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PITMAN'S ECONOMICS SERIES

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TRANSPORT AND COMMUNICATIONS

TRANSPORT AND COMMUNICATIONS

BY

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AND "TRANSPORT CO-ORDINATION"



LONDON

SIR ISAAC PITMAN & SONS, LTD.
PARKER STREET, KINGSWAY, W.C.2
BATH, MELBOURNE, TORONTO, NEW YORK

1931

PRINTED IN GREAT BRITAIN
AT THE PITMAN PRESS, BATH

PREFACE

IN this book an attempt is made to review the whole field of transport and communications in a concise manner. The aim of the author has been to describe and analyse the salient economic characteristics and methods of charging for each type of communication, and, in addition, to give some account of its historical and recent improvement. It is hoped that the book will provide a synthesis of the economics of transport and communications viewed as a whole. Compression, however, has been inevitable, since the scope of the subject is so wide, and it may appear that some aspects of the problems are unduly condensed.

The author desires to render grateful acknowledgment to Mr. Andrew Morton, Manager for Scotland of the General Steam Navigation Co., Ltd., who has offered many valuable suggestions for the chapter on "Shipping"; and to Mr. Alfred H. Roberts, O.B.E., Superintendent and Engineer, Leith Docks and Harbour, who has kindly read the MS. of the chapter on "Ports and Docks." Responsibility for opinions and for any inaccuracies in these chapters, however, rests with the author. His thanks are also due to Mr. R. H. Tolerton, D.S.O., M.C., of the Ministry of Transport, and Mr. G. H. Taylor, A.M.I.E.E., Edinburgh District Manager, Post Office Telephones, for help in obtaining certain statistics.

For reading the MS. and proofs, the author is greatly indebted to his wife and father.

CONTENTS

	PAGE
PREFACE	V
STATISTICAL TABLES	ix

CHAPTER I

INTRODUCTION	1
Primitive transport—The development of modern transport.	

CHAPTER II

SHIPPING	6
Sea routes—Tramps and liners—Liner services—Tramps—The coasting trade—OCEAN FREIGHT RATES—Liner rates—Conference lines—The Royal Commission on Shipping Rings—Legislative action against shipping rings.	

CHAPTER III

PORTS AND DOCKS	19
Rates and charges—Port ownership—Labour at the ports.	

CHAPTER IV

ECONOMICS OF RAILWAY TRANSPORT	26
The legal position of the railways—State regulation of railway charges—Post-war railway reorganization—The Railways Act, 1921—The Railway Rates Tribunal—Criticisms of the Act—RAILWAY CAPITAL—Electric railways—Underground and elevated railways—Railway expenditure—THEORY AND PRACTICE OF RAILWAY RATES AND FARES—Practical limitations on the charging powers of railways—Owner's risk rates—Tapering rates—Amounts sent at a time—Speed of transit—Zone rates—British and foreign railway rates—Passenger fares—Fixation of passenger fares.	

CHAPTER V

INLAND WATER TRANSPORT	49
Waterway tolls and charges—The Royal Commission of 1906-09—The advantages of inland water transport—The limitations of inland water transport—The British canal system—Deficient organization—The future of British canals.	

CHAPTER VI

PAGE

ROAD TRANSPORT	61
--------------------------	----

The advantages of motor transport—The sphere of road transport—The tramway—Road construction and maintenance—Road transport rates and fares—The problem of the return load—Motor transport in undeveloped countries.

CHAPTER VII

THE RELATION OF ROAD AND RAIL TRANSPORT .	71
---	----

Railways and road powers—The Road Traffic Act, 1930—Co-ordination of road and rail transport—Recent development in Great Britain.

CHAPTER VIII

AIR TRANSPORT	78
-------------------------	----

Ground organization—The sphere of air transport—The limitations of air transport—Subsidies—Types of subsidies—Commercial flying other than on regular air lines—The commercial airship.

CHAPTER IX

THE COMMUNICATION OF INTELLIGENCE	90
---	----

The Post Office—The penny post—Post Office charges—The telegraph—The telephone—The submarine cable—Cable tariffs—Wireless.

BIBLIOGRAPHY	97
------------------------	----

INDEX	99
-----------------	----

STATISTICAL TABLES

	PAGE
Ownership of Steamships and Motorships	7
Percentage Ownership of World's Steam and Motor Tonnage	7
Percentage of Gross Tonnage according to Type of Propulsion	8
Railway Mileage in Principal Countries of the World . .	26
Approximate Railway Mileage per 100 Square Miles and per 100,000 Inhabitants	26
Number of Motor Vehicles in Great Britain, 1904-1920 .	61
Number of Motor Vehicles Licensed on 31st August, 1921- 1930	62
Road Mileage per Square Mile of Area	65
Total Expenditure on Roads and Bridges in Great Britain. 1910-11 to 1927-28	66
Motor Taxation Receipts, 1921-1929	67
Air Transport between Great Britain and the Continent .	79
British Air Transport on Regular Routes	81
British Commercial Flying other than on Regular Air Routes	81
Work of the Post Office	91
Telephone Calls in the United Kingdom, 1922-30 . .	93
Number of Telephones per 100 Persons	94
Number of Telephones per Square Mile	94

TRANSPORT AND COMMUNICATIONS

CHAPTER I

INTRODUCTION

ADEQUATE means of transport and communications are essential to the development of industry and commerce. Trade cannot expand nor can industry be conducted on a large scale unless cheap and rapid transport is available. Improved and extended transport facilities contribute greatly to the prosperity of cities and nations. In ancient and mediaeval times, transport was slow and expensive, and, in consequence, trade (other than in local produce) was almost entirely confined to articles of luxury, such as silks, gems, precious metals, spices, wines, and costly raiment. Except on the seas, where the force of the winds could be used, the limits to the weights which could be carried and the speed which could be attained were soon reached when human or animal power was all that was available. Nevertheless, despite difficulties and limitations, transport by land, sea, and desert was considerably developed between important centres of trade and commerce.

Primitive Transport. Even among primitive peoples and in early times, transport methods of one kind or another have been developed. Commercial intercourse at first was generally effected by land routes, and, as has been said, "Caravans not Argosies" began the history of trade. "The human beast of burden"

was undoubtedly the most primitive means of transport, and in some parts of the world porters are still the main method of transportation. Professional carriers such as African porters can carry much greater loads than could an untrained man, and according to Dr. Haddon a porter who goes short distances and returns unloaded can transport 135 lb. seven miles a day.

The next stage of development is marked by the introduction of the pack animal, for which purpose various beasts have been used in different times and places, e.g. dogs by the Eskimos, the ass and mule in ancient times, the llama and yamma in South America, and the zebra in Kenya. Horses at first were used only for riding and not till comparatively lately as draught animals. Elephants have long been employed in transport as they can carry a load of half a ton with ease. They are wonderfully intelligent and can be trained to build a wall or to stack logs almost without supervision. Even more ancient is the use of camels as beasts of burden. They were employed on the earliest trade routes across the deserts of Asia and North Africa, which afforded an easier passage than the roadless expanse elsewhere of forest, jungle or swamp.

Where snow abounds, the natural type of transport is the sledge and its human counterpart, the snow-shoe. Among the Eskimos and the Samoyedes of Northern Siberia, dogs are usually employed to draw the sledges, and on a good surface half-a-dozen dogs can draw a load of 8 to 10 cwt. at seven miles an hour.

The earliest form of cart was the slide car which trails along the ground. These were to be found in the Scottish Highlands during the eighteenth century, and even later in Ireland. The origin of the wheeled cart is lost in antiquity, though probably it arose from the slide car, through the device of placing rollers under it when

heavy weights had to be moved. In Northern China, wheel-barrows are a common means of transport for both passenger and goods traffic, as they are well suited to the muddy paths and narrow, raised stone-causeways found in that country.

Ships appear to have been built as far back as 6000 B.C. by Babylonian settlers who came west to colonize Egypt. The Egyptians, however, built only river ships as they feared the sea which swallowed up their sacred river. After the Nile, the Mediterranean was the great school of early navigation, and here the Phoenicians were the pioneers. Oars were the chief instrument of navigation because sailing vessels in the Mediterranean might lie becalmed for days together. As time went on, there was a tendency to increase the number of rows of oars. Pliny states that ships of five or six banks were built at Salamis and Syracuse respectively, and Alexander the Great constructed ships with ten banks.

The Development of Modern Transport. In comparatively recent times, through the application of mechanical power, remarkable developments in transport have been effected. "The dominant fact of our own age is the development not of the manufacturing but of the transport industries." * Efficient systems of transport and communications provide the basis of industrialization with its great manufacturing towns, its localization and specialization of industry, its large-scale production, its complex banking and financial organization, its international commerce and world-wide markets.

In the eighteenth century, when the modern industrial period may be said to commence, the introduction of canals into Britain enabled the raw materials and finished products of the new industries to be carried

* Marshall, *Principles of Economics*, Book VI, Chap. XII, para. 4.

far more cheaply than before, when pack-horses had to be utilized owing to the bad state of the roads. In the early nineteenth century, however, the roads were wonderfully improved through the labours of the great road builders—Metcalf, Telford, and M'Adam—and the great bridge builders—Rennie and Smeaton. Between 1825 and 1840 the development of the railway revolutionized the means of inland transport. Speeds formerly undreamt of were now possible, and from about 1850 the railway overshadowed all its rivals in Britain. Elsewhere railway development was somewhat slower, but after 1870 extensive building took place in America and on the Continent of Europe.

From 1840 to 1850 ships were built of wood and iron, but about 1850 iron ships were much in demand. In 1872 steel was introduced for shipbuilding, and about the same time, ocean transport was revolutionized by the invention of the compound engine and the surface condenser. Before the invention of the compound engine, the consumption of fuel was 6 lb. per i.h.p., whereas now it is about 1 lb. per i.h.p.* The railways, after 1870, opened up continental interiors, while the steamships brought all parts of the world into connection with each other. In the same period the communication of intelligence was revolutionized by the invention and commercial exploitation of the telegraph, the submarine cable, and the telephone. In comparatively recent years invention and development have proceeded apace, and we are now on the threshold of a new era in which transport will play a still more important part in world economy. In shipping there have been the application of the Parsons' turbine, the utilization of liquid fuel, and the introduction of the Diesel engine. On the railways there have been

* Kirkaldy, *British Shipping*.

the evolution of powerful steam locomotives and the beginnings of electrification on a large scale. The applications of the internal combustion engine have been responsible for the introduction of motor and air transport—the former more flexible than any earlier mechanical method of inland transport, and the latter capable of speed far greater than ever before thought possible. Recent applications of the motor vehicle show promise of the evolution of mechanical transport capable of traversing those desert and undeveloped regions which present so difficult a transport problem. The opening up of tropical regions, which is at present being accomplished by the gradual improvement of transport facilities, should mean that in the future these areas will play an important part in world commerce. The development of wireless telegraphy, telephony, and broadcasting presents new possibilities, such as the recent introduction of telephonic communication across the Atlantic.

