88.

9. Ibid, p 49, para 188, and HADFIELD (2), p 319.

10. BWB (3).

11. Ibid, p 6, para 32, and App 7, pp 119-121.

12. Ibid, p 9, para 48.

13. Ibid, p 12, para 66.

14. Ibid, p 14, para 75.

15. LINDSAY, J., '<u>The Canals of Scotland</u>', Newton Abbot, 1968, App 4, p 222.

16. BWB (2), p 38, para 138.

17. BWB (3), p 32, para 170.

18. Ibid, App 7, p 121.

19. Ibid, App 7 and 8 for lengths.

20. BAGWELL (2), pp 350-351.

21. '<u>Transport Policy</u>, Cmnd 3057, July 1966.

22. '<u>British Waterways: Recreation and Amenity</u>', Cmnd 3401, Sep 1967.

23. <u>Transport Act 1968</u>, section 104.

24. Ibid, Schedule 12, pt 1.

25. BWB (3), p 14, para 75.

26. Ibid, p 13, para 69.

27. Transport Act 1968, section 43.

28. BWB, 'Annual Report and Accounts 1969', p 5, para 31.

29. Eg BWB, 'Annual Report and Accounts 1974', p 72, statement F1.

30. BWB, 'Annual Report and Accounts 1969', p 6, para 34.

31. BWB, 'Annual Report and Accounts 1964', p 6, para 27.

32. Eg BWB, 'Annual Report and Accounts 1969', p 3, para 14 (loss of 650,000 tonnes); BWB, 'Annual Report and Accounts 1971', p 5, para 31 (loss of 550,000 tonnes); and BWB, 'Annual Report and Accounts 1974', p 6, para 35 (loss of 400,000 tonnes).

33. BWB, 'Annual Report and Accounts 1966', p 7, para 39.

34. BWB, 'Annual Report and Accounts 1964', p 7, para 32.

35. BWB, 'Annual Report and Accounts 1969', p 4, para 20.

36. BWB, 'Annual Report and Accounts 1963', p 9, para 49.

37. BWB, 'Annual Report and Accounts 1964', p 7, para 30.

38. BWB, 'Annual Report and Accounts 1969', p 4, para 22.

39. LINDSAY, J.,'The Canals of Scotland', Newton Abbot, 1968, App 3, p 218.

40. BWB, 'Annual Report and Accounts 1969', p 4, para 19.

41. BWB, 'Annual Report and Accounts 1970', p 4, para 22.

42. BWB, 'Annual Report and Accounts 1968', p 6, para 32.

43. BWB, 'Annual Report and Accounts 1970', pp 6-7, paras 37-38.

44. BWB, 'Annual Report and Accounts 1967', p 8, para 33.

45. YOUNG, J., 'New freight service with barge-carrying catamaran', Times, 4 March 1974.

46. BWB, 'Annual Reports and Accounts', 1963 to 1974.

47. BWB, 'Annual Report and Accounts 1967', Footnote, p 88.

48. 'Annual Abstract of Statistics 1974', p 226, Table 242; 'Annual Abstract of Statistics 1975', p 243, Table 252.

49. Sources: 1963-1969: MSC, 'Annual Report 1969', p 16.
1970-1974: MSC, Personal communications, 17 July 1975 and 2 Sept 1975.
n.b. Since 1969, no statistics have been included in the Annual Reports; traffic figures published since that date show inconsistencies.

50. MANCHESTER SHIP CANAL CO (BRIDGEWATER DEPT), Personal communication, 21 March 1975.

51. Sources: Dues: 1963-1972: COLCHESTER BOROUGH COUNCIL, 'Accounts of Colchester Harbour and Navigation', year ending 31 March 1964 to y.e. 31 March 1973, Colchester.
1973-1974: IDEM (HARBOUR AND NAVIGATION DEPT), 'Return for the Year ended 31 March 1975', Colchester.
Tonnages: 1966: IDEM (BOROUGH ENGINEER'S OFFICE), 'Schedule of vessels calling'. Although covering the period Aug 1965 to April 1968, 1966/7 if the only complete year. No other books in this series available.
1969-1972: IDEM, Internal report from Borough Treasurer to Property and Development Committee, Nov 1974.
1973-1974: As for Dues.

52. DARTFORD & CRAYFORD NAVIGATION COMMISSIONERS, Cash Books and Minute Books. I am grateful to Martyn Denney for letting me use his extracts from these Books.

53. TRANSPORT ON WATER, Personal communication, 22 Oct 1975. The lighterage tonnages are an underestimate as they refer to AMLBO members only.

54. MANCHESTER SHIP CANAL CO, 'Annual Reports', Manchester, 1963-1974; IDEM, Personal communication, 17 July 1975.

55. IDEM (BRIDGEWATER DEPT), Personal Communication, 2 Sept 1975.

56. Ditto, 31 Jan 1974.

57. Ibid; HAYMAN, A., 'Bridgewater Dept - the end of an era (1)', Port of Manchester Review 74, Manchester, pp 2-3, and ANON, 'The last grain trade', Waterways World, 3, Burton-on-Trent', Feb 1974, pp 24-25.

58. COLCHESTER BOROUGH COUNCIL, "Harbour and Navigation Fund Accounts', years ending 31 March 1965 and 31 March 1974.

59. ANON, 'Thames Tideway', Waterways World, 1, Burton-on-Trent, Oct 1972, pp 19-20.

60. 1957 figures from HENMAN; 1960 figures from ROBOTTOM; 1974 figures as Ref 53 (except largest lighter size from OCEAN GROUP INFORMATION DIVISION, News Release 'Cory on the River', June 1975).

61. As reported by, eg, VIGARS, L, 'Make London a little Venice say Labour', Evening News, 9 March 1973, and DARLINGTON, J., 'Canals could reduce London's traffic problems - Labour chief', Financial Times, 10 March 1973.

62. LABOUR PARTY, 'Britain will win with Labour', Oct 1974, p 20.

63. The only other mention that waterways received in the past three election manifestos (1970, 1974 twice) was from Liberals who, in Feb 1974, suggested that before any more closures took place, the freight potential of canals and railways be considered.

64. CENTRAL OFFICE OF INFORMATION, 'Freight Transport', Reference Pamphlet 101, 1971 (1st edition) and ditto, 1975 (2nd edition) pp 22-23.

65. DOE (1).

66. IWA (1). The report was also reproduced in full in IWA Bull., No 101, June 1972, pp 17-40.

67. DOE (2).

68. Ibid, p 13, para 30.

69. Ibid, p 9, para 20.

70. Ibid, p 10, para 24; pp 14-15, para 33.

71. IWA (2).

72. ANON, 'Commercial Carrying and Waterways Development', IWA Bull., No 98, July 1971, p 19; and HADFIELD, C., 'Trade and Navigation', IWA Bull., No 100, March 1972, p 38.

73. IWA, 'New Waterways', 1965.

74. HADFIELD (2), p 325.

75. RICHARDSON and KIMBER, pp 303-304.

76. IWA (3).

77. RAND, D., 'LASH ship makes her first call in the Medway', Dock and Harb.Auth., 50, 1969, pp 337-338.

78. LLOYDS LIST, Personal communication, 20 March 1974.

79. IWA (4).

80. Ibid, pp 5-6.

CHAPTER 4: The Present Status of the Waterway Industry in Great Britain

1. Apparently the only guide existing in law is contained in 'The Merchant Shipping (Life-saving Appliances) Rules 1965' (S.I. No 1105, HMSO, 1965); These rules offer a negative approach by defining the sea as lying outside certain lines drawn across estuaries etc. This definition is being used by the DOE in their collection of statistics relating to 'internal waterways'. (see note 3 to this chapter).

2. Transport Act 1968, section 104 (1) a.

3. Although the list in Appendix 2 may not be complete, it is both more rigorous and more extensive that that in IWA (3). The DOE started to compile a list of traffics on 'internal waterways' carrying sea-going vessels in 1973 (DOE, letter to IWA, 6 June 1975); this failed to include the Rivers Crouch, Dart, Dee, Dutch, Fal, Lune, Medway (above Rochester), Mersey, Great Ouse, Parrett, Kent Stour, Suffolk Stour, Tay, Torridge, Truro, Urr Water, Wensum and Witham; the BWB's Gloucester & Sharpness Canal, and Weaver Navigation; and the Exeter Ship Canal.

4. MULLEY in Hansard, 10 June 1974, Col 441.

5. DOE (Devereux), Personal communication, 22 May 1975.

6. The later of which was DOE, 'Reorganisation of the Ports: Second consultation document', April 1975.

7. COENCO, letter to DOE (Ports Directorate), 7 June 1975; and DOE (Green), letter to COENCO, 18 July 1975 (in reply).

8. A clause included in all those Acts of Parliament which authorise the construction of enclosed docks in London, maintaining the rights of lighters to enter the docks free of charge and hence receive from or discharge to vessels without payment of wharfage (see BIRD, p 392).

9. HILL, P., 'State boards disagree over Bacat charges', Times, 3 Sept 1974.

10. Ie in the 'Annual Abstract of Statistics'.

11. IWA (3): 45.8 million tonnes in 1st ed, 51.1 in 2nd.

12. 'Annual Abstract of Statistics 1974'.

13. DOE, letter to IWA, 7 January 1975.

14. On certain waterways there is only a single user, and if this user is a private company, they may be reluctant to issue information on freights handled. Where such data has been provided in confidence, it has been aggregated in the tables in the relevant Appendices to prevent any possibility of breach of confidence.

15. The starting points for the survey were EDWARDS, IWA (3), BENN'S 'Ports' and NPC "Annual Digest', but none are complete and the first three contain obsolete information.

16. 'Annual Abstract of Statistics 1976', Table 269.

17. Eg by BAXTER and WILLIAMS who state 'Petroleum and petroleum products shipped British ports amounted to 74.3 million tonnes'. This total is actually a handling total, not a freight total.

18. BAGWELL, P.S., 'Inland Navigation and Coastal Shipping', paper delivered at 'The Way Ahead in Transport History', a conference held at the Polytechnic of Central London, 26-27 Sept 1975.

19. Sources: 1948: FORD, P., and BOUND, J.A., 'Coastwise Shipping and the Small Ports', Oxford, 1951, excluding traffics to Orkneys, Shetlands, Isle of Man, Northern Ireland, Channel Island and Eire, and assuming oil traffic to be negligible.
1949-1960: Coal and dry cargo: ANON, 'Coasters on the hard' Economist, 1 April 1961, pp 49-50, corrected to exclude 'offshore' traffics.
Liner: 1960 as above; 1949-1959 assumed linear between 1948 and 1960.
Oil: 1949-1951, 1953, assumed linear between 1948 (zero) and 1952, and 1952 and 1954; 1952, 1955-1960, by difference from total.
Total: 1948-1951, 1953 by summation. 1952, GLOVER, K.F., and MILLER, D.H., 'The Outlines of the Road Goods Transport Industry', Jnl. Royal Statistical Soc., Series A, 117, 1954, p 318; 1954-1958, Annual Abstract of Statistics 1965; 1959-1960, Annual Abstract of Statistics 1970.
1961-1962: Total: Annual Abstract of Statistics 1970.
1963: Total: Annual Abstract of Statistics 1974.
1964: Coal: NATIONAL PORTS COUNCIL 'Port development an interim plan', 1965, p 29, Table 8, with 3.7 million tonnes deducted to represent non-mainland traffic (estimate by comparison with statistics for 1965-1967).
Total: Annual Abstract of Statistics 1974.
1965-1974: NATIONAL PORTS COUNCIL Annual Digest 1966 (for 1965), 1967 (for 1966), 1968 (for 1967) and 1974 (for 1968-1974). In all cases using 'inward' figures only.

20. 1973 mainland port figures from BAXTER and WILLIAMS: remainder from NPC 'Annual Digest 1973' and 1974.

21. Sources 1955-1963: 'Annual Abstract of Statistics 1965'.
1964-1974: 'Annual Abstract of Statistics 1975'.

22. Sources 1955: LE FLEMING, H.M. 'Coastal Ships', n.d. but 1955.
1960: IDEM, 'Coastal Cargo Ships', 4th ed, n.d., but 1960.
1962: CHESTERTON, D.R., 'Coastal Cargo Ships', 5th ed., n.d. but 1962.
1967: IDEM, 'Coastal Ships', 1967.
1968-1971: SELECT COMMITTEE ON NATIONALISED INDUSTRIES, p 213.

23. ANON, Jnl. Inst. Transp., 22, 1948, p 702.

24. INGHAM, M., 'Freightwaves '75 turns the tide', Waterways News, No. 50, Sept 1975, p 12.

25. INLAND WATERWAYS ASSOCIATION'S NORTH EAST INLAND SHIPPING COMMITTEE, 'Canal and River Carriers, N.E. England, based Humberside', unpublished, n.d. but 1975. The estimated size of BWB's Tom Pudding fleet given in the above does not agree with BWB's own figure (derived from BWB, 'Annual Report and Accounts 1975'). The latter has therefore been used.

26. UK data as above; other data from STATISTICAL OFFICE OF THE EUROPEAN COMMUNITIES, 'Annual Statistics Transport and Communication, Tourism, 1972-1973', Luxembourg, 1975, Table 5.5, pp 60-61.

27. UK data as 25; other data from IWA (4), Table 34, p 77.

28. Eg LAMBERT, J., 'Belgian bargemen's row in deadlock', Sunday Times, 12 Oct 1975.

29. Local Government Act 1974, Section 6.

30. DOE circular 104/73, 'Local Transport Grants', 7 Aug 1973.

31. DOE circular 27/74, 'Transport Supplementary Grants: More Details of the New System', 5 April 1974.

32. DOE circular 104/73, op. cit., paras 2 and 3.

33. ANON, Surveyor, 146, 19/26 Dec 1975, p 2.

34. DOE circular 27/74, op. cit., Annex B, para 7(ii).

35. EXPENDITURE COMMITTEE (1), pp xv and xvi, paras 49 and 50.

36. Ibid, p ix, para 13.

37. EXPENDITURE COMMITTEE (2), p 4, para 3.

38. RICHARDSON and KIMBER.

39. DOE circular 60/74, 'Transport Supplementary Grant Submissions for 1975/6', 5 April 1974.

40. DOE circular 43/75, 'Transport Supplementary Grant Submissions for 1976/7', 4 April 1975.

41. DOE circular 125/75, 'Transport Supplementary Grant Submissions for 1977/78', 22 Dec 1975, para 32.

42. BWB, 'Annual Report and Accounts 1964', p 6, para 28.

43. BWB, 'Annual Report and Accounts 1966', p 6 para 36.

44. BWB, '<u>Annual Report and Accounts 1967</u>', p 6, para 22.

45. HADFIELD (2), p 323.

46. BWB, '<u>Annual Report and Accounts 1969</u>', p 4, para 21.

47. BWB, '<u>Annual Report and Accounts 1971</u>', p 7, para 39.

48. BWB, <u>News Release PRI/117</u> 'Improvement of the Sheffield and South Yorkshire Navigation', 18 April 1972.

49. Letter from ELDON GRIFFITHS (DOE) to Sir Frank Price (Chairman, BWB), 1 March 1973.

50. DAFTER, R., 'Waterways Board to fight for more freight traffic', <u>Financial Times</u>, 26 March 1973.

51. FARNDON, R., 'Waterways board can 'prove' £2.4 m scheme', <u>Times</u>, 10 April 1973.

52. HANSARD, 11 July 1973, Cols 1505/6.

53. Letter from Sir FRANK PRICE (Chairman, BWB) to Eldon Griffiths (DOE), 13 July 1973.

54. BWB, <u>News Release PRI/163</u>, 'Sheffield & South Yorkshire Navigation Improvement Scheme', 26 Nov 1973.

55. Eg ANON, 'Canal Toll', <u>Times</u>, 18 Feb 1975; FRANCIS, J., 'Inland from the Humber', <u>Transport Management</u>, <u>9</u>, Coventry, June 1975, pp 16-18.

56. DOE, <u>Press Notice 506</u>, 'Sheffield & South Yorkshire Navigation', 26 May 1976.

57. ANON, 'CC may go it alone on canal scheme', <u>Surveyor</u>, <u>148</u>, 9 July 1976.

58. EXPENDITURE COMMITTEE (1).

59. Ibid, p xv, para 49.

60. Ibid, p xxi, para 50.

61. Ibid, p ix, para 13.

62. SELECT COMMITTEE ON NATIONALISED INDUSTRIES.

63. Ibid, p lxxv, recommendation 11.

64. SELECT COMMITTEE ON SCIENCE AND TECHNOLOGY.

65. Ibid, p 30, para 51.

Pages 120 - 127

CHAPTER 5: The Role of Waterways in Europe

1. UNITED NATIONS, (Statistical) Annexes 1 and 2 except for data for USA which is taken from HOWE, p 18, and 'Actual' data for UK which is taken from Tables 18 and 21, and Appendix 4.

2. ANON, 'Barge train for West Africa', Dock and Harb. Auth., 39, 1958, p 167.

3. ANON, 'Third ocean-going barge launched', Ship and Boat International, 29, Mariefred, Sweden, 1975/1976, p 51. Also ROSS CO LTD, Personal communication, 2 March 1976.

4. ANON, 'Columbia begins interoceanic canal', World Construction, 30, New York, 1977.

5. ANON, 'Modernization of Rivers and Canals in Belgium', Times, 10 Aug 1955, p 5.

6. FLITCROFT, K., 'Belgium: a port and industry survey', Dock and Harb. Auth., 50, 1969, pp 92-93.

7. IWA (4), p 11.

8. SEILER, E., 'Die Schubschiffahrt als Integrationsfaktor zwischen Rhein und Donau', Zeitschrift für Binnenschiffahrt und Wasserstrassen, No. 8, Duisberg, 1972, pp 300-312.

9. MINISTERE DES TRAVAUX PUBLICS, Personal communication, 9 Sept 1977. The division of responsibility was altered in January 1977 with the establishment of the Dienst voor de Scheepvaart.

10. OFFICE DE LA NAVIGATION, 'Rapport Annuel - 1975 Partie Statisque', Liege, Tableau XXXIII.

11. INTERNATIONAL ROAD TRANSPORT UNION, 'World Transport Data', Geneva, 1973, p 155.

12. OFFICE DE LA NAVIGATION, op cit, Tableau IX.

13. AMBASSADE DE FRANCE EN GRANDE BRETAGNE, Personal communication, 16 June 1977.

14. IWA (4), p 21.

15. AMBASSADE DE FRANCE (LONDON), 'Transport in France', n.d. but probably 1973, p 21.

16. INTERNATIONAL ROAD TRANSPORT UNION, op cit, p 175.

17. IWA (4), p 32.

18. THE GERMAN MINISTRY FOR COMMUNICATION, Personal communication, 17 March 1976.

19. ANON, 'Dam break on new canal floods wide area', Times, 19 July 1976.

20. ANON, 'In brief', New Civil Engineer, 20 June 1977, p 9.

21. RITTER (1), p 55.

22. INTERNATIONAL ROAD TRANSPORT UNION, op cit, pp 186-187.

23. IWA (4), pp 45-46.

24. Ibid, Tables 16 and 17, p 46.

25. INTERNATIONAL ROAD TRANSPORT UNION, op cit, pp 213-214.

26. ROSSINI, T., 'Works for the regulation of the minor bed of the River Po in view of navigation by vessels of 600 tons', PIANC Bull. , No 40, Brussels, July 1954, pp 175-207.