The keynotes of the improvements in transport have been increase of speed, regularity, cheapness, and reliability, and on these has hinged the growth of industry and commerce.

CHAPTER II

SHIPPING

SEA conveyance provides by far the cheapest method of transport, and it is possible on some routes to carry certain cargoes at rates as low as $\frac{1}{10}$ d. and sometimes even less per ton-mile. Shipping is thus of vital importance for the carriage of foodstuffs, raw materials, and manufactured goods between the various countries of the world and coastwise. The United Kingdom has been for many years the owner of the largest proportion of the world's shipping tonnage, and the services performed by British shipowners have been an important source of those "invisible exports" which enable Britain year after year to import more material commodities than she exports. The effect of the War, however, has led to a considerable reduction in the *proportion* of British-owned tonnage, though Britain is still the largest owner. During the War there was great activity in shipbuilding, world construction during the years 1914-23 being over $35\frac{1}{2}$ million tons, whereas in the decade 1904-13 less than $24\frac{1}{2}$ million tons were built. War losses amounted to about 15 million tons.

The distribution of the world's tonnage, and the changes that have taken place since 1914, are shown in the tables on page 7, compiled from the figures given in *Lloyd's Register*.

Since 1914 important changes have taken place in the composition of the world's fleets. The average size of vessel has increased considerably, and there has been a noticeable increase in the number of motor-driven ships, while for steam-operated vessels the use of oil fuel has become very popular. Large numbers of

OWNERSHIP OF STEAMSHIPS AND MOTORSHIPS
(Gross Tons)

	1914	1927	1930
Great Britain and Ireland .	18,892,000	19,179,000	20,322,000
British Dominions .	1,632,000	2,699,000	2,788,000
Denmark	770,000	1,032,000	1,072,000
France	1,922,000	3,362,000	3,471,000
Germany	5,135,000	3,320,000	4,199,000
Greece	821,000	1,026,000	1,391,000
Holland	1,472,000	2,645,000	3,079,000
Italy	1,430,000	3,396,000	3,262,000
Japan	1,708,000	4,033,000	4,317,000
Norway	1,957,000	2,803,000	3,663,000
Spain	884,000	1,136,000	1,207,000
Sweden	1,015,000	1,329,000	1,594,000
U.S.A. (Sea)	2,027,000	11,171,000	10,646,000
U.S.A. (Lakes)	2,260,000	2,435,000	2,458,000
Other Countries	3,479,000	3,701,000	4,555,000
Total	45,404,000	63,267,000	68,024,000

PERCENTAGE OF WORLD'S STEAM AND MOTOR TONNAGE

	1914	1927	1930
	Per cent	Per cent	Per cent
Great Britain	41·0	30·3	29·9
U.S.A.	9·4	21·6	19·2
Japan	3·8	6·4	6·4
Italy	3·1	5·4	4·8
France	4·2	5·3	5·1
Germany	11·3	5·2	6·2
Norway	4·3	4·4	5·4
Holland	3·2	4·2	4·5

oil "tankers" have been constructed since 1914. The sailing vessel has suffered a notable decline, and has now ceased to be a factor in British overseas trade.

The following figures show the percentage of each type of propulsion employed in gross tons—

PERCENTAGE OF GROSS TONNAGE

	1914	1927
	Per cent	Per cent
Sailing vessels and sea-going barges .	8.06	2.95
Oil in internal combustion engines .	0.45	6.55
Oil fuel for boilers	2.65	28.35
Coal	88.84	62.15

During the War, freight rates rose considerably, but since March, 1920, owing to trade depression, there has been a rapid fall, and this has been the more severe owing to the great additions to tonnage made during the War period. During 1930, owing to world trade depression, the surplus of tonnage was unprecedented although freights fell 20 per cent below pre-War levels. The Chamber of Shipping freight index number, taking 1920 as 100, shows a fall to 28.4 in 1923, to 29.6 in 1924, and to 25.3 in 1925. A new index number, taking 1924 rates as equal to 100, shows a fall in Time Charter Rates to 64 in December, 1930, and in Freight Rates to 71 at the same date. Passenger fares, on the other hand, have remained almost unaffected, and have been maintained at about the 1920 level.

The amount of capital and the number of men employed in shipping (excluding fishermen), contrary to what might be expected by those unfamiliar with the industry, are relatively small as compared with the capital and number of employees in rail and road transport. The world's shipping employs about half a

million men, though another quarter million are occupied on construction and repair. In 1929 there were 203,560 persons employed on vessels belonging to the United Kingdom, of whom 16,380 were foreigners and 53,570 lascars. On the average, one person is employed for every 46 net tons. The number of persons employed on the railways of the United Kingdom amounts to about three-quarters of a million. The estimated pre-War value of the world's ocean-going shipping is about £300,000,000, whereas in the United Kingdom alone the paid-up capital of the railways is about £1,200,000,000.

Sea Routes. Ocean routes are determined by traffic considerations, by the sphericity of the earth (the shortest distance between two points on the globe being the arc of the great circle connecting them), by the location of fuel stations, and the cost of coal and oil at these places. In the days of the sailing vessels, routes were also greatly influenced by the direction of the prevailing winds.

The Atlantic ~~route~~ from Europe to Canada and the States has the heaviest traffic, probably one-sixth of the world's shipping being engaged on this route. Traffic is not well balanced, as British imports are about double the exports, and are, moreover, bulky in proportion to their value, e.g. grain, timber, pulp, flour, apples, etc. Exports, on the other hand, are valuable in proportion to the cargo space required. Passenger traffic is considerable in both directions, though it is somewhat heavier in the westward direction owing to immigrant traffic. The American coastal trade is reserved to American ships and, therefore, British ships are placed at a disadvantage as they are not allowed to unload at several ports.

Circular routes are often important. One important circular route is from Britain to South Africa with,

say, mining machinery and materials, thence to India with South African coal, and then home with Indian produce via the Suez Canal. By this means surplus tonnage need not return to Britain in ballast.

Tramps and Liners. Ships may be divided into two distinct classes, the "tramp" and the "liner." Liners ply between fixed centres, and sail at fixed dates. Tramp steamers, on the other hand, are ready to go to any port where traffic can be obtained, and start at any time according to charter or cargo offering at the port. Certain vessels, however, may on occasion be employed as liners though generally engaged as tramps, but, as a rule, the liner is a faster, larger, and more expensive vessel.

Liner Services. The liners ply on a fixed route, carrying passengers or goods or both. As they offer the advantages of quick transport by reliable vessels sailing at short intervals, they are utilized by passengers, mails, and such cargo as can bear higher rates for rapid transport. Liners can be divided into several classes: (1) Mail and passenger steamships or express liners, which carry passengers, mails, express goods, and high-class freight. They have relatively little cargo space. (2) "Combination liners," carrying both passengers and cargo. They have a greater cargo space, and are willing to carry more bulky freight, such as foodstuffs, cotton, iron, and steel goods. (3) "Cargo liners" carry cargo exclusively, but operate like all other liners on definite routes, according to fixed schedules. They include many of the fastest and most efficient freighters, and they are generally fitted for the particular traffic of the routes on which they operate, though they are willing to carry smaller consignments for numbers of traders. To the passenger liners, emigrant traffic has proved profitable in the

past, since considerable numbers can be cheaply accommodated on a lower deck. The larger liner companies have made it their business to establish agents and central publicity organizations in Europe in connection with their emigration facilities. The slowing down of emigration, mainly as a result of the American quota system, has, however, led to a marked decline in the traffic, and for a few years past the companies have set out to cater for an entirely new form of traffic by encouraging third-class tourist travel across the Atlantic.

Tramps. The advantages offered by the liners are not so important as cheapness to the trader requiring transport for low-grade goods sent in bulk, such as coal, grain, wool, jute, minerals, etc. For such purposes it is more economical to "charter" or hire one or more tramp vessels on charter contracts for either a given voyage or a stated period of time. Shippers are able to select whatever type of vessel they require, both as to size and speed, as such steamers are prepared to move to any part of the world to obtain their cargo. In British shipping, tramps play an important part, and they may be described as the back-bone of the British mercantile fleet, though as a class they were the hardest hit during the War. Some are owned by individual shipowners, some by partnerships, and others by companies. Nowadays, ownership by companies is the rule, because this gives the advantage of limited liability and because a greater capital outlay is required as compared with the old sailing days.

The Coasting Trade. Coastwise shipping used to be of great importance to Britain before the coming of the railways. It remained a serious competitor to the railways during the 19th century, and it has been described as the British counterpart of the canal and river

competition on the Continent. During recent years, however, the coasting trade has declined, and entrances and clearances were 36 million tons net in 1928 as compared with 45 million tons in 1913. Coastwise shipping is a very cheap form of transport and is especially suited for coal and other bulk cargoes, and for the distribution of imported food-stuffs and other commodities discharged from ocean-going vessels. Both the Balfour Committee on Industry and Trade (1929) and the Royal Commission on Transport (1931) have recommended that steps should be taken to revive and improve some of the smaller ports in order to facilitate the coastwise trade. The Royal Commission stated that "many of the ports most used by and most useful to coastwise are in a state of decay. Some have silted up, others lack storage accommodation or adequate equipment for loading or unloading vessels" (Final Report p. 138). Decay of the coasting trade, during and since the War, has also been attributed to keen competition from the railways. To safeguard the coastwise trade, provisions were inserted in the Railways Act, 1921, empowering the Railway Rates Tribunal to revise any "exceptional rate" which unduly affected coastwise shipping.

OCEAN FREIGHT RATES

Corresponding to the distinction between liners and chartered vessels or tramps, two types of ocean transport rates have to be considered. Tramp rates are the more susceptible to competitive influences, whereas liner rates are determined, broadly speaking, under monopoly conditions.

Any change in the demand for shipping services, or in the supply of shipping tonnage, is quickly reflected in tramp rates, which fluctuate according to

the conditions of the freight markets. Harvest variations, fluctuations in trade prosperity, etc., cause changes in the demand. On the side of supply, it is not easy quickly to adjust the amount of shipping to requirements, as it does not pay owners to lay up their ships unless conditions are extremely bad, while, on the other hand, if more shipping is required, it takes time to build new vessels.

Where shipping is scarce and when many traders are anxious to reach particular markets in a hurry, rates will be high, but when traffic is scarce tramps may be forced to carry at nominal rates in the hope of a fair freight homewards. Low rates also will be quoted to ports where traffic is plentiful. Tramps are chartered either for particular voyages or on "Time Charter." Trip rates are quoted according to cargo tonnage, while time charter rates are based on deadweight or vessel tonnage. In the latter case the charterers usually provide the fuel and pay all port and terminal charges other than those involved in manning the vessel.