27. BEATTIE, J.H., 'The development of river radar', Dock and Harb. Auth., 43, 1962, pp 123-128.

28. ANON, 'Italian Canal', Waterways World, 2, No 10, Burton-on-Trent, October 1973, p 35.

29. TIFFEN, C.E., 'Freight traffic comeback planned for Venice', Waterways News, December 1974, p 4.

30. UNITED NATIONS, p 19. Note that this study is also referred to by ROSSINI (see Ref 26 above) suggesting that little progress has been made.

31. EEC (1).

32. MANCE (2), p 339.

33. DESPICHT (2), p 323.

34. RITTER (1), pp 99-100.

35. SEILER, E., 'L'interet economique de la liaison Rhin-Main-Danube', PIANC Bull., No 11, Brussels, 1972, pp 55-65.

36. RITTER (1), pp 95-99.

37. SEILER, E., 'Die Schubschiffahrt als Integrationfaktor zwischen Rhein und Donau', Zeitschrift für Binnenschiffahrt und Wasserstrassen, No 8, Duisberg, 1972, pp 300-312.

38. RITTER (1), pp 96-98.

39. SCARGILL, D.I., 'New hope for the Rhone-Rhine waterway', Geography, 61, Sheffield, 1976, pp 157-160.

40. ANON, 'Giscard pledge on international canal link', Times, 25 Nov, 1975.

41. GOURDON, A., 'The Moselle Ship Canal and the Port of Thionville', Jnl. Inst. Transp., 31, 1965, pp 44-52 and 56.

42. Ibid, p 45.

43. MARTIN, J.E., 'Some effects of the canalisation of the Moselle', Geography, 59, Sheffield, 1974, pp 298-308.

44. RITTER (2), p 63.

45. MARTIN, op cit, p 298.

46. Ibid, p 307.

47. Ibid, p 302.

48. TREATY OF ROME (1957), Title IV.

49. Ibid, Article 74.

50. Ibid, Articles 76 and 79.

51. Ibid, Articles 77 and 92-94.

52. EEC (2).

53. BEAGLEY, T.L., 'Transport policy in the European Economic Community: The contribution Britain can make', Jnl. Inst. Transp., 35, March 1973, pp 99-108.

54. FEATHERSTONE, H.R., 'The Common Transport Policy', Jnl. Inst. Transp., 36, 1974, pp 135-136.

55. TREATY OF ROME, Article 84 (1).

56. Ibid, Article 84 (2).

57. Regulation 11 of 27 June 1960/EEC.

58. Ibid, Article 6.

59. Ibid, Article 8.

60. Regulation (EEC) 1017/68.

61. Ibid, Article 2.

62. Ibid, Article 9.

63. Ibid, Article 4.

64. Ibid, Article 18.

65. Regulation (EEC) 1191/69.

66. Ibid, Article 1, para 1.

67. Ditto, para 2.

68. Ibid, Article 19.

69. Regulation (EEC) 1192/69.

70. Transport Act 1947.

71. BALDWIN, M., Letter to Directorate A, Directorate General VII (Transport), European Communities Commission, 9 May 1975.

72. ECC Directorate General VII (Transport) (Dousset), Personal communication, 29 May 1975.

73. BALDWIN, M., 'The current position of United Kingdom waterways in relation to EEC transport policy and legislation', unpublished paper, October 1975.

74. Eg BWB, 'Annual Report and Accounts 1974', p 58, para 24.

75. Transport Act 1968, Section 116 (6).

76. Ibid, section 117.

77. BWB, 'Annual Report and Accounts 1976', p 51, para 16.

78. BWB, News release PR1/184, 'British Waterways Board welcomes independent engineering survey', 27 June 1974.

79. Transport Act 1968, section 104 (1) (b) and Schedule 12, part II.

80. Ibid, section 104 (1) (a) and Schedule 12, part I.

81. Ibid, section 43 (3) (a).

82. BWB, 'Annual Report and Accounts 1974', p 79.

83. Ibid, pp 80-82.

84. EXPENDITURE COMMITTEE (2), p 4, para 3.

85. Regulation (EEC) No 1107/70.

86. Articles 92 to 94.

87. Regulation (EEC) No 1108/70.

88. EEC (1).

89. Ibid, p 3.

90. EEC (3).

91. Ibid, p 33.

92. DOE (Rooney, Directorate of Statistics), Personal communication, 12 June 1975.

93. EEC (3), p 3.

94. Ibid, p 33.

95. Regulation (EEC) No 2598/70.

96. Ditto, No 281/71.

97. Ibid, quoting Regulation (EEC) No 1108/70, Article 3(e).

98. DOE (Hope, Ports B Division), letter to F. Doerflinger, 7 January 1976.

99. DOE (Devereux), Personal communication, 22 May 1975.

Pages 152-161

CHAPTER 6: Topography, Industry and Transport in Great Britain

1. BOWN, A.H.J., 'Port Economics, Part 10:1 - Inland Water Transport', Dock and Harb. Auth., 44, 1963, pp 29-33.

2. BOWES REPORT, p 13, para 34.

3. FRASER, p 181.

4. POWNALL, J.F., 'The Projected Grand Contour Canal', Birmingham, 1942.

5. WACHSMUTH, W., 'Fall structures and intersectional structures of the Elbe Lateral Canal', PIANC Bull., No 20, Brussels, 1975, pp 47-51.

6. KUHN, R., 'Le Canal Main-Danube', PIANC Bull., No 11, Brussels, 1972, pp 71-97.

7. RICHARDSON, G.C., 'Ice Harbor Navigation Lock', PIANC Bull., I, No 7, Brussels, 1963, p 19.

8. BALANIN, V.V., 'The Ust-Kamenogorskiy Lock on the River Irtish', PIANC Bull., II, No 8, Brussels, 1971, pp 53-61.

9. CALVERT, R., 'Inland Waterways of Europe', 1965, App 1.

10. BEZYUKOV, K., et al, paper to Section 1, Subject 5, 24th International Navigation Congress at Leningrad, Brussels, 1977. The lengths of some waterways have been scaled from maps.

11. RITTER (2), pp 31-33.

12. RITTER (1), p 13.

13. RITTER (3), pp 12-13.

14. SHURPITZI, V.K., 'V.I. Lenin Volga-Baltic Waterway', PIANC Bull., III, No 25, Brussels, 1976, pp 31-39.

15. HOWE, p 77.

16. Heights estimated from 1:63,360 O.S. maps, lengths from EDWARDS.

17. WILLIAMS, E.L. 'The Manchester Ship Canal', Min. Proc. Inst. Civ. Eng., CXXXI, 1897, pp 14-30.

18. UNITED NATIONS, (Statistical) Annex 2, except where indicated.

19. Ibid, footnotes to (Statistical) Annex 2.

20. Quoted in UNITED NATIONS, p 20.

21. GB freight figures from 'Annual Abstract of Statistics 1975', rest as follows. Areas from UNITED NATIONS, 'Annual Bulletin of Transport Statistics for Europe 1974', New York, 1975. Freight transport and

GDP from this source also, supplemented respectively where necessary by INTERNATIONAL ROAD TRANSPORT UNION, 'World Transport Data', Geneva, 1973 and ECONOMIST (pub), 'The World in Figures', 1976 (with scaling to relate national income/head to GDP).

22. England and Wales: CENTRAL ELECTRICITY GENERATING BOARD, 'Statistical Yearbook 1976-77', 1977, pp 6-11; Scotland: ELECTRICAL TIMES (pub), 'Electricity Supply Yearbook, 1976'.

23. ANON, 'Major pipelines in Great Britain', Journal of the Pipeline Industries Guild, No 52, Summer 1975, pp 19-23.

24. Adapted from HUBBARD, M., 'The Economics of transporting oil to and within Europe', 1967, Fig 25.

25. Ditto, Fig 26.

26. COUPER, A.D., 'The Geography of Sea Transport', 1972, p 160.

27. TAYLOR, A., 'Freight transfer in prospect', Surveyor, 146, 16 May 1975, pp 18-20.

28. ANON, 'SGB Pal for Thameside Terminal', Dock and Harb. Auth., 56, 1975, p 222.

29. INBUCON, 1, pp 42-45.

30. ANON, 'Dutch owners start Rhine container service', Dock and Harb. Auth., 49, 1968, pp 120-121.

31. BALDWIN, M., 'Shipping on the Danube', National Waterways Transport Association Newsletter, No 2, Autumn 1977, pp 5-6.

32. DREWRY, p 6.

33. Ibid, p 9.

34. Ibid, p 35 etc.

35. GREATER LONDON COUNCIL (DEPT OF PUBLIC HEALTH ENGINEERING), Personal communication, 20 Aug 1975.

36. INBUCON, 1, pp 56-59, etc.

37. HALFAR, N., 'Cargo Liners', Waterways News, No 43, Jan 1975, p 11.

Pages 178-190

CHAPTER 7: Costs of Waterway Construction and Operation

1. Eg in SEILER, E., 'Die Schubschiffahrt als Integrationsfaktor zwischen Rhein und Donau', Zeitschrift für Binnenschiffahrt und Wasserstrassen, No 8, Duisberg, 1972, pp 300-312.

2. HOWE, p 30.

3. DENNING, F.C., 'Tennesse-Tombigbee Waterway', PIANC Bull., No 23, Brussels, 1976, pp 16-20.

4. BEHRENS, H.J., 'The construction of the Elbe Lateral Canal', PIANC Bull., No 20, Brussels, 1975, pp 37-45.

5. KUHN, R., 'Le Canal Main-Danube', PIANC Bull., No 11, Brussels, 1972, pp 71-97.

6. Road data: DEPT OF ENVIRONMENT, 'Manual of Standard Highway Designs Part 1: Rural Motorways', 1972. Rail data: PATERSON, A., 'Railway track and structures', paper deliverd to Institution of Civil Engineers Symposium, Developments in Railway Traffic Engineering, 1967, pp 1-9.

7. BEHRENS, op cit, pp 40-43.

8. IWA (4), p 19, except for Elbe Lateral Canal; for this the cost estimate at opening is from ANON, 'Dam break on new canal floods wide area', Times, 19 July 1976, to which was added a figure for repairs (not flood damage) from ANON, 'Elbe canal to reopen in July', Lloyd's List, 15 June 1977.

9. The non-GLC costs are derived from 44 indentifiable motorway sections in progress or planned and costed, the GLC costs from 5 sections. All lengths and costs from DOE, 'Roads in England 1974-75', 1975.

10. IWA (4), p 20, except for figure for repairs (not flood damage) derived as indicated in note 8.

11. AUBERT, J., 'The layout of new navigable waterways', PIANC Bull., 4, No 6, Brussels, 1970, pp 17-39.

12. Ibid, adapted from Fig 12, p 28.

13. Ibid, adapted from Fig 13, p 30.

14. SMITH, N.A.F., 'A History of Dams', 1971, pp 164-165.

15. INTERNATIONAL COMMISSION ON LARGE DAMS, 'World Register of Dams', 4 vols, Paris: 1964.

16. BWB, 'Annual Report and Accounts 1974', p 60.

17. HOWARTH, C., 'Powers of arrest', Port of Manchester Review 74, Manchester, 1975, pp 20-22.

18. ROEHLE, W. et al, 'Measures against damage to locks and ships and measures during winter operation on the Austrian Danube', Proceedings of the 24th International Navigation Congress (Leningrad), Brussels, 1977, pp 7-20.

19. BWB, 'Annual Report and Accounts 1976', para 121, p 19.

20. BWB, 'Annual Reports',1971-1976.

21. Adapted from INBUCON, 2, App 27, p 122.

22. Annual Abstract of Statistics 1976, Tables 271, 272, pp 264-5, taking one route length for 1973 in both cases.

23. INBUCON, 1, p 96.

24. Ibid, p 93.

25. BRITISH WATERWAYS BOARD and SOUTH YORKSHIRE COUNTY COUNCIL, 'Sheffield & South Yorkshire Navigation: Appraisal of the Improvement Proposals', Barnsley and London, 1977, p 29.

26. HENMAN.

27. (a) dates of construction taken from MAYES; (b) ages taken from CHAMBER OF SHIPPING OF THE UNITED KINGDOM, 1974, Table 2.7.

28. Dates of construction taken from MAYES.

29. EEC (1), Table 4.7.

30. BEATTIE, J.H., 'The development of river radar', Dock and Harb. Auth., 43, 1962, pp 123-128.

31. HENMAN.

32. HIRST, E., 'Transportation Energy Use and Conservation Potential', Science and Public Affairs, (The Bulletin of the Atomic Scientists of Chicago), Chicago, 1973, 29, pp 36-42, reprinted in TRANSPORT 2000, 'Energy in Transport', 1974.

33. ANON, 'The Energy Sweepstakes: Railroads are Easy Winners', Railway Age, New York, 10 December 1973, reprinted in TRANSPORT 200 'Energy in Transport',1974

34. Ibid, the Missouri Pacific.

35. ANON, 'Energie et transport: 4-La France', La Vie du Rail, Paris, 10 Feb 1974, pp 50-55.

36. MASEFIELD, P., 'Energy for traction', Railway Engineering Journal, 4, March 1975, pp 39-49.

37. BREACH, I., 'Freightwaves of tomorrow', New Scientist, 12 July 1973, pp 68-70.

38. BRITISH WATERWAYS BOARD, 'Energy Conservation - the Inland Waterway Role', May 1975.

39. MASEFIELD, op cit, p 49.

40. INBUCON, 2, pp 28 and 30.

41. IDEM, 1, p 46.

42. Ibid, p 47.

43. Ibid, pp 36-37.

44. Ibid, p 37.

45. IWA (4), p 11.

46. NOORTMAN, H.J. 'Inland waterways - their role and significance in European transport'. Transportation Planning and Technology, 2, New York, 1973, pp 129-138.

CHAPTER 8: Non-transport Benefits and Costs of Waterways

1. HYDE, T.M., 'Water supply for waterways', Proc. 24th International Navigation Congress, Brussels, 1977, Section 1, Subject 5, p 106.

2. BWB, 'Annual Report'.

3. HYDE, op cit, p 111.

4. MARSH, C.M., 'Use of water for navigation', Proc. Symposium Conservation of water resources in the United Kingdom, 1962, pp 52-58.

5. See BALDWIN, M., 'Dual-purpose water channels', Surveyor, 31 May 1974, pp 27-28, for account of studies on potential of Lancaster Canal as water channel.

6. BRITISH WATERWAYS BOARD (pub), Birmingham Canal Navigations, 1970.

7. Ibid, pp 10-11.

8. Ibid, p 33.

9. Ibid, p 13.

10. Ibid, p 10.

11. HYDE, op cit, pp 106-107.

12. Eg the Grand Junction Canal in 1811 - vide HADFIELD, C.,'The Canals of the East Midlands', 2nd ed, Newton Abbot, 1970, p 118.

13. WILLEMS, G., 'Programme for the general modernization of the Belgium navigable waterways', PIANC Bull., No 40, Brussels, July 1954, p 74.

14. WATER RESOURCES BOARD, Water resources in England and Wales, vol 1, 1973, p 23.

15. For an analysis of the Grand Contour Canal Scheme, see BALDWIN, M., 'The Grand Contour', Waterways World, 4, Burton-on-Trent, October 1975, pp 22-24.

16. HADFIELD, C., 'The Canals of the West Midlands', 2nd ed, Newton Abbot, 1969, p 251.

17. Originally 38.6 Mld, this was later increased. In fact the average abstraction rate is about 45 Mld. MID AND SOUTH EAST CHESHIRE WATER BOARD, Personal communication, March 1974.

18. MARSH, op cit, p 57.

19. INGHAM, M., 'Tapping the canal', Waterways News, No 46, April 1975, pp 4-5. The original arrangement was for 114 Mld; new arrangements have raised the permitted abstraction rate to 332 Mld.

20. BRISTOL WATERWORKS CO., Personal communication, March 1974.

21. After KUHN, R., 'Le Canal Main-Danube', PIANC Bull., No 11, Brussels, 1972, Fig 3, p 74.

22. SEILER, E., 'L'interet economique de la liaison Rhin-Main-Danube'. PIANC Bull., No 11, Brussels 1972, p 65. Seiler's figure of 11.7 million DM has been converted at the rate of 8 DM/£1.

23. ANON, 'Anglian throws Ely Ouse into reverse', New Civil Engineer, 26 August/2 September 1976, pp 6-7, and ANDREWS, C.D., 'We didn't wait for the rain', 1976, pp 48-49.

24. HYDE, op cit, p 106.

25. BALDWIN, M., 'Dual purpose water channels', Surveyor, 31 May 1974, pp 30-31.

26. WATER RESOURCES BOARD, 'Water Resources in England and Wales', 2 vols, 1973.

27. These ideas were dealt with more fully by BALDWIN, op cit.

28. BRITISH WATERWAYS BOARD (publishers), Birmingham Canal Navigations, 1970, p 10.

29. HYDE, op cit, p 112.

30. BWB, op cit, p 13.

31. HYDE, op cit, p 113.

32. Quoted by EDWARDS, pp 149-150.

33. Section I, Subject 6 (common to Sections I and II).

34. Report of Proceedings, 21st International Navigation Congress, Brussels, 1965, p 333.

35. Section I, Subject 5.

36. Report of Proceedings, 23rd International Navigation Congress, Brussels, 1973, p 164.

37. Ibid, p 364.

38. Quoted in UNITED STATES ARMY (CORPS OF ENGINEERS - ST LOUIS DISTRICT) 'Locking Through', St Louis, March 1954.

39. 1971-1973: OFFICE OF POPULATION CENSUSES AND SURVEYS, 'Statistical Review of England and Wales for the year 1973: Part 1(B) Tables: Medical', 1976, Table 7.
1974: IDEM, 'Mortality Statistics 1974', 1977, Table 6.
1975: IDEM, 'Mortality Statistics: Cause (1975)', 1977, Table 2.

Pages 220-226

40. CRANE, D.A., 'Recreation and ecological considerations at inland navigation projects', Proc. 23rd International Navigation Congress, Section I, Subject 5, Brussels, 1973, p 209.