The capital and operating costs of tramp steamers are less than those of a liner company. Permanent berths, warehouses, etc., are not required since cargoes can be obtained from the shipbrokers who are to be found in all the large ports.

Tramps are owned by some hundreds of individuals or companies, and they ply on the most diverse of routes. It is, therefore, difficult to maintain fixed rates, and, in general, the rates are determined by competition. Variations in freight rates affect the allocation of the world's tonnage to the world's requirements, and they determine the amount of new tonnage which will be laid down in the shipyards or, in times of depression, the amount of tonnage that will be laid up through want of cargo.

Liner Rates. Conditions are very different among the liner companies, whose rates are fixed on monopoly principles, and are not therefore subject to the same fluctuations as are tramp rates. In all there are only about 40 liner companies, and practically all of them are well established, well organized, extensively advertised, and bound together into national or international associations known as Conferences. These Conferences have been established to prevent competition in rates or facilities and to maintain regular sailings.

For many years freight rates have been based on tonnage, either weight or measurement. Some lines have established freight classifications and quote different rates for a limited number of classes. "Exceptional rates" for certain articles are more common, however, than classification, and this development indicates a tendency to modify the old custom. Tariffs are, however, seldom published for public information.

Thus, under the Conference system, quasi-monopoly enables the lines to maintain different rates for different articles, and these rates are largely governed by the nature of the cargo and its volume, taking into account the cubic measurement to be occupied on board ship. Valuable high-grade cargo would be charged higher rates, but low-grade cargo, usually of a heavy nature, may sometimes be accepted between two points in place of "ballast," and is considered profitable if the rate obtained is in excess of the expense involved in working it in and out of the ship.

Higher rates are charged in those cases where extra cost of service is involved. For example, there may be heavy lifts, while stowage, loading or unloading may be a cause of extra expense, or bulky goods may require special treatment. Costs are, however, difficult to estimate and, in consequence, they are more frequently

taken into account when fixing rates to different ports served by the same line than in fixing rates between different commodities. Lower rates are usually quoted to those ports where dues are low, or where handling facilities are good, or where cheap coal or oil is available. Rates may also be adjusted on the principle of seeking remuneration on the "round voyage" rather than on each part of the route by itself, or lower rates may be given on either the outward or the homeward voyage when traffic is lighter in the one direction than in the other.

Conference Lines. Certain difficulties are inherent in the provision of liner services. The vessels must be run to a definite schedule on fixed routes, and must sail, whatever the amount of traffic that offers. There is thus an incentive to combination, which is increased by the fact that the lines are comparatively few in number and are highly capitalized.

The Calcutta Conference of 1875 was the first of the Conferences. It was agreed that no preferential treatment would be given to any shipper. In 1877 the deferred rebate system was introduced, whereby rebates were granted to shippers who utilized none but Conference vessels. The rebates were not paid till after a further period of loyalty, thus constituting a tie on shippers. Any rebates outstanding were forfeited if a shipper severed his connection by utilizing other than Conference vessels. The system spread till it covered nearly all the outward routes from Great Britain except to Canada and the U.S.A. Coal and special shipments are not included, and in the homeward trade deferred rebates are not so common, because traffic consisted mainly of wheat, timber, oil, ore, and other articles which can be shipped in bulk and require cheap rather than rapid transport.

Each Conference has its own particular area, covering certain sea routes, though it is not unusual to find mutual agreements between different Conferences. It is claimed for the Conferences that they provide regular services and give stability to freight rates, so that shippers can send their supplies regularly to market and can make forward contracts at a fixed price, including cost, freight, and insurance. This, it is said, fits in with modern trading methods as nowadays merchants do not carry large stocks. The companies having a regular traffic can supply vessels of greater speed and of a higher class, and, where necessary, adapted to the requirements of the particular route or to particular trades. Goods are delivered with greater dispatch and in better condition. Working costs, it is said, are reduced, as larger ships may be used and competitive advertisement is eliminated to a large extent, while other operating savings may be effected. Another argument in favour of the Conference is that the rates (except for "contract quantities" for rough goods in bulk, Government stores, etc.) are the same to all shippers, so that the small man does not suffer in comparison with his larger rival. It will be noticed that the majority of these arguments apply with greater force to traders than to the consumer of foreign produce. Traders may be able to pass off an increase of rates to the consumer, while at the same time they benefit from the better organization of shipping services.

The Royal Commission on Shipping Rings. About the beginning of the present century complaints became frequent about excessive freight rates and arbitrary and unreasonable action. In 1906 a Royal Commission on Shipping Rings was set up to inquire into the operation of the Conferences. In the Report (Cd. 4669) issued in 1909 the majority of the Commissioners

viewed the operation of the Conferences with equanimity, but recommended the establishment of Shippers' and Merchants' Associations to prevent any undue exploitation of monopoly. They also advocated supervision by the Board of Trade. A minority of the Commissioners, however, were more emphatic on the dangers of monopoly, the limitations on which they considered were in many cases illusory and tended to decline. They held that the Conferences had raised rates and that the system had been injurious to tramps, the strongest element in the British mercantile marine. Manufacturers and consumers have very little power of resistance, though affected adversely by high rates. As a safeguard against abuses the minority stated that they relied "strongly upon the effect of full publicity, which has not hitherto existed, as to the working of the Conferences, and a valuable check would be that the results of official inquiries would be promptly brought to the notice of Parliament."

In 1923 the Imperial Shipping Committee investigated systems of deferred rebates, and decided that "it is necessary for the Conference to have some assurance of continuous support from shippers such as will constitute an effective method of preventing intermittent and irresponsible competition for berth cargo by outside ships."

Legislative Action against Shipping Rings. In various countries, legislative action has been taken against shipping rings, as by Australia (1906-10), South Africa (1911), and the U.S.A. (e.g. 1916 and 1920). The 1916 Act in the U.S.A. was an attempt to break down the monopolies obtained by the Conferences, and a special Shipping Board was set up to administer the Act. Government ownership of mercantile fleets by the U.S.A., Australia, and Canada has also been a factor in

the attacks on the Conference system. Opposition to the deferred rebate has led to the "Agreement System," which is now in operation in the Australian and South African trade. Shippers are asked to pledge their entire support to the regular lines, and in return the lines undertake to provide adequate sailings, to afford sufficient tonnage, and to maintain stable rates. In the Australian agreement a discount of 5 per cent is allowed for cash payments.

It may be concluded that while Conferences have enabled the lines to provide services which it would have been unremunerative to supply under competitive conditions, it is desirable, from the point of view of consumers and manufacturers, that some check such as adequate publicity should be available against abuses if they arise.

CHAPTER III

PORTS AND DOCKS

PORTS link ocean and land transport together, and provide for the collection and distribution of ocean cargoes. The first function of a port is to provide shelter, so that loading and unloading may be carried on in all kinds of weather. Natural shelter is sometimes available, as at Milford Haven or San Francisco, but, generally, shelter has to be provided by the construction of breakwaters, etc., e.g. the mole at Zeebrugge. During recent years ships have developed considerably in size, for, as it has been said, "deep ships are cheap ships." In consequence, ports and docks built in earlier days are hard taxed to cope with the increased requirements. It is not essential, however, that all ports should cater for the largest vessels; it is sufficient if they can accommodate the type of vessel likely to use them. Many of the great ports of the world have at least an effective depth of 30 ft. at low water, while a number of the largest may be up to 40 ft. Where depth at low water is not sufficient, docks or basins have to be provided to enable ships to remain in port. Docks have the advantage that ships can leave or enter by means of locks at any time, whereas with the basin, vessels are prevented from entering or leaving after high tide. Wet docks are used to retain water so as to enable vessels to berth alongside the walls at any state of the tide. Dry docks or graving docks are used for overhauls or repairs, though sometimes floating docks are used for this purpose. There is a good deal to be said in favour of both

types, and the choice between a floating or a dry dock depends on circumstances.

A port is something more than a place of shelter or a harbour. Adequate facilities for transshipment between vessels and the shore are essential, and this necessitates the provision of quays, warehouses, cranes, hoists, railway sidings, road approaches, etc. Power for cranes, capstans, etc., may be steam, electric, or hydraulic. Steam is somewhat limited as each unit will require a separate power plant, but as between electricity and hydraulic power there is not much to choose, and both have their advocates. Hydraulic power has certain advantages for work such as opening and closing dock gates, and for this reason it is favoured by some dock authorities. Trouble however, may be caused by freezing in winter, but on the other hand, electrical apparatus is liable to be adversely affected by damp. Good port organization and adequate facilities for handling traffic are of great importance to both shipowners and dock authorities; to the former because the ship can be "turned round" more quickly, to the latter because more ships can be dealt with in a given time. Mechanical and labour-saving appliances are essential, though there are yet many ports where out-of-date appliances are in use. Rapid bunkering, i.e. coaling of steamships, is likewise of importance, and this depends very largely on the shore equipment. British ports suffer from the tradition of small railway wagons, but since port equipment and colliery appliances have been adapted to the small wagon it is now difficult to change round. The evolution of the mechanical trimmer has enabled the trimming or levelling of the coal in the ship's hold to keep pace with bunkering, and at some ports great progress in rapid bunkering has been made during recent years. Floating elevators

at Southampton can load 200 tons per hour with a crew of 8 men, and in London an elevator is in use capable of transferring 300 tons an hour with 9 men. In contrast with these improvements, there are still ports in the East where coaling is performed with baskets carried by natives. The use of oil fuel, which is becoming more general, greatly reduces the expense, dirt, and delay caused by bunkering, and the number of ports fitted with pipe lines for fueling is increasing year by year.

Road, rail, and canal communications at docks must be capable of dealing quickly and smoothly with traffic, even when several vessels come in at the same time. To facilitate rail traffic movements to and from the docks, especially in shipment of coal, systems of "train and traffic control" have been adopted by certain railway companies, e.g. in Fife and the Lothians. By the "release system," used in conjunction with the "control," consignments are not sent forward until "opening orders" are obtained for the ship to start taking in coal consignments. These expedients have done a great deal to prevent congestion, and in Scotland, at least, they have enabled a difficult traffic problem to be solved.

Rates and Charges. The revenue of a port is derived from the various rates, dues, and charges levied on shipping using the port. The number of the separate charges that may be imposed is somewhat confusing to those unfamiliar with the matter, and, moreover, the particular charges vary with different ports. *Rates and dues*, some levied on the net or gross tonnage of the vessel, and others assessed against the cargo, are used to defray capital charges and maintenance costs involved in providing the port facilities. *Harbour dues*, levied as tonnage rates when a ship enters the harbour,

are imposed for the shelter and accommodation provided. Rates vary according to the distance a vessel has come, as presumably the short distance vessels will use the harbour more frequently. Lower rates are granted to coasting vessels, ships in ballast and ships of call. A rent of so much per day may be imposed when a vessel stays beyond a certain time, as such vessels may prevent others entering at busy times. *Dock dues*, additional to harbour dues, or combined in one rate, are levied on those ships using the docks and dock appliances. *Light dues* are imposed for channel lighting by the lighthouse authority and by the customs officials on behalf of Trinity House, the chief lighting authority in Britain. After a certain number of light dues have been paid, exemption from further payments is granted for the year. *Pilotage charges* may also be imposed for sea and river services rendered, and are based on the draught of the vessel. *Towage rates* have to be paid for the services of tugs, but these are a matter of arrangement between the parties concerned, though maximum rates may be fixed by the port authorities.

In addition to the various dues and charges aforementioned, *tolls*, *town dues*, or *port dues* are levied on goods arriving (by land or sea) at the port. A *landing rate* is charged when the port authority supplies the labour, but if it does not, a *wharfage* or *royalty charge* is substituted. A *management* or *consolidated rate* charged in addition covers the warehousing of goods, their preparation for sale, and sometimes their delivery. These rates are sometimes called *prime rates*.

Cranes provided by the port authority may be utilized on payment of a fee, and are let for hire on a time basis. Other miscellaneous charges are those for police supervision, lighting, water supply, use of dummy barges,

floating cranes, etc. The practice of charging varies very considerably at the different ports of the world. Thus, at New York most of the port facilities are leased out to steamship companies. At Seattle, charges are imposed on cargo only, not on vessels. At Philadelphia, at the railroad-owned docks, no fees are payable where through freight is concerned.

Port Ownership. Many forms of port ownership and control are to be found: private individuals, companies, municipal, state, railway, steamship, local commission, or trusts. In France the harbour fabric is generally maintained by the State, while local authorities or autonomous commissions provide cranes, transit sheds, warehouses, etc., e.g. at Havre. In South Africa the Government directs the affairs of all ports and docks. Commission or trust working is to be found in many British ports, such as London, the Mersey, the Clyde, Leith, Belfast, Newcastle, Dundee, etc., and overseas at Melbourne, Sydney, Toronto, Calcutta, Genoa, and the ports in New Zealand. There is a great diversity in practice in regard to details, though the commissions generally consist of a representative body elected from among the shipowners, dock ratepayers, chambers of commerce, and municipalities. The commissions are usually set up by special Acts of Parliament, and are public trusts which do not work for profit and have no private interests to serve. About 110 British harbours are controlled by such independent trusts, established under statutory authority for the management of particular ports. Maximum charging powers are prescribed by their special Acts, but they are free to vary rates within these maxima.

In Great Britain many important ports are owned or partially owned by railway companies, e.g. Southampton, Hull, Hartlepool, Middlesbrough, and ports in

South Wales. In the U.S.A. there are railway-owned docks at Boston, Baltimore, Philadelphia, Norfolk, etc. In some of the British railway-owned ports the railways have virtual control, though local harbour boards may be nominally responsible for dredging, etc. Similar, though not so common, is ownership by canals or navigations. In Britain, Goole and Manchester docks are thus owned. Municipal ownership is not usual in Britain, the most important examples of this type of ownership being Bristol and Preston, though on the Continent and in America municipal ports are more important, e.g. Hamburg, Antwerp, and Rotterdam. Privately-owned ports administered by limited liability companies are to be found in a few places, e.g. Ardrossan, Larne, and Seaham, but on the whole they are not important.

Labour at the Ports. The employment of labour at ports depends on the arrival and departure of ships. The problem is that of casual labour, the work being largely unskilled, though hard, and the labour market is generally overcrowded. Various systems of engaging labour for handling cargoes are followed at various ports. Sometimes the men are employed by the port authorities, sometimes by shipowners, and elsewhere by contractors, such as stevedores or master porters. "Calling on," i.e. selecting men by picking them from assembled groups of would-be workers, is usually the rule. This is unsatisfactory, and is liable to abuse. From the social point of view, casual labour with its irregularity of employment is highly undesirable, though the practical problem of finding another system to take its place is by no means easy. The P.L.A. (Port of London Authority), in an attempt to cope with the problem, has divided the men into three classes, "Permanent," "B" Class, and "C" Class (Casuals).

The first are in constant employment, the "B" men are given tickets which entitle them to preference after work is available for all permanent men. "B" men are rostered in order of priority. As the result of reports by the Shaw Committee and the Docks Decasualization Committee, joint registration schemes were set up during 1927 at all the principal ports, except Glasgow, and at most of the smaller ports.

Progress towards decasualization, however, has been slow. Registration has been a great check against the inflow of labour from other industries, but the demand for labour has fallen owing to the adoption of mechanical appliances, and it has not been possible to decrease the registers owing to the lack of absorption in other industries.

CHAPTER IV

ECONOMICS OF RAILWAY TRANSPORT

LITTLE more than one hundred years ago, the first public railway to be operated by steam locomotives was opened between Stockton and Darlington. Since then there has been a remarkable expansion in mileage, and numerous technical improvements have been effected.

In 1923 railway mileage in the principal countries of the world was as follows—

U.S.A.	251,678 miles	Brazil	18,633 miles
Canada	40,401 ..	Italy	12,473 ..
Germany	38,744 ..	Japan	12,256 ..
India	38,038 ..	Spain	9,622 ..
France	33,208 ..	Belgium	6,989 ..
Russia	30,732 ..	Austria	3,930 ..
Argentina	23,105 ..	Ireland	3,450 ..
Gt. Britain	20,314 ..	Holland	2,136 ..

Mileage figures are not, however, a very good indication of railway development until they are studied in relation to population and area. When this is done, the relative position of the various countries is considerably altered.

APPROXIMATE RAILWAY MILEAGE

Per 100 Sq. Miles of Area		Per 100,000 Inhabitants	
Belgium	40 miles	Canada	465 miles
U.K. and Ireland	20 ..	U.S.A.	224 ..
Germany	20 ..	South Africa	164 ..
France	13 ..	France	70 ..
U.S.A.	7 ..	Belgium	62 ..
Japan	3 ..	Germany	60 ..
South Africa	2 ..	U.K. and Ireland	50 ..
India	2 ..	Japan	15 ..
Canada	1 mile	India	11 ..

Belgium, as regards railway development, is in a class by herself, there being 40 miles of railway (including light railways) to every 100 sq. miles of her area. The density of population, industrial development, topographical features, and the popularity of the light railway, account for the high proportion of mileage to area.

Great Britain has a very extensive network of railways, there being 20,314 route miles, which, if reduced to single track (including sidings), gives a track mileage of 51,818 miles. It is doubtful if there is now any great scope left for further railway building, other than the duplication of tracks, short extensions, etc. Development possibilities in Britain lie not so much in the extension of route mileage as in the adoption of technical improvements and improved methods of operating.

European railways have been built to cater for existing traffic, but in the U.S.A. and Canada railway construction has been pushed ahead of the demand, as is evident from the proportion of mileage to inhabitants, though in Canada especially there are yet many of the sparsely populated areas without railway communications of any kind.

In the New World, railway construction has been facilitated by the fact that capital outlay has been less, land has been cheaper, and standards of construction have been lower than in Great Britain.

The Legal Position of the Railways. In Great Britain and the U.S.A. practically all the capital required for construction has been provided by private enterprise, but, in nearly all other countries, Government aid in one form or another has been given to promote railway construction. Thus in Canada there have been free gifts of land, in Ireland loans on favourable terms, and in Austria certain exemptions from taxation.

Government construction has been the rule in Australia, Belgium (except for light railways), and the smaller German States. In France, and at one time in India, money has been raised for construction on Government guarantee.

In the United Kingdom railways are statutory joint-stock companies. Railways require legal powers of compulsory land purchase to prevent the scheme from being held up by a few persons, and to gain these powers a Private Bill has to be introduced into Parliament. If the Bill is passed, after objections have been heard, the corporation thus constituted is a statutory company with certain privileges and certain obligations. On the one hand, it can purchase land or easements by agreement or under compulsion; it can frame its own by-laws, which are enforceable, provided they do not conflict with the law of the land, and it can apply to Parliament at any time for the extension of its powers, though it does not follow that this will be granted. On the other hand, it can only perform those functions for which it has specific powers, and it is restricted from divesting itself of any powers necessary for the proper exercise of its functions. Other restrictions are imposed by legislation applicable to railways in general, such as those Acts of Parliament which relate to rates and fares. Finally, the Common Law places further restrictions on the railways, such as the Law of Common Carriage (with certain exceptions, e.g. silk).

State Regulation of Railway Charges. Early railway charges took the form of tolls for the use of the permanent way, which charges were regulated by the Private Act which incorporated the particular railway. It was thought that traders would run their own wagons on the railway, but it soon became evident that such a

method was not possible if safety and expedition were to be secured. In 1845, recognizing this fact, Parliament fixed maximum rates for conveyance by railway. From the beginning, rates varied with the value of the commodity carried, classifications being drawn up for the purpose. From 1845 to 1891 the statutory schedules of maximum charges remained stereotyped, some 40 to 60 articles being enumerated into 5 or 6 groups, while all others not mentioned by name were lumped into one of the higher classes. The Railway Clearing-house, however, within the limits set by these maxima, evolved a more complete classification. Parliamentary revision was not undertaken until 1888, when the Railway and Canal Traffic Act (1888) made provisions for new maximum rates and a new classification applicable to all railways. Various scales of maximum charges were prescribed for (1) goods and minerals, (2) animals, (3) carriages, (4) exceptional rates, (5) perishables by passenger train, and (6) small parcels. The revision of the classification for goods and minerals was a matter of great complexity, but eventually the Railway Clearing-house classification was adopted with but slight modifications. Eight classes were introduced, lettered A (which was the lowest), B and C, and numbered 1 to 5 (5 being the highest). These remained in force till the "appointed day" prescribed by the Railways Act, 1921 (1st January, 1928).

The following examples selected from the numerous items contained in the General Railway Classification of Goods by merchandise train, illustrate the nature of the system—

Class A. (4 ton minimum.) Basic slag (unground), coal.

Class B. (4 ton minimum.) Basic slag (ground), china clay.

Class C. (2 ton minimum.) Copper ore, gypsum, hay (compressed).