41. Ibid, p 213.

42. ANON, 'Leeds and Liverpool Canal', IWA Bull., No 102, Sept 1972, p 42.

43. BWB, 'Annual Report and Accounts 1972', pp 15-16, para 95.

44. ANON, 'Leeds-Liverpool closure call', IWA Bull., No 105, June 1973, p 15.

45. ANON, 'Drownings', IWA Bull., No 103, Dec 1972, p 46.

46. TOURIST FEDERATION OF THE PROVINCE OF HAINAUT, 'Visits to the sloping Lock of Ronquières', (Tourist Leaflet), Mons, Belgium, 1974.

47. CHEETHAM, C., 'The Port of Manchester', CTMB Newsletter, No 31, Nottingham, Summer 1976, p 10.

48. BITTMANN et al, Paper on 'Arrangement of navigable waterways for recreation and preservation of environment (artificial beaches, water sports and fishing, etc)', Proc. 23rd International Navigation Congress, Section I, Subject 5, Brussels, 1973, pp 83-84.

49. DOERFLINGER, F., 'Inland waterways - a new environmental dimension', Environmental Conservation, 2 (2), Lausanne, Switzerland, Summer 1975, p 95.

Appendix 1: British waterways carrying commercial traffic in 1947 but not nationalised under the Transport Act 1947

	Length in km	Notes
R. Ancholme	31	
R. (Bristol) Avon	21	
Beverley Beck	1	
Bridgewater Canal etc	84	(1)
Chelmer & Blackwater Navigation	22	
R. Clyde	47	
R. Colne Navigation	18	
R. Crouch	28	
R. Dart	17	
Dartford & Crayford Navigation	6	
R. Dee	53	
Dutch River (R. Don)	9	
Exeter Ship Canal	8	
R. Fal (including creek to Penryn)	16	(2)
R. Forth	100	
R. Foss	2	
Grosvenor Canal	1	
Helford River	10	(2)
R. Hull (and Arram Beck)	33	
Linton Lock Navigation - see R. (Yorks) Ouse		
R. Lune	12	(2)
Manchester Ship Canal (main line)	58	
Market Weighton Drainage and Navigation	5	
R. Medway	69	
R. Mersey	57	(2)
R. Nene	147	
R. Orwell	15	
R. (Great) Ouse (main line)	120	
R. (Sussex) Ouse	15	
R. (Yorks) Ouse above Goole, including Linton Lock Navigation	85	
R. Parrett	55	
R. Ribble	24	(2)
R. Roding	3	
R. Severn (lower)	33	
R. (Kent) Stour	31	
R. (Suffolk) Stour	57	
Surrey Canal	5	
R. Tay	50	
R. Thames (including creeks and branches)	340	
R. Torridge	10	(2)
R. Truro	6	(2)

(cont.

continued

	Length in km	Notes
Urr Water	14	(2)
R. Wear	17	
R. Wensum - See R. Yare		
R. Wey	31	
R. Witham (lower)	11	(2)
R. Yare (main line only but including R. Wensum to New Mills, Norwich)	51	
TOTAL	1828	

Notes: Waterway lengths are taken from EDWARDS unless otherwise indicated:

(1) MANCHESTER SHIP CANAL CO, '<u>Report of the Directors Statement of Financial Returns and Statistical Returns.....1948</u>', Manchester, p 12.

(2) Scaled from 1:63, 360 Ordnance Survey maps.

(3) The Rivers Blackwater (Essex), Cart, Itchen, Roach and Test possibly also deserve inclusion, but their commercial status in 1947 needs further clarification.

APPENDIX 2: British waterways carrying commercial traffic in 1974, but not controlled by the British Waterways Board.

N.b. Rivers only used for aggregate dredging and gravel pits are omitted.

	Navigation authority type and length (km)				Note No.
	RWA	Local A	Port A	Other(1)	
R. Avon (below Bristol)		14			(2)
Beverley Beck (lower)		1			(3)
Bridgewater Canal				4	(4)
R. Clyde (below Glasgow)			70		(5)
R. Colne Nav'n (below Colchester)		16			(6)
R. Crouch			28		(7)
R. Dart Nav'n (Totnes to Dittisham)				11	(8)
(below Dittisham)			5		(8)
Dartford & Crayford Nav'n				6	(9)
R. Dee (below Hawarden Bridge)	23				(10)
Dutch R. (or Don) (lower)	1				(11)
R. Fal (below junction with R. Truro) plus Penryn Creek		16			(12)
R. Forth (below S. Alloa)			79		(13)
R. Foss		2			(14)
Grosvenor Canal		1			(11)
Helford River (below Gweek)				10	(15)
R. Hull (Grove Hill to Sculcoates Goate)				17	(16)
(below Sculcoates Goate)		1			(16)
R. Humber			59		
R. Lune (below Lancaster)			12		(17)
Lydney Canal (lower)			1		(18)
Manchester Ship Canal				58	
R. Medway (below Aylesford)			38		(19)
R. Mersey (below Eastham)			28		(20)
R. Nene (below Wisbech)		19			(21)
R. Orwell (below Ipswich)			15		
R. Gt. Ouse (below King's Lynn)			4		(22)
R. Yorks Ouse (Lendal Br., York, to Goole)		54			(23)
(below Goole)			16		
R. Parrett (below Dunball)		25			(24)
R. Ribble (below Preston)		25			(25)
R. Roding (below Ilford)				3	(26)
R. Severn (below Sharpness)			33		
R. (Kent) Stour (below Sandwich)			6		(27)

(cont.

continued

	Navigation authority type and length (km)				Note No.
	RWA	Local A	Port A	Other(1)	
R. (Suffolk) Stour (below Mistley)			15		(28)
R. Tay (Perth to Balmerino)		31			(29)
(below Balmerino)			19		(29)
R. Thames (Staines to Teddington)	27				(30)
(below Teddington)			104		
R. Torridge (below Bideford)				10	(31)
R. Trent (below Gainsborough)			42		
R. Truro (below Truro)		6			(12)
Urr Water (below Palnackie)				9	(32)
R. Wear (lower)		5			(33)
R. Witham (below Boston)			11		(34)
R. Yare plus R. Wensum (below Norwich)				51	(35)
TOTALS	51	216	585	179	
GRAND TOTAL = 1031 km					

N.b. The Rivers Blackwater (Essex), Cart, Itchen, Roach and Test possibly also deserve inclusion, but their commercial status needs further clarification.

Notes to Appendix 2

Waterway lengths are taken from EDWARDS unless otherwise indicated.

(1) This category includes waterways controlled by navigation commissions and by private companies plus those which have no navigation authority ('free'navigations).

(2) PORT OF BRISTOL AUTHORITY, Personal communication, 27 August 1975.

(3) ANON, 'Yorkshire Waterways', Waterways World, 4, Burton-on-Trent, September 1975, p 28.

(4) MANCHESTER SHIP CANAL CO (BRIDGEWATER DEPT), Personal communication, 21 March 1975. Only 4 km has been included here as there was no commercial traffic on the remainder in 1973 and 1974. See also App. 3.

(5) The length quoted is not to the seaward limit of the Clyde Port Authority, but to the end of the marked channel between Garroch Head and Little Cumbrae Island (sealed from 1:63,360 Ordnance Survey map). See CLYDE PORT AUTHORITY, 'Map of Dock Areas and Jurisdiction', Glasgow, nd.

(6) ROWE, R.P., 'Improvements planned at the port of Colchester', Dock and Harb. Auth., 55, 1974, p19.

(7) ANON, 'Burnham River Co oppose Crouch Bill', International Freighting Weekly, 28 February 1974.

(8) RIVER DART NAVIGATION COMMISSIONERS, Personal communication, 23 August 1975. Lengths scaled from 1:63,360 Ordnance Survey Map.

(9) DARTFORD & CRAYFORD NAVIGATION COMMISSIONERS, Personal communication, 14 December 1973.

(10) BRITISH STEEL CORPORATION (SHOTTON), Personal communication, 27 August 1975.

(11) INLAND WATERWAYS ASSOCIATION, 'River Ouse (Yorkshire) (Trent Falls to York section)', Inland Shipping Group Factsheet No 21, August 1975, p 2. Length scaled from BRITISH TRANSPORT DOCKS BOARD, 'Port of Goole', nd but probably 1973.

(12) CARRICK DISTRICT COUNCIL, Personal communication, 29 September 1975. Lengths scaled from 1:63,360 Ordnance Survey map.

(13) FORTH PORTS AUTHORITY, Personal communication, 11 September 1975.

(14) GREATER LONDON COUNCIL, Personal communication, 20 August 1975.

(15) KERRIER DISTRICT COUNCIL, Personal communication, 23 September 1975. Length scaled from 1:63,360 Ordnance Survey map.

(16) BEVERLEY BOROUGH COUNCIL, Personal communication, 28 August 1975; YORKSHIRE RIVER AUTHORITY, Personal communication, 25 January 1974; CITY AND COUNTY OF KINGSTON UPON HULL, Personal communication, 13 June 1973. Length between entrance to Beverley Beck and Grove Hill shipyard from map received from Beverley Borough Council; other lengths from EDWARDS.

(17) LANCASTER PORT COMMISSION, Personal communication, 12 September 1975. Length scaled from 1:63,360 Ordnance Survey map.

(18) BRITISH TRANSPORT DOCKS BOARD (NEWPORT), Personal communication, 8 September 1975.

(19) MEDWAY PORTS AUTHORITY, Personal communication, 18 August 1975.

(20) UPPER MERSEY NAVIGATION COMMISSIONERS, Personal communication, 31 January 1974, confirms no traffic above Garston. Length below Liverpool docks scaled from 1:63,360 Ordnance Survey map.