- Class 1. Borax, hammer handles, pears.
 - Class 2. Arrowroot, oranges, hay (e.o.h.p. unpressed).
 - Class 3. Books, handcuffs, cherries.
 - Class 4. Billiard cues (in bundles), pineapples (packed e.o.h.p.).
 - Class 5. Calculating machines, grapes (e.o.h.p.).
- ("e.o.h.p." signifies "except otherwise herein provided.")

In 1891 and 1892 a series of 35 Acts applicable to 35 railways or groups of railways were passed, setting up the new maximum rates which were provided for in the 1888 Act. The companies were, however, allowed to grant "exceptional rates" at their discretion, i.e. rates lower than the ordinary in special circumstances, for example, where traffic is sent in bulk. Rates were to be tapered or "cumulative," i.e. the average rate per mile decreases as the distances increase. Formerly, after six miles, equal mileage rates had been imposed. Certain types of traffic, however, continued to go at flat rates, e.g. horses, 3d. per mile; corpses, 1s. per mile; carriages, 4½d. per mile. "Bonus" mileage was allowed for certain sections of line which have been expensive to construct, e.g. Forth and Tay Bridges, and the Severn Tunnel.

In 1893 the railway companies raised their rates, including exceptional rates, up to the new maxima in those cases where they were lower, partly to recoup themselves for the loss from rates which had been lowered, and partly because there was not time to revise all the schedules. A storm of complaints arose, and a new Act—the Railway and Canal Traffic Act, 1894—was passed, which, in effect, made the rates of 1892 the most which could be charged where these were lower than the rates permitted by the Acts of 1891 and 1892. To raise any rate above this level a railway company had to show that there was an increased cost of working the particular traffic. This was a serious

matter for the companies, as it is difficult to prove that costs have risen in particular cases. Elasticity in railway rates disappeared because the companies were afraid that, if they experimented in lowering rates, they might not be allowed to raise them again if the experiment were unsuccessful.

Post-War Railway Reorganization. During the War the financial position of the railways became critical in most countries owing to increased cost of materials and labour. The question of future State policy in relation to railways, therefore, became prominent in the years after the War, and important decisions have been taken which greatly modify the position of the railways. In Britain the basis of the new policy is the Railways Act of 1921, which is described in the next paragraph. In the U.S.A. the restoration of the railroads to private enterprise—they had been controlled during the years 1917-20—has been effected by the Transportation Act, 1920, which is somewhat similar to the British Act of 1921, and makes a considerable modification in previous policy. Standard revenues based on estimated capital values are allowed to the various companies, while voluntary grouping is encouraged. In Canada, after the War, the Dominion Government, when certain railroads found themselves in financial difficulties, acquired a transcontinental system, comprising 52 per cent of the total railway mileage in Canada. In the Irish Free State, the Railways Act of 1924 led in the following year to the unification of all the lines into the Great Southern Railway. In Germany, since the War, the various systems were first united into a single State system, but later were handed over to a company to be operated under a Commission set up according to the Dawes Scheme of Reparations. The railways play an important part in reparations policy.

In France, a law of 1922 established a Supreme Railway Council, and, while retaining the old six principal systems, standardized and co-ordinated financial administration, wages, equipment, and operation. In Belgium, the State railways were transferred to a company in order to provide credits for currency stabilization.

The Railways Act, 1921. In Great Britain the Railways Act, 1921, introduced far-reaching changes of the greatest importance. The main provisions of the Act can be classified under the following heads: (1) grouping, (2) compensation, (3) charging powers, (4) relation to employees, and (5) the recasting of the statistics required by statute to be rendered by the railways.

Part I of the Act dealt with the reorganization of the railway systems of Great Britain, which have been thereby formed into four large groups: the London and North Eastern, the London, Midland and Scottish, the Great Western, and the Southern Railways. The Act, by providing for compulsory grouping in place of the former Parliamentary policy of encouraging competition, thus marked a turning point in the history of our railways. Amalgamation, it was hoped, would lead to considerable economies and to greater efficiency of working. Some 120 separate railway companies have been combined into one or other of the four groups, though there still remain some 90 other railways outside the groups. Some of these, however, are jointly owned by two or more of the groups, e.g. Cheshire Lines Committee; some are suburban railways; others are of narrow gauge, e.g. Tal-y-llyn; while yet others are very small, e.g. Easingwold Railway.

Though each of the groups has a partial monopoly in its own area, there is still a certain amount of competition—which the Act was intended to eliminate—

as rival routes exist between certain important centres. This has been responsible for wasteful expenditure contrary to the intention of the Act.

Amalgamation has resulted in the more economic operation of the systems. Certain savings of a general nature have been obtained from the elimination of competitive advertisement, the reduction of administrative costs, and through the lessened need for competitive facilities. Other economies of a technical nature also present considerable possibilities of savings, among which may be instanced the reorganization of tranship sheds, marshalling and concentration yards, stations, depots, etc., the re-arrangement of engine working, and the standardization of equipment. Time, however, was required for the consolidation of the various systems into a working whole, and, in consequence, the benefits of fusion were not immediately obtained. In many cases the expenditure of further capital was required before the savings could be effected.

Under the Act, compensation amounting to £60,000,000 was paid by the Government to cover arrears of maintenance, repairs, etc., postponed during the War period, when the railways were worked on non-commercial principles for the carriage of troops and munitions.

The Railway Rates Tribunal. The sections of the Act relating to rates and charges are of the first importance. A special Rates Tribunal has been set up with very extensive powers, covering every phase of railway charges. The Tribunal is to fix rates, fares, and other charges, so that a "standard revenue" will be earned by each of the groups, provided "management is efficient and economical." The "standard revenue" is defined as the aggregate revenues of the constituent

and subsidiary companies for 1913, plus 5 per cent on certain specified capital expenditure. Up to 33½ per cent of economies effected as a result of amalgamation may be retained by the groups, while, if savings are effected through subsequent economies, the companies may retain 20 per cent, the remainder going to reduce rates. Ancillary businesses, such as hotels and docks, must be run on a self-supporting basis, and their charges come under the purview of the Tribunal.

The statutory classifications set up by the Acts of 1891 and 1892 were swept away, and a new classification of 21 classes was substituted. This it was hoped would lead to a reduction in the number of exceptional and reduced rates at owner's risk, and to a greater degree of uniformity of railway tariffs. "Exceptional" rates must now conform to certain limitations, though as it has happened a great many still figure in the Rate Books. In addition to the 21 classes, there are six sections for perishable traffic conveyed by passenger trains, while merchandise and live stock by passenger train are divided into 13 groups with many subdivisions. Separate consideration is also given to timber, returned empties, rolling stock, dangerous goods, and live stock by merchandise train. The new classification and the amended rates came into operation on the "appointed day," which after protracted discussions and negotiations was fixed for the 1st January, 1928.

As the charges allowed by the Tribunal in the first instance could only be approximate, they were to be revised at the end of the first year, and after that periodically, so that the "standard revenue" may be earned by each group. After the "appointed day" no variation from the standard rates was allowed except by way of an exceptional rate or fare.

To improve the relations between the companies and their employees, a system of conciliation councils has been set up with functions not dissimilar to those of the Whitley Councils established in other industries after the War. These bodies are consultative only, and their decisions are not legally enforceable.

Criticisms of the Act. Considerable controversy has arisen as to the merits of the Railways Act, especially in regard to the sections dealing with rates and fares. The advantages of the new system are, briefly, that the old and somewhat clumsy system of maximum charges has been scrapped, and there is now a greater degree of elasticity. The railways, by the new system, are given the chance to earn an adequate return on their capital, though this is not guaranteed, and, actually, the revenues earned have fallen considerably below the standard revenue.

Though it is admitted that the new procedure has many advantages over the old, the critics argue that there are many practical limitations. In the first place, there is no connection between the Rates Tribunal and the Wages Boards, though wages are a very important item in expenditure.

During periods of trade depression, rates and fares would have to be raised to make up for loss in revenue, but this would not improve the position since it would cause traffic to fall off still more and would react moreover on trade activity. No doubt, in practice, the Tribunal would not feel themselves bound by the letter of the law. Indeed, already rate reductions have been granted to distressed industries.

Criticisms have also been raised anent the details of rate fixing. One concerns the proportion of revenue to be raised as between passenger and goods traffic. If charges have to be raised, how is the distribution

between passenger fares and goods rates to be calculated? Again, if charges were raised by one group which has failed to earn its standard revenue, this would lead to great difficulties in regard to competitive routes. Another criticism relates to the ancillary enterprises, many of which have been undertaken in the hope that they would bring traffic to the railway. It may be a difficult matter to place some of these on a self-supporting basis, and, if charges are raised, traffic may be lost. Difficulties have also arisen in regard to circuitous routes, and the fructification of that capital on which returns were not expected for some years after it was expended.

The work involved in the settlement of the standard charges has been enormous. Schedules setting out the standard charges suggested by the railways—after much labour on their part—were lodged on 21st July, 1923, and notice of objection from 612 trade associations, public authorities, passenger associations, and individual traders had then to be considered by the Tribunal. Eventually, the standard revenues were fixed at £20,326,622 for the L.M.S., £14,787,733 for the L.N.E.R., £8,312,013 for the G.W.R., and £6,631,479 for the S.R. Rates have been stabilized at 60 per cent above pre-War charges, and fares at 1½d. for 3rd Class, and 2½d. for 1st Class, per mile, though in order to help depressed industries the companies have agreed to grant a reduction from the standard revenues of £2,500,000 through reduced classifications and by means of exceptional rates to coal, iron, steel, and agricultural products. Further reductions have been effected under the de-rating scheme. By this Act, local government rates on freight transport hereditaments have been reduced by 75 per cent on condition that the savings effected were passed on directly as reductions in freight

rates on export and blast furnace coal, colliery materials. and agricultural produce.

RAILWAY CAPITAL

The capital outlay necessary to provide and equip a railway is very large. In Great Britain the expenditure on capital account had amounted to £1,181,320,000 by 1923, while in the U.S.A. the present value of the railroads has been estimated at \$22,350,000,000, or about £4,470,000,000. In 1923 the annual gross receipts of British railways amounted to £224,443,000, or about one-fifth of the capital outlay. It thus takes a railway about five years to turn over its capital. The greater part of the capital is spent for the benefit of the traffic as a whole, and it is a very difficult matter to allocate the cost against different types of traffic, much less against particular consignments. Before any traffic can be carried at all, a large amount of capital expenditure must be incurred in providing the permanent way, buildings, etc., but these charges do not increase in proportion to the traffic. Consequently, the average cost of rail transport decreases with increased traffic. Railways follow the law of decreasing cost, though the law as applied to railways is not continuous. Suppose that traffic increases so that the existing lines are not sufficient to carry it. Considerable capital expense would have to be incurred in doubling tracks, in improving signalling, or in introducing electric operation, but after this had been done there would be no corresponding increase in traffic to meet the greater capital outlay. In this connection seasonal traffic is often a problem. Holiday traffic in Britain and harvest traffic in Canada and Australia necessitate, for instance, a greater expenditure on rolling stock than is necessary for work all the year round.