(21) BRIDGER, J.E., 'Wisbech-capital of the fens', Dock and Harb. Auth., 54, 1974, pp 335-336.

(22) Length is c0.8km above dock entrance (KING'S LYNN CONSERVANCY BOARD, Personal communication, 22 August 1975; IDEM, 'Port of King's Lynn, 1973-1976', King's Lynn, nd but probably 1973, pp 10-11) plus 3.2 km from EDWARDS.

(23) BROADHEAD, I., 'From source to sea', Waterways World, 3, Burton-on-Trent, October 1974, pp 27-29; INLAND WATERWAYS ASSOCIATION, 'River Ouse (Yorkshire) (Trent Falls to York Section)', Inland Shipping Group Fact Sheet No 21, August 1975.

(24) BRIDGWATER PORT AND NAVIGATION, Personal communication, 18 August 1975.

(25) Length from dock entrance to seaward end of South Training Wall, given in CORPORATION OF PRESTON, 'Port of Preston, 1973 Tide Tables, etc', Preston, p 14.

(26) BARKING & ILFORD NAVIGATION CO, Personal communication, 21 August 1975.

(27) SANDWICH PORT AND HAVEN COMMISSIONERS, Personal communication, 18 August 1975.

(28) INLAND WATERWAYS ASSOCIATION, 'River Stour Navigation', Inland Shipping Group Fact Sheet No 16, January 1975.

(29) BULLER, A.T., CHARLTON, J.A. & McMANUS, J., 'Charting the Tay Estuary', Dock and Harb. Auth., 54, 1973, pp 162-164. Lengths of sections scaled from 1:63,360 Ordnance Survey map.

(30) THAMES WATER AUTHORITY, Personal communication, 26 August 1975. A nominal length has been included as the traffic is small, but its origins and destinations are unknown.

(31) BIDEFORD TOWN COUNCIL, Personal communication, 26 August 1975. Length scaled from 1:63,360 Ordnance Survey map.

(32) URR NAVIGATION TRUST, Personal communication, 18 September 1975. Length scaled from 1:63,360 Ordnance Survey map.

(33) PORT OF SUNDERLAND AUTHORITY, Personal communication, 30 January 1974.

(34) ROWE, R.P., 'Port of Boston', Dock and Harb. Auth., 55, 1974, p245. Length scaled from 1:63,360 Ordnance Survey map.

(35) RIVERS YARE, BURE & WAVENEY COMMISSIONERS, Personal communication, 26 August 1975.

APPENDIX 3: British waterways not controlled by the British Waterways Board on which carrying has recently ceased.

	Last Use	Navigation authority type and length (km)				Note No.
		RWA	Local A	Port A	other(1)	
R. Alde (below Snape)	c1969				34	(2)
R. Ancholme (below Brigg)	1971	14				(3)
Bridgewater Canal	1974				65	(4)
Chelmer & Blackwater Nav'n	1972				22	(5)
Exeter Ship Canal	1973(?)		8			(6)
R. Parrett (Bridgwater to Dunball)	1971		5			(7)
TOTALS		14	13	0	121	
GRAND TOTAL = 148 km						

Notes to Appendix 3

Waterway lengths are taken from EDWARDS unless otherwise indicated

(1) This category includes waterways controlled by private companies plus those which have no navigation authority('free' navigations).

(2) SIMPER, R., 'Coasters and Concerts', Waterways World, 3, Burton-on-Trent, March 1974, pp20-21; GOODERHAM, G. (Proprietor, Snape Maltings), Personal communication, 20 August 1975.

(3) ANGLIAN WATER AUTHORITY, Personal communication, 21 August 1975.

(4) Length from MANCHESTER SHIP CANAL CO., 'Directors Report, Financial Accounts and Statistical Returns 1968', Manchester, p 25. There was a small movement of grain on the canal in early 1975, but this was essentially a non-commercial operation (MSC CO, BRIDGEWATER DEPT., Personal communication, 21 March 1975).

(5) MARRIAGE, J.E., 'A brief history of the Chelmer & Blackwater Navigation', IWA London and South East Branch Rally Brochure, Spring 1973, p7.

(6) EXETER CITY COUNCIL, Personal communication, 18 August 1975, states no commercial traffic since 1973; but cf. ANON, 'Exeter Canal', Waterways World, 3, Burton-on-Trent, August 1974, p37, which refers to sludge vessel working two trips weekly.

(7) BRIDGWATER PORT AND NAVIGATION, Personal communication, 18 August 1975.

APPENDIX 4: British waterways, commercial traffic (tonnes), by movement type and waterway type, 1973 and 1974.

In this Appendix (and in App. 5), foreign and coastal traffics to the following sea-board ports are excluded:

River	Port/Wharf etc
Clyde	Ardrossan, Finnart, Greenock Irvine, Loch Fyne
Dart	Dartmouth
Dee	Mostyn
Fal	Falmouth
Forth	Kirkcaldy, Leith, Methil
Humber	All ports and wharves on Humber
Lune	Glasson Dock
Medway	Chatham, Rochester
Mersey	Birkenhead, Liverpool
Severn	Avonmouth
(Suffolk) Stour	Harwich
Thames	All docks and wharves downstream of GLC boundary
Wear	Sunderland
Yare	Gt. Yarmouth

Note: There are certain inconsistencies in the table where individual port totals have been derived from National Ports Council figures as these omit certain traffics (marine dredged aggregates, bunkers, oil-rig traffics, returnable packaging and material for dumping at sea) which are invariably included in the returns prepared by the port authorities themselves. Where possible, NPC coastal figures have been increased to include these traffics.

(a) Extended Docks	FREIGHT TRAFFIC IN TONNES 1973 INLAND	1973 COASTAL	1973 FOREIGN	1974 INLAND	1974 COASTAL	1974 FOREIGN	NOTE NO
Beverley Beck	c7,000	-	-	c7,000	-	-	(1)
Bridgewater Canal	136,911	-	-	33,467	-	-	(2)
Caledonian Canal (terminal basin) A	-	-	c49,487	-	-	c49,487	(3)
Crinan Canal (" ") A	-	-	13,942	-	-	11,594	(4)
Dartford & Crayford Nav'n	126,993	-	-	129,045	-	-	(5)
*Dutch R. (or Don)	*	*	*	*	*	*	(6)
R. Foss	n.a.	-	-	n.a.	-	-	
Grosvenor Canal	206,386	-	-	200,466	-	-	(7)
*Lydney Canal	*	*	*	*	*	*	(8)
*Manchester Ship Canal (Q.E. II dock)	*	*	*	*	*	*	(9)
R. Roding	11,492	-	-	6,833	-	-	(10)
*Amalgamated for confidentiality	23,246	c2,197,869	c2,210,446	23,336	c2,397,409	c2,433,351	

- indicates assumed zero
n.a. indicates not available but not zero.
A indicates that the waterway is also known to provide access for fishing craft or shipbuilding.

FREIGHT TRAFFIC IN TONNES

(b) Locked Waterways

Locked Waterways		1973 INLAND	1973 COASTAL	1973 FOREIGN	1974 INLAND	1974 COASTAL	1974 FOREIGN	NOTE NO
Aire & Calder Nav'n		2,467,148	-	-	1,598,782	-	-	(11)
BWB Cruiseways		150,000	-	-	134,000	-	-	(12)
Caledonian Canal	A	-	c1,737	-	-	c2,546	-	(3)
Calder & Hebble Nav'n		153,688	-	-	119,163	-	-	(11)
Crinan Canal	A	-	-	-	-	-	-	(4)
Gloucester & Sharpness Canal		c70,949	c266,891	-	c42,825	c255,833	-	(11)
R. Lee Navigation		699,829	-	-	561,875	-	-	(11)
Manchester Ship Canal		c144,850	c4,966,640	c7,222,263	c117,553	c6,020,728	c6,469,158	(9)
R. (Yorks) Ouse (above Selby)		c31,516	-	-	31,516	-	-	(13)
R. Severn (above Gloucester)		19,821	-	-	15,526	-	-	(11)
Sheffield & S. Yorks Nav'n		399,123	-	-	417,055	-	-	(11)
R. Thames (above Teddington)		11,098	-	-	1,726	-	-	(14)
R. Trent (above Gainsborough)		433,419	-	-	433,678	-	-	(11)
R. Weaver		c394,616	c129,438	c14,382	c375,931	c117,524	c13,058	(15)

A indicates that the waterway is also known to provide access for fishing craft or shipbuilding

\- indicates assumed zero

(c) Tidal Navigations		FREIGHT TRAFFIC IN TONNES 1973 INLAND	1973 COASTAL	1973 FOREIGN	1974 INLAND	1974 COASTAL	1974 FOREIGN	NOTE NO
R. Avon		-	c652,000	c87,000	-	c585,000	c18,000	(16)
R. Colne Navigation	A	-	355,000	399,000	-	321,000	320,000	(17)
R. Crouch		-	c1,591	c84,959	-	c338	48,307	(18)
R. Dart Navigation		29,495	-	c36,400	20,948	-	c21,000	(19)
R. Dee		-	-	3,648	-	-	2,444	(20)
R. Fal		-	37,500	16,780	-	40,430	19,400	(21)
Helford R.	A	-	2,642	-	-	2,032	-	(22)
R. Hull	A	c22,000	c228,000	-	c22,000	c228,000	-	(23)
R. Lune		-	c1,480	c3,520	-	c1,360	c2,280	(24)
R. Medway		236,418	12,000	-	157,810	6,600	-	(25)
R. Nene		-	56,952	153,000	-	52,947	146,000	(26)
R. Orwell		-	1,552,568	749,000	-	1,503,000	1,169,000	(27)
R. (Gt.) Ouse		-	415,183	478,000	-	396,731	456,757	(28)
R. (Yorks) Ouse (below Selby)	A	c210,728	c432,212	c1,541,212	c210,230	c463,212	c1,908,212	(13)
R. Parrett		-	584,024	29,928	-	559,824	29,777	(29)
R. Ribble		-	1,053,000	738,000	-	845,000	715,000	(30)
R. (Kent) Stour		-	142,292	-	-	204,950	-	(31)
R. (Suffolk) Stour		-	c20,000	c80,000	-	c20,000	c80,000	(32)
R. Tay		90,650	41,345	94,000	86,304	16,599	79,000	(33)
R. Torridge		-	50,000	31,000	-	33,000	36,000	(34)
R. Trent (below Gainsborough)		c433,419	c92,000	c2,171,000	c433,678	c68,000	c1,822,000	(35)
R. Truro		-	30,500	16,780	-	33,430	19,400	(21)
Urr Water		-	2,368	-	-	1,779	-	(36)
R. Wear	A	-	700,215	-	-	664,389	-	(37)
R. Witham		-	1,600	821,000	-	27,306	748,000	(38)
R. Yare and Wensum		-	30,309	41,856	-	24,159	35,549	(39)

A indicates that the waterway is also known to provide access for fishing craft or shipbuilding

- indicates assumed zero

(d) Major Estuaries		FREIGHT TRAFFIC IN TONNES 1973 INLAND	1973 COASTAL	1973 FOREIGN	1974 INLAND	1974 COASTAL	1974 FOREIGN	NOTE NO
R. Clyde (below Glasgow)	A	n.a.	c2,514,398	c4,664,500	n.a.	c2,400,992	c4,313,833	(40)
R. Forth (below S. Alloa)		n.a.	3,802,308	4,119,168	n.a.	3,275,728	4,342,245	(41)
R. Humber	A	c544,147	c652,212	c3,712,212	c544,406	c659,212	c3,730,212	(42)
R. Mersey (below Eastham)		268,359	8,104,064	9,963,680	209,810	9,458,798	9,326,135	(43)
R. Severn (below Sharpness)		c68,395	c364,000	c507,000	c67,314	c370,000	c399,000	(44)
R. Thames (below Teddington)		4,360,000	8,880,000	4,300,000	4,010,000	9,140,000	4,040,000	(45)

A indicates that the waterway is also known to provide access for fishing craft or shipbuilding

n.a. indicates not available but not zero.

Sources for Appendix 4

Note: NPC 73 and 74 represent NATIONAL PORTS COUNCIL, 'Annual Digest of Port Statistics 1973', Vol. 1, and 1974, Vol. 1, respectively.

(1) BEVERLEY BOROUGH COUNCIL, Personal communication, 28 August 1975.

(2) MANCHESTER SHIP CANAL CO (BRIDGEWATER DEPT), Personal communication, 21 March 1975.

(3) The apparent average haul length is about 1.5km (BRITISH WATERWAYS BOARD, Personal communication, 9 September 1975) but in fact the bulk of the traffic is in sea-going vessels entering the basin at Corpach, for which the sea-lock was enlarged in 1964 (ANON, 'Extension of Caledonian Canal sea-lock', Dock and Harb. Auth., 45, 1965, p 322). As there is no working to wharves along the canal, it is assumed that the t-km total can be ascribed to coastal vessels passing along the entire length (96.5 km), the remaining tonnage being attributable to foreign traffic in pulp to the paper mills at Corpach.

(4) The Crinan is in a somewhat similar position to the Caledonian (see note 3) but all its traffic is handled in the terminal basins, BRITISH WATERWAYS BOARD, Personal communication, 9 September 1975.

(5) DARTFORD & CRAYFORD NAVIGATION COMMISSIONERS, Cash Books and Minute Books. I am grateful to Martyn Denney for letting me use his extracts from these books.

(6) FISONS LTD, Personal communication, 22 September 1975.

(7) GREATER LONDON COUNCIL (DEPT OF PUBLIC HEALTH ENG), Personal communication, 20 August 1975.

(8) FACTORIES DIRECTION LTD, Personal communication, 16 September 1975.

(9) MANCHESTER SHIP CANAL CO, Personal communication, 22 July 1975. The 'extended dock' tonnages are estimates of the traffic at Queen Elizabeth II Dock, Eastham. Although these are included in the Company's quoted figures, they are not canal traffic as the dock has a separate entrance lock. Inland figures are from MANCHESTER SHIP CANAL CO, Personal communication, 2 September 1975. Foreign figures NPC 73 p 28 and NPC 74 p 28 (Manchester). Coastal figures adjusted to include categories excluded by NPC. As the canal traffic figures also include Weaver traffic, the relevant data for the Weaver has also been used.

(10) BARKING & ILFORD NAVIGATION CO, Personal communication, 21 August 1975.

(11) BRITISH WATERWAYS BOARD, Personal communication, 9 September 1975.

(12) BRITISH WATERWAYS BOARD, 'Annual Report and Accounts 1974', p 72. There are a number of quasi-commercial movements, mostly of coal, which are not included in this total (see, e.g. ANON 'Coals from Gopsall', IWA Bull., No 106, September 1977, pp 26-28). As one of the leading companies involved only handles about 1000 tpa (ASHBY CANAL TRANSPORT LTD, Personal communication, 8 September 1975), these unrecorded movements are unlikely to account for more than a few thousand tonnes annually.

(13) Above Selby: INLAND WATERWAYS ASSOCIATION, 'River Ouse (Yorks) (Trent Falls to York Section)', Inland Shipping Group Factsheet No 21; below Selby: Goole tonnages are added (BRITISH TRANSPORT DOCKS BOARD, 'Report and Accounts 1974', pp 36-37).

(14) THAMES WATER AUTHORITY, Personal communication, 26 August 1975.

(15) As ref 11 plus BARGE AND CANAL DEVELOPMENT ASSOCIATION, 'Canal and Navigation Traffics, North Western Area', Wakefield, 1975.

(16) PORT OF BRISTOL AUTHORITY, Personal communication, 27 August 1975.

(17) NPC 73 p 41 (Colchester); NPC 74 p 42 (Colchester); COLCHESTER BOROUGH COUNCIL (HARBOUR AND NAVIGATION DEPT), 'Return for the year ended 31 March 1975', Colchester, 1975.

(18) CROUCH HARBOUR AUTHORITY, Personal communication, 20 November 1975.

(19) RIVER DART NAVIGATION COMMISSIONERS, Personal communications, 23 and 29 August 1975.

(20) BRITISH STEEL CORPORATION (SHOTTON), Personal communication, 27 August 1975.

(21) CARRICK DISTRICT COUNCIL, Personal communication, 29 September 1975.

(22) BENNETTS LTD (PENZANCE), Personal communication, 1 October 1975.

(23) Assuming Beverley Beck tonnages are all inland (see note 1) and the balance of the river traffic (IWA(2)) is coastal.

(24) LANCASTER PORT COMMISSION, Personal communication, 12 September 1975, for total coastal/foreign ratio assumed as for Lancaster plus Glasson Dock (NPC 73 p 45 and NPC 74 p 46 (Lancaster)).

(25) Totalled from REED PAPER AND BOARD (UK) LTD (AYLESFORD), Personal communication, 22 September 1975, and TOWNSEND HOOK AND CO LTD (SNODLAND), Personal communication, 2 September 1975.

(26) Foreign figures (for Wisbech) from NPC 73 p 48 and NPC 74 p 49. Coastal figures adjusted to include categories excluded by NPC. Total figures from PORT OF WISBECH AUTHORITY, Personal communication, 28 August 1975.

(27) Foreign figures (for Ipswich) from NPC 73 p 39 and NPC 74 p 40. Coastal figures adjusted to include categories excluded by NPC. Total figures from IPSWICH PORT AUTHORITY, Personal communication, 18 August 1975.

(28) Foreign figures (for King's Lynn) from NPC 73 p 49 and NPC 74 p49. Coastal figures adjusted to include categories excluded by NPC. Total figures from KING'S LYNN CONSERVANCY BOARD, Personal communication, 22 August 1975.

(29) BRIDGWATER PORT & NAVIGATION, Personal communication, 18 August 1975

(30) NPC 73 p29; NPC 74 p29.

(31) SANDWICH PORT AND HAVEN COMMISSIONERS, Personal communication, 18 August 1975.

(32) INLAND WATERWAYS ASSOCIATION, 'River Stour Navigation', Inland Shipping Group Factsheet No 16, 1975.

(33) Foreign figures are NPC returns for Perth, (NPC 73 p47 and NPC 74 p 48). Coastal figures are NPC returns for Newburgh (NPC 73 p47 and NPC 74 p 48) plus balance of Perth traffic excluding sand and gravel which is inland (TAYSIDE REGIONAL COUNCIL, Personal communication, 26 August 1975).

(34) Foreign figures from NPC 73 p 43 and NPC 74 p 44. Coastal figures adjusted to include categories excluded by NPC. Total figures from BIDEFORD TOWN COUNCIL, Personal communication, 22 August 1975.

(35) Exact information for the Trent cannot be obtained as a high level of secrecy prevails amongst the several dozen carriers and wharfingers in the area. Estimates have been made using: NPC total figures for Trent (NPC 73 p 48 and NPC 74 p 49) and NPC 'Survey of Non-scheme Ports and Wharves', 1973, Table C9, p 52.