Electric Railways. The capital costs of electrified railways are even higher than steam-operated systems, because elaborate overhead wires or third rail systems, together with the necessary feeders, sub-stations, etc., have to be provided. Where traffic is heavy, or where there is a considerable difference in the cost of coal and hydro-electric power, electrification has many advantages. It gives greater acceleration and braking power, while on gradients more power is available, and on the downward sections current can be regenerated for return to the power station. In the case of suburban traffic there are advantages in case of reversing the trains, while operating costs can be more readily proportioned to the amount of the traffic than is the case with steam trains. The displacement of steam by electric services, however, would seem only to be justified in this country where traffic is exceptionally heavy, since in that case the greater capital expenditure is spread over many traffic units.

Underground and Elevated Railways. The capital cost of underground or elevated railways is extremely heavy, and is only justified in the largest cities where intensive services can be operated. Electric traction is almost invariably employed now in underground railways. Elevated railways are to be found in New York and Berlin, but they are generally very noisy and shut out the light from the streets. Underground railways on the other hand become prohibitively costly when hard rock has to be tunnelled.

Railway Expenditure. On all railways a considerable annual expenditure is incurred on maintenance charges and in providing interest on capital in addition to the operating expenses and general charges. A large amount of this expenditure is necessary whatever the amount of the traffic. The permanent way is worn

out by weather as well as by traffic, while obsolescence may be a charge as well as depreciation. Acworth* calculated that half of the total expenditure is fixed, the other half varying with the traffic but not in direct proportion to it. A railway system involves perhaps the largest capital expenditure of any industry, and shows a very large proportion of fixed costs to running expenses, though not unique in this last respect. Gas, water, electricity supply, telegraphs and telephones are somewhat similar, and they likewise require a continuous track and must obtain "way-leaves."

THEORY AND PRACTICE OF RAILWAY RATES AND FARES

Theoretically, a railway can be regarded as a monopoly, since competitive lines following the same route would be clearly uneconomic. Further, a railway is in the position to fix differential prices per ton-mile for the services which it renders. This system of charging different prices to different customers for the same service or the same article is not, however, peculiar to railways. It can be found in a number of industries, especially those which have a natural monopoly and engage in performing services which cannot be resold or transferred. Gas companies, for instance, charge lower rates per therm to power users than to lighting users, while electricity supply rates are fixed on a similar principle. On a monopoly basis railway rates would be so adjusted that the greatest profit would be obtained, and rates would be so fixed that for each type of traffic the net receipts (i.e. the number of units carried, multiplied by the rate per unit less any special costs involved) would be a maximum. It is important to notice that it is the maximization of the product of

* W. M. Acworth, *Elements of Railway Economics*.

the number of units carried multiplied by the receipts per unit which is aimed at. Hence, if the demand for transport is elastic (i.e. increases considerably when rates are lowered), it might be to the advantage of the railway to charge lower rates, especially as the average cost per unit tends to decrease as traffic increases. All classes of traffic will be accepted provided that they can pay sufficient to cover at least the out-of-pocket expenses involved, though any commodity which could pay a higher rate per ton-mile would, theoretically, be charged up to the limit which it could bear. For this reason this system of charging is known as "charging what the traffic can bear." The nature of railway costs makes this the most practical method of fixing rates, as the greater proportion of the capital outlay and a considerable part of the annual costs of maintenance are necessary whatever the amount of the traffic. So long as the "additional net cost" of carrying a consignment is met, it will pay a railway to accept this traffic. The system of charging "what the traffic can bear" is not unfair to the higher grade traffic, as the lower grade contributes a little to the fixed charges, and if this contribution were not available the higher grade traffic would have to meet the whole cost.

In pure theory, the criterion of ability to pay would be the difference in *place values* of the commodity which is being transported. If the cost of production in *A* were x , and the value of the article in *B* were p , then the maximum charge that could be imposed for transport from *A* to *B* would be $p - x$, which is the difference in place values. Any higher charge would eat up more than the profit to be obtained by the trader. In practice, however, it would be too complicated a matter to base charges on place values, and any such

attempt would moreover be likely to arouse considerable opposition. As a basis of discrimination, market values, not place values, are taken. Costly commodities are charged at higher rates than cheap articles.

Practical Limitations on the Charging Powers of Railways. In practice there are many limitations on the charging powers of railways. Thus restrictions on freedom of charging are imposed by competition from other forms of transport and by statute law. But, though in practice railways have not complete freedom in fixing their charges, the principle of differential charging is partially applied by means of the "classification," since for each class a different rate per ton-mile is charged. Value is usually the determining factor which settles the class in which a particular commodity is placed, though in certain cases other considerations, such as cost of service, may be taken into account. Commodities of considerable bulk in proportion to weight are naturally placed in higher classes than similar articles of less bulk, e.g. compressed hay is given a lower classification than unpressed hay.

Considerable modifications in the standard classifications and rates result from the existence of numerous "exceptional rates." These are lower than the ordinary class rate and are granted to traders in special circumstances, e.g. where large consignments are sent regularly, to compete with water transport, etc. The actual number of rates on the Rate Books—they have to be entered therein, as no undue preference to one trader over another is allowed by law—used to be between 30 and 40 millions, and it has been estimated that about 80 per cent of traffic on British railways was carried at "exceptional rates." It was hoped that by increasing the number of classes to 21 and eliminating those rates which were not in use, the number would

be greatly reduced after the "appointed day." The number, however, has not suffered any marked reduction, because "exceptional rates" can be continued or newly introduced by agreement between traders and the railways, almost without reference to the Rates Tribunal, except that no "exceptional rate" must be less than 5 per cent or more than 40 per cent below the standard rate of the class into which the commodity falls. The Tribunal's assent is necessary for any rate below 40 per cent, and it is open to a trader to make application to have any "exceptional rate" brought within the jurisdiction of the Tribunal.

Owner's Risk Rates. Reduced rates are also quoted in many cases where traders agree to relieve the railway from liability for damage during transit. In a sense, the lower rate represents the deduction of an insurance premium. Such rates are applicable to commodities which are easily damaged, if not properly packed, and also to certain articles which are not likely to suffer damage at all. Owner's risk rates apply, for instance, to wire ropes, wooden gate-posts, tombstones, trees and shrubs, alabaster figures, glass retorts, glass jars and bottles. At one time owner's risk rates were granted to induce traders to consign by a particular railway, but after 1894 matters were tightened up, and now, by the Railways Act 1921, it is laid down that reductions shall be equivalent to the risk, and if the difference is considerable the company must quote both owner's and company's risk rates.

Tapering Rates. In this system, which has been adopted in many countries, the charge per mile is less as the distance increases. The Belgian Railways adopted tapering rates (*barême belge*) at an early date, but it was not till 1888 that they were introduced into Britain. The imposition of separate terminal charges,

it should be noted, has the effect of making rates taper. Tapering rates may be justified on the ground that it costs a railway less per mile to carry for a long distance than for a short, because on the long haul terminal expenses are spread over a greater mileage. At the same time the lower rates encourage traffic which could not bear a high charge for a long distance.

Amounts sent at a Time. In Canada and the U.S.A. higher charges are imposed for "less than carload" shipments (L.C.L. rates), and in Britain small lots not exceeding 3 cwt. are charged at the "smalls" rate, which is higher than the proportionate amount of the ordinary rate. Small consignments involve increased cost to the railway, and there is thus a justification for the higher charge. Better wagon loading would mean considerable savings in operating costs, and this is a field where publicity should give good results. By the Railways Act it is now to the advantage of traders to help the railways to economize. The New York Central Railroad have a very effective method of publicity in this matter. They publish "Hints to Shippers" on their ordinary passenger time-tables, emphasizing the advantage to all parties of better loading. In the new classifications in this country the minimum loads in the lower classes have been increased from 4 to 6 tons, though this does but little more than maintain the old ratio of minimum load to wagon capacity, since the standard goods wagon has increased in capacity from about 8 tons in 1892 to 12 tons (R.C.H. standard wagon), and 20 tons for mineral traffic at the present time. There is thus hardly any greater incentive to economy than there used to be in 1892.

Speed of Transit. In most countries higher rates are charged for rapid transport, though in Britain higher

charges are made only in the case of commodities sent by passenger train. In France a distinction is drawn between *grande* and *petite vitesse*, the latter being much slower but cheaper. It has often been suggested that British railways should introduce a system of express goods traffic at higher rates.

Zone Rates. In the zone system the rate is the same whatever the distance, and the principle is thus similar to the post office rates for letters and parcels. The system was partially adopted by the Hungarian railways in 1889, but it did not prove very successful and had to be abandoned. In the U.S.A., at one time, milk was carried any distance for a certain charge, while in Britain there are partial applications in "parcels" and milk rates. Rates for "parcels" are "blanketed" in each of a number of zones, e.g. the first zone is for any distance up to 15 miles, while milk rates are divided up into five zones.

Zone rates based on average cost of service have the attraction of simplicity, while they also encourage traders to consign to more distant markets, hence the adoption of zone rates for milk traffic. They do not work, however, where the distances traversed vary considerably, nor does the postal analogy hold good. In the letter post cost of transit is a very small part of the total expense. Terminal charges for collection and delivery are the heaviest part of the cost, and these do not vary with the distance. But if a flat rate charge or zone system were introduced on the railways, short distance traffic would fall off or might be transferred to road transport. Yet it is upon this traffic that the railway would depend to make up for the loss on the long-distance traffic carried below cost.

British and Foreign Railway Rates. Comparisons between the charges of British and foreign railways—

not always flattering to British railways—are often made, but as conditions vary so much they do not serve a very useful purpose. In the first place the British trader demands and obtains a very much better service than the foreigner. He gets a quicker service, and the higher classifications include collection and delivery, whereas in other countries this is not usual. In Britain minimum loads are smaller, average distances are shorter, and demurrage is less expensive to the trader. In any comparison it should also be remembered that in Britain a great proportion of the traffic is carried at exceptional rates, which brings down the average charge very considerably.

Passenger Fares. Fares have been comparatively little affected by legislation, though by the Railways Act they are brought under the jurisdiction of the Rates Tribunal. In the early days, contrary to expectations, passenger traffic was more important than goods, receipts from passengers constituting about 75 per cent of the total. As time went on the proportion decreased to 40 per cent or less, where it stands to-day, except in the case of the Southern Railway, which is mainly a passenger-carrying line, only about 27 per cent of its revenue being derived from goods traffic.