(36) URR NAVIGATION TRUST, Personal communication, 18 September 1975.

(37) PORT OF SUNDERLAND AUTHORITY, Personal communications, 30 January 1974 and 28 August 1975.

(38) 1973 figures from NPC 73 p48 (Boston). 1974 foreign figure from NPC 74 p49 (Boston). 1974 total figure calculated as one quarter of the traffic ye 31 March 1974 plus three quarters of the traffic ye 31 March 1975 (PORT OF BOSTON AUTHORITY, Personal communication, 20 August 1975).

(39) RIVERS YARE, BURE & WAVENEY COMMISSIONERS, Personal communication, 26 August 1975. Foreign/coastal ratio assumed same as for Gt Yarmouth (NPC 73 p49 and NPC 74 p38).

(40) The Clyde is exceptional as an estuarial waterway in that its major port facilities are not concentrated on the sea-board but are inland on the Clyde and its tributary lochs such as Loch Fyne and Loch Long. Indeed the limit of navigation on the Clyde is not far upstream of the limit of the commercial activities of the Clyde Port Authority (CPA), although the most upstream dock (Kingston) and quays (Broomielaw and Windmillcroft) are disused as is the right-bank Queen's Dock. Nevertheless there is still intensive use made of the remaining 16 km of the 'canalized Clyde', stretching down to Bowling. The CPA administers a number of ports and publishes the traffic figures as a total. By subtracting the figures for Ardrossan, Finnart, Greenock, Irvine and Loch Fyne, the figures in the table have been derived. Ref: BIRD, p76 et seq; CPA, '<u>Report and Accounts: 1974</u>', Glasgow, 1975; CPA, Personal communication, 16 September 1975; NPC 73 pp30 and 46; NPC 74 pp30 and 47.

(41) FORTH PORTS AUTHORITY, Personal communications, 11 and 17 September 1975, taking the same foreign/coastal ratio as for the whole Forth traffic (NPC 73 p31 and NPC 74 p31).

(42) The difficulties for the Humber are comparable to those for the Trent (see note 35). It has not been possible to quantify any barge traffic within the Humber, so the figures are based on the assumption that all the inland traffic on the Beverley Beck, Hull, Ouse and Trentoriginates at Hull.

(43) Figures derived from returns for Bromborough (UML LTD, Personal communication, 2 October 1975), Garston (BRITISH TRANSPORT DOCKS BOARD, '<u>Report and Accounts 1974</u>', pp36-37), Manchester Ship Canal (see note 9) and Weaver (see note 15).

(44) Figures derived from returns for Sharpness (NPC 73 p44 and NPC 74 p45) plus lighterage to Lydney (see note 8) and from Avonmouth (PORT OF BRISTOL AUTHORITY, Personal communication, 9 September 1975).

(45) Figures based on GREATER LONDON COUNCIL (DEPT OF PLANNING AND TRANSPORTATION), Personal communication, 16 September 1975. Adjustments made in accordance with GREATER LONDON COUNCIL (DEPT OF PUBLIC HEALTH ENG), Personal communication, 20 August 1975, TRANSPORT ON WATER, Personal communication, 22 October 1975, and W.M. CORY AND SON LTD, Personal communication, 4 November 1975.

APPENDIX 5

British waterways, commercial traffic (t-km)
by movement type and waterway type,
1973 and 1974

(see Appendix 4 for list of excluded traffics)

FREIGHT TRAFFIC IN TONNE-KM x 10^3

(a) Extended Docks	1973			1974		
	INLAND	COASTAL	FOREIGN	INLAND	COASTAL	FOREIGN
Beverley Beck	7	-	-	7	-	-
Bridgewater Canal	511	-	-	130	-	-
Caledonian Canal (terminal basin)	-	-	-	-	-	-
Crinan Canal (" ")	-	-	-	-	-	-
Dartford & Crayford Navigation	547	-	-	544	-	-
*Dutch R. or Don	*	*	*	*	*	*
R. Foss	n.a.	-	-	n.a.	-	-
Grosvenor Canal	165	-	-	160	-	-
*Lydney Canal	*	*	*	*	*	*
*Manchester Ship Canal (QE II dock)	*	*	*	*	*	*
R. Roding	17	-	-	10	-	-
*Amalgamated for confidentiality	15	19	29	15	5	43
TOTALS	1,262	19	29	866	5	43

n.a. indicates not available but not zero

\- indicates assumed zero

(b) Locked Waterways		FREIGHT TRAFFIC IN TONNE-KM x 10^3 1973 INLAND	1973 COASTAL	1973 FOREIGN	1974 INLAND	1974 COASTAL	1974 FOREIGN	NOTE NO
Aire & Calder Nav'n		49,286	-	-	36,361	-	-	
BWB Cruiseways		844	-	-	504	-	-	
Caledonian Canal	A	-	168	-	-	247	-	
Calder & Hebble Nav'n		1,216	-	-	951	-	-	
Crinan Canal	A	-	-	-	-	-	-	
Gloucester & Sharpness Canal		1,916	5,557	-	1,156	5,144	-	(1)
R. Lee Navigation		3,873	-	-	2,400	-	-	
Manchester Ship Canal		3,166	112,393	193,364	2,470	-	-	
R. (Yorks) Ouse (also Selby)		976	-	-	976	139,859	168,966	
R. Severn (above Gloucester)		433	-	-	325	-	-	
Sheffield & S. Yorks Nav'n		8,268	-	-	8,200	-	-	
R. Thames (above Teddington)		111	-	-	17	-	-	(2)
R. Trent (above Gainsborough)		13,813	-	-	13,556	-	-	
R. Weaver		c2,343	c1,852	c206	c2,256	c1,742	c194	
TOTAL		86,245	119,970	193,570	69,182	146,992	169,160	

A indicates that the waterway is also known to provide access for fishing craft or ship-building

\- indicates assumed zero

(c) Tidal Navigations		FREIGHT TRAFFIC IN TONNE-KM x 10^3						NOTE NO
		1973			1974			
		INLAND	COASTAL	FOREIGN	INLAND	COASTAL	FOREIGN	
R. Avon		-	9,128	1,218	-	8,190	252	
R. Colne Navigation	A	-	3,958	5,499	-	3,748	4,668	
R. Crouch		-	17	923	-	4	525	
R. Dart Navigation		181	-	601	129	-	346	
R. Dee		-	-	84	-	-	56	
R. Fal		-	530	267	-	576	308	
Helford R.	A	-	26	-	-	20	-	
R. Hull	A	c397	c413	-	c397	c413	-	
R. Lune		-	42	18	-	27	16	
R. Medway		8,794	429	-	5,983	252	-	
R. Nene		-	1,082	2,901	-	1,006	2,774	
R. Orwell		-	23,289	11,235	-	22,552	17,535	
R. (Gt.) Ouse		-	1,661	1,912	-	1,454	1,960	
R. (Yorks) Ouse (below Selby)	A	7,756	9,795	24,068	7,756	10,194	28,791	
R. Parrett		-	13,608	697	-	13,044	694	
R. Ribble		-	26,325	18,450	-	21,125	17,875	
R. (Kent) Stour		-	854	-	-	1,230	-	
R. (Suffolk) Stour		-	304	1,215	-	304	1,215	
R. Tay		2,266	1,555	4,700	2,158	597	3,950	
R. Torridge		-	500	310	-	330	360	
R. Trent (below Gainsborough)		18,310	1,803	42,551	18,321	1,333	35,711	(3)
R. Truro		-	178	98	-	195	113	
Urr Water		-	21	-	-	16	-	
R. Wear	A	-	2,255	-	-	2,139	-	
R. Witham		-	176	9,031	-	300	8,228	
R. Yare and Wensum		-	1,546	2,135	-	1,232	1,813	
TOTAL		37,704	99,495	123,213	34,744	90,281	127,190	

A indicates that the waterway is also known to provide access for fishing craft or ship-building

\- indicates assumed zero

(d) Major Estuaries

FREIGHT TRAFFIC IN TONNE-KM X 10^3

		1973			1974		
		INLAND	COASTAL	FOREIGN	INLAND	COASTAL	FOREIGN
R. Clyde (below Glasgow)	A	n.a.	151,241	280,570	n.a.	144,420	259,477
R. Forth (below S. Alloa)		n.a.	257,095	277,386	n.a.	220,943	292,121
R. Humber	A	14,887	38,312	218,059	14,894	38,723	219,117
R. Mersey (below Eastham)		2,555	225,685	277,353	2,016	263,580	259,696
R. Severn (below Sharpness)		2,238	12,155	16,931	2,201	12,356	13,324
R. Thames (below Teddington)		266,042	568,568	317,398	242,320	587,937	298,030
TOTAL		285,722	1,253,056	1,387,697	261,431	1,267,959	1,341,765

A indicates that the waterway is also known to provide access for fishing craft or ship-building

n.a. indicates not available but not zero

Notes to Appendix 5

In general the sources are as for Appendix 4; further data is:

(1) Assuming non-liquids are barge traffic to Gloucester (inland), remainder coastal.

(2) No origin/destination records being available, the average haul length is taken as 10 km.

(3) The problems with the Trent were referred to in Appendix 4, note 35. To estimate t-km figures, the sources listed in that note were supplemented by BARGE AND CANAL DEVELOPMENT ASSOCIATION, 'Canal and Navigation Traffics, North Eastern Area', Wakefield, 1975.

INDEX

Note: this index refers only to material in Chapters 1-9 and in the tables in Appendices 1-5.