The most striking development since the early days has been the increase in third-class travel. Originally third-class fares were 1½d. per mile, but accommodation was very primitive, often only open trucks being provided. In 1844 Parliament passed the "Cheap Trains Act," by which on every passenger line one train per day in both directions, and stopping at every station, had to be run conveying third-class passengers at 1d. (now 1½d.) per mile. These "Parliamentary" trains were tediously slow and very uncomfortable. In 1872

the Midland Railway Company decided to admit third-class passengers to all their trains. Though at first opposed by the other companies, this proved financially successful, and has become universal except on a few boat trains. In 1930 official statistics show that 897,515,000 third-class passengers were carried by British railways as against 17,519,000 first-class and 2,306,000 second-class passengers. Season tickets (reduced to an equivalent number of annual journeys) totalled 654,570 third-class, 83,000 first-class, and 42,090 second-class, and in addition there were 301,313,000 workmen's tickets (reduced to single journeys).

Fixation of Passenger Fares. The problems involved in the fixation of passenger fares are simpler than those presented by the determination of goods rates. Terminal services are not so complex and classification is not so rigid, being determined largely by the passengers themselves. Continental railways attempt to enforce a certain degree of compulsion by restricting the best trains to first- and second-class passengers, and by charging an extra fee for express trains. In Great Britain restrictions are seldom imposed except as regards the issue of cheap tickets, which are generally limited to special trains, or are only available after certain hours, while comfort is less and free luggage allowances may not be made. There are many varieties of these reduced fare tickets, including season, zone (on Scottish suburban lines), first-class 1,000 miles, week-end, market day, afternoon, rambler's, hawkers', traders', and golfers' tickets.

From the railway point of view, cheap fare tickets are justified if they induce persons to travel who would otherwise not do so, and if at the same time they do not unduly reduce the receipts from ordinary and regular travellers. Thus season tickets tend to induce

travellers to use the railway for all their journeys. Reduced fares are justified since the extra cost of carrying additional passengers is small once trains have been put on the route, while if special excursion trains are run they will be a paying proposition, provided they can be filled and do not interfere too much with the running of ordinary trains. Cheap fares are also justified if they lead to good loading during what would otherwise be slack hours. In recent years road transport competition has made the issue of cheap tickets a necessity if traffic is to be retained, and for this reason the issue of mid-day tickets, etc., has been extended in certain areas. Owing to the large number of reduced-fare tickets, the average rate works out at a great deal less than the normal charge of 1d. per mile in pre-War days, and the normal 1½d. of the present time. Before the War, indeed, the average fare was nearer ½d. than 1d. per mile.

In some cases fares have been determined by considerations other than the purely commercial. Legislation has been invoked, for instance, to obtain cheap fares for workmen, shipwrecked mariners, school children and others. Workmen's fares have been considerably extended since they were first introduced some 50 years ago, and a similar obligation has been placed on tramways, though not on motor buses. The impulse behind this extension has been the laudable desire to minimize overcrowding in the cities, though to the railways the obligation involves a heavy burden, and it is said that overcrowding is merely transferred to those suburban areas from which such fares are available.

Passenger fares are almost invariably equal mileage charges, one of the few exceptions being the "bonus mileage" granted in certain cases. Tapering fares are

not usual except in Austria, Italy, and Belgium, as there is not the same force in the arguments for such decreasing charges as in the case of goods traffic. Terminal services are not required, while on the average the short distance passenger is the more frequent traveller. The Metropolitan Railway, however, has adopted the principle of tapering fares in order to encourage people to live farther out from the centre of London, and thus to build up traffic for the future.

CHAPTER V

INLAND WATER TRANSPORT

INLAND waterways comprise rivers, ship canals, navigations, and canals, and, therefore, vary greatly in size and character. At the one end of the scale there are great rivers like the Mississippi and the Rhine, while at the other extreme are those "narrow canals" in Britain which are suited only to the smallest of horse-drawn barges. It is usual to distinguish the several categories as: (1) Natural waterways, including rivers, estuaries, and lakes; (2) "navigations," or improved and canalized rivers; and (3) canals or purely artificial waterways. Inland water transport is of greater importance in Holland, Belgium, Germany, France, Canada, and the U.S.A. than elsewhere. On many of the waterways in these countries barges of 300 to 600 tons capacity can be used and mechanical propulsion is the rule. In Holland, canals intersect the country in all directions, and though built in the first place for the drainage of low-lying land and the polders, they carry a great amount of traffic. In the U.S.A. and Canada short lengths of canal connect the rivers and the Great Lakes, and on these routes a vast traffic is forwarded after the harvests for shipment to Europe. In France and Germany the governments have devoted especial care to the waterways and, as a result, rates are cheap and traffic is diverted to this means of transport.

In the United Kingdom an extensive system of inland waterways was built up before the railway period. The greater part of these waterways in England

forms a connected whole, lying chiefly in the Midlands and the southern parts of Yorkshire and Lancashire. In England and Wales the approximate mileage of inland waterways in 1906 was 1,930 miles of canal, 1,310 miles of navigations, and 810 miles of open rivers. This gives a total of 4,050 miles for England and Wales, as compared with 153,000 miles of roads and some 16,000 route miles of railway. The network of canals is closest in the Midlands, where practically all the industrial towns are connected by canals, though only the smallest "narrow" barge or "monkey" boat can traverse many of the canals. In Scotland the waterways are relatively unimportant, and are entirely unconnected with the English system.

The amount of traffic carried on British canals is not very considerable, and has been declining steadily. In 1905 traffic amounted to about $37\frac{1}{2}$ million tons, but by 1929 it had fallen to $14\frac{1}{2}$ million tons. During the War period canal traffic declined considerably, mainly because the staffs were not "protected" from military service until near the end of the War. Improvement has been slow owing to a number of causes, among which may be mentioned trade depression, road and rail competition, increased labour costs, and dislike of the conditions imposed by "living-in" on barges. As compared with the beginning of the century, the decline of traffic has been very marked on the smaller canals.

Waterway Tolls and Charges. Tolls are imposed by the proprietors of inland waterways to defray interest charges and the maintenance of the works. On British canals, anyone willing to pay the tolls is at liberty to use the canal in carrying articles in his own barges, or to act as a carrier for others. The tolls vary with the commodity carried, and a classification is enforced

not unlike that of the railways: indeed, the early railway classifications were based on the then existing canal schedules. Canal classifications have remained very similar to those of the railways, and in many cases the actual railway classes A, B, and C, and 1 to 5 are employed. As a rule, however, the numerical classes are grouped into one, and the lowest toll A may be subdivided into two, so as to give a specially low rate for things of little or no value, such as basic slag, refuse, etc. The published rates are, however, maximum tolls and, in actual practice, the rates charged are often less. Canal tolls are not computed on an equal mileage basis, but are tapered according to the distance. They taper somewhat sharply, and the lowest rate is often reached after about 30 miles as compared with the 100 miles of the railways or the usual 40 miles of road transport concerns.

Actual carriage is mainly undertaken by separate firms of carriers owning a fleet of boats and horses or tugs. There are also numerous individuals who have set up for themselves in a small way of business, owning one or two boats and a few horses, but these generally accept short distance traffic only. The carriers—large and small—are known as by-traders. They usually work on contract jobs on a “trip rate system,” whereby so much is paid per journey, and thus there is seldom a regular service to be found. Lower rates are often quoted for return loads in order to obtain full cargoes both ways. Transport charges paid by the consignor consist of two parts—the toll paid to the canal company, and a payment for the services performed by the actual carrier. The charge for capital costs and the particular expenses of transport are thus clearly differentiated. By-traders usually work on a system of “sharing,” called “thirds” or “fourths,” the

shares being calculated in both cases, not on the total receipts, but on the net freight receipts, that is, exclusive of tolls. In the case of "thirds," there are three shares. The owner takes one for the boat—which includes costs represented by interest, depreciation, and repairs, as well as working stores such as ropes, lamp oil, boat hooks, covers, etc. The captain takes the other two-thirds, out of which he pays his mate and meets any charges involved by towing, hauling, or assistance in loading or unloading. This method of payment is common on the rivers and estuaries of the North-east Coast, where the captain is regarded as a partner. In the "fourths" system, commonly used on canals, the captain receives half the net freight receipts and pays his mate's wages. One-quarter goes to the owner for the supply of the boat and the working stores, while the last share goes for haulage and towing, paid for by the owner. The owner finds the cargo and, in most cases, the return load. This method of paying the captain by tonnage, i.e. half the boat's earnings, is said to work well. In other cases the crews own their own craft and horses, and until recently these people formed a community of their own, living-in on the boats accompanied by their wives and families. Habits are now changing and the younger members are marrying outside of their own community, and "living-in" on canal boats is tending to become unpopular. This is in part due to the necessity of school attendance of the children and in part to a desire to have a permanent home.

In a few cases canal companies themselves act as carriers, as they are permitted to do so by an Act of 1845. If they elect to do so they become common carriers in the eye of the law, and cannot pick and choose their traffic as can the by-trader working to

contract. They are restricted, unlike the by-traders, in regard to the rates which they may charge by an Act of 1888. They are allowed, however, to impose charges for station and service terminals.

On the Continent tolls and dues on canals and canalized rivers are very low as the result of State aid. In France canals are toll free, being provided and maintained by the Government in much the same way as are the roads. In Germany the canalized rivers are generally toll free, while very moderate charges are imposed for the use of the canals.

The Royal Commission of 1906-09. A Royal Commission was appointed in 1906 to inquire into the condition and possible improvement of the inland waterways of the United Kingdom. Its report, issued in 1911, contains a vast amount of useful information on the subject, though unanimity was not obtained as to its recommendations. The majority recommended that four main routes should be reconstructed, connecting the Birmingham district with the estuaries of the Thames, Humber, Mersey, and Severn. As these routes intersect each other about the centre of England they are generally called "the Cross." The numerous canals and navigations forming these routes were to be amalgamated and improved so as to carry modern vessels of at least 100 tons capacity, though the Commissioners also suggested the consideration of a more ambitious scheme for 300-ton boats. They recognized, however, that the necessary capital would not be forthcoming unless the Government guaranteed the stock to be issued. They strongly advocated the appointment of a Waterways Board if the principle of unification of waterways was adopted. This, they stated, was the most urgent part of their recommendations.

The total mileage of the "Cross" would be 534 miles, exclusive of branches, or, with branch canals, 1,049 miles. The cost of reconstruction was estimated at £15,222,000, or, if branches be included, £17,517,000, though in addition the cost of acquisition would amount to another £6,000,000. At the present time, owing to the rise in prices, the cost would be probably 60 to 70 per cent greater. The recent development of road transport, and the further decline in canal traffic, make it more doubtful than in 1909 if any such ambitious schemes would be worth while. In 1920 the Chamberlain Committee recommended that English waterways should be divided into seven groups each to be supervised by a public trust, though no steps have as yet been taken to put these recommendations into practice.

During recent years some attention has been devoted to proposals for less ambitious schemes. Among these is a scheme to make Birmingham an inland port by improving its connections with the Bristol Channel. Another scheme which has now been put into execution is the improvement of the Trent from the Humber to Nottingham. Between Nottingham and Newark four new locks and weirs have been built, and the river bed has been thoroughly dredged. Barges of 100 to 120 tons burden, working in trains towed by tugs are used, and the locks are of sufficient size to take a tug and three barges at one "penning." In 1923 a Commission of the Irish Free State recommended the establishment of a Waterways Board and the immediate commencement of certain improvements. Six waterways were scheduled for improvement, the most ambitious being that of the Shannon Navigation, which included the building of a tidal dock at Limerick to give access to the sea.

The Advantages of Inland Water Transport. The main advantages of inland water transport may be summarized as follows—

1. Cheapness of transport. Little power is required to move heavy weights through water since the resistance is low, probably one-fifth of the average resistance offered by rails. The necessary dead weight that is hauled is low, and, since there is little risk of damage to cargo, insurance premiums are not heavy.

2. It is frequently possible to load and unload cargo direct to and from sea-going vessels. Where canal barges can approach vessels lying in an estuary, lighterage and dock and warehouse charges will be eliminated.

3. Canals usually cost less to construct and maintain than railways or first-class roads.

4. Barges cost less than railway wagons or mechanical road vehicles of similar capacity, and are less expensive to repair.

5. A barge can deal more efficiently with larger loads than a railway wagon or a motor-lorry.

6. Barges can load or unload at almost any point along the canal bank, whereas railways only serve stations or private sidings.

7. Canal competition helps to keep down railway rates along the line of route, and this competition serves to stimulate efficiency.

8. The ton-mile capacity of a canal for the carriage of traffic is very considerable.

9. Canals, if they took over the carriage of heavy commodities, would help to relieve the expense involved in the upkeep of the roads. In the early days of canals their construction was stimulated, because heavy traffic had made the roads all but impassable.

10. Canals are well suited for the carriage of heavy

commodities of low value, and for which speed is not necessary.

The Limitations of Inland Water Transport. Inland waterways, however, it must be admitted, suffer from serious limitations which have been increased by the modern tendency of traders to demand rapid services and quick deliveries. Waterways, except in Holland, are not so ubiquitous as roads, and it is not possible to carry them over difficult country as economically as it is railways and roads. Topographical features may render differences of level essential, because to construct cuttings, embankments or tunnels would be too expensive. Thus, locks or some other contrivance such as hydraulic lifts or inclined planes must be provided. Locks are responsible for much waste of time, and may cause difficulties in regard to water supply, while mechanical contrivances are expensive and the traffic may not justify the considerable capital expenditure. Generally, therefore, canals are confined to natural valleys and flat country. The supply, control and pumping of water often present difficulties and involve considerable expense. Further, in summer, drought may be experienced, while in winter, navigation may be impeded by ice. Rivers are also capricious unless the flow is regulated and a well-dredged and clear channel is kept. From the commercial point of view slowness of travel is the most serious defect of canal transport. Increase of speed, even where it is possible to use mechanical power, rapidly increases resistance and, moreover, the wash produced may cause damage to the banks. In Britain, trains of barges drawn by steam tugs are utilized on the Aire and Calder, the Weaver, and the Trent Navigations, but the limited size and the weak construction of the majority of the canals prevent the utilization of

mechanical haulage, and so the old-fashioned horse-drawn barge is still the rule. Mechanical haulage, it is said, causes damage to the banks of "narrow" canals if speeds over 3 m.p.h., and of wide canals if over 6 m.p.h., are attempted. In consequence of the low speed, traffic is usually limited to low-grade commodities, say, Classes 1 to 10 of the new railway classification, since delays would not be tolerated in the case of valuable articles. On a few of our more modern canals, where better speeds are practicable, goods in the higher but not in the highest classes are carried. Another difficulty is to obtain the large consignments which pay best, since traders nowadays order in small lots as a rule, and numerous small consignments are not dealt with so economically by canals as by railway or by road. Improvements in canals or new extensions are very expensive in towns, especially where the canals run through and are flanked by valuable properties. It is, however, in such places that improvement is often most called for.

The British Canal System. The British system of inland waterways may be divided into five categories: estuaries such as the Severn or the Humber; navigations such as the Aire and Calder or the Trent; ship canals like the Manchester or the Caledonian; barge canals in which the locks are over 14 ft. wide; and narrow canals where locks are under 14 ft. in width. British waterways suffer from the natural limitations which have been described earlier, but in addition the owning companies have for the most part shown a marked lack of enterprise in past years, especially when the first clash came with the development of the railways. There is an almost complete lack of co-ordination and consolidation of the various local systems which were planned in the constructional

period almost without relation to each other. There is no uniformity of depth, width, general conditions, etc., or in the dimensions of over-bridges, locks, tunnels, etc. As a result of these variations of gauge and standards only the smallest barge can navigate over any distance. On one stretch the locks may suit those long, narrow barges called "monkey boats," but in the next link of a through route the locks may be built to suit wide, short boats. On the Continent and in the New World 600-ton barges are the standard, whereas on British canals the maximum is often below 100 tons, and may sink as low as 40 tons. It is in consequence difficult to arrange for through traffic, and this is in any case very slow. Transshipment would involve too great expense, while the use of boats small enough to navigate different canals would be uneconomical, since haulage and labour costs are disproportionately high for small vessels. Further, the canal network is somewhat restricted, and many of the routes are tortuous and roundabout, while important links may be missing. The more successful inland waterways are those where a special local traffic is available, for example the Aire and Calder Navigation, the Birmingham Canal Navigations, and the Trent Navigation.

Deficient Organization. Except on a few canals, through tolls are somewhat difficult to obtain, and as canal tolls taper somewhat sharply this places through consignments passing over several sections of canal at a disadvantage. No clearing house system like that of the railways has been instituted, though an Act of 1888 provided improved machinery for determining through rates and gave powers to set up a waterways clearing house. The absence of any organized system of collection and delivery is another disadvantage. Few canals are common carriers and, in consequence,

regular services run to schedule are seldom provided. Of the 150 canals and navigations constructed in Britain since 1760, only 15 have acted as common carriers. In 1905 there were only seven, while at the present time the number has been reduced to three—the Aire and Calder, which is notable for the introduction of compartment boats for coal traffic, the Bridgwater, and the Trent Navigation. The Royal Commission of 1906-09 held that railway ownership was a contributory cause of canal decadence, and though such canals are well enough maintained—that, indeed, being a statutory obligation—the railways are apt to regard canals as an out-of-date mode of transport, and it is not to their interest to push canal traffic. It is, indeed, probable that the railways would be glad to get rid of their canals, which seldom pay their way. These canals, however, it is maintained, are important links in the canal system as a whole.

The cause of deficient organization is partly historical and partly due to lack of enterprise. As the Royal Commission on Canals stated: “With few exceptions, waterways stand to-day as they stood in the middle of the nineteenth century.” Since 1850 the extension, consolidation, modernization or enlargement of existing canals or the construction of new canals has been almost completely neglected. As the result of this lack of a progressive policy, new capital is almost impossible to obtain because the public—at least the investing public—feels that there is no future for canals. Recently, however, five separate undertakings including the Regent and the Grand Junction Canals have been amalgamated into a single concern, known as the Grand Union Canal Company. The capital of the new company is 3½ million pounds and the combined canals have a mileage of 240, the route extending from London

to Birmingham. A progressive policy has been adopted for the improvement of the system and a considerable increase in traffic has resulted.

The Future of British Canals. In regard to the possibilities of inland water transport in Britain certain broad conclusions seem to be fairly well established, though the whole question of their future has aroused a considerable amount of controversy. It must be admitted that a certain number of canals which now carry a negligible amount of traffic are obsolete, and the best policy would be to abandon them and sell the property, though in some cases they might profitably be turned into motor roads. There are, however, a number of canals and navigations better placed in regard to traffic, which would seem to be worth improving. Where necessary, these should be dredged and brought up at least to their original standard. Grouping is essential, and other improvements which might be suggested are the introduction of mechanical handling at terminals, improvement of locks, utilization of mechanical haulage, co-ordination with road transport, and the introduction of scheduled runs. Such improvements should enable these canals and navigations to hold their own, and to provide services of considerable value to the community for the carriage of coal, raw materials, and the lower grades of traffic generally.

CHAPTER VI

ROAD TRANSPORT

THE rapid development of mechanical road transport has been one of the outstanding events of the post-War period. During the greater part of the nineteenth century the railways completely eclipsed the roads (except in the case of purely local traffic), but now the whirligig of time has brought the road into its own again.

The remarkable increase which has taken place in the number of motor vehicles in use in Great Britain is shown by the following statistics—

NUMBER OF MOTOR VEHICLES IN USE IN GREAT BRITAIN,
1904-1920

Year	No. of Vehicles	Year	No. of Vehicles
1904	45,000	1913	243,000
1905	56,000	1914	307,000
1906	67,000	1915	321,000
1907	80,000	1916	345,000
1908	92,000	1917	276,000
1909	101,000	1918	189,000
1910	114,000	1919	271,000
1911	152,000	1920	551,000
1912	193,000		

Since 1921 more complete figures are available as a result of the substitution of a vehicle tax for the former petrol tax. Analysis of the figures for each quarter shows that there is a marked seasonal trend, owing to the fact that many private owners of cars and motor-cycles find it advantageous to lay up their machines during the winter months and thereby avoid the

quarter's tax. The total number of vehicles licensed is, therefore, greatest during the quarter ending 31st August, and least during the winter months.

NUMBER OF MOTOR VEHICLES LICENSED ON 31ST AUGUST,
1921-1930

Quarter ending 31st Aug.	Motor- cars	Motor- cycles	Commercial Motor Vehicles	Motor Hackneys	Miscel- laneous	Total
1921	242,500	373,200	128,200	82,800	44,082	870,782
1922	314,769	377,943	150,995	77,614	54,652	925,973
1923	383,525	430,138	173,363	85,965	58,574	1,131,565
1924	473,528	495,579	203,156	94,153	59,932	1,326,348
1925	579,901	571,552	224,287	98,833	62,767	1,537,340
1926	676,207	629,648	248,367	99,077	64,992	1,718,291
1927	778,056	671,620	274,651	95,676	68,723	1,888,726
1928	877,277	690,672	294,190	93,429	71,371	2,026,943
1929	970,275	705,025	318,253	95,798	73,725	2,163,076
1930	1,042,258	698,878	334,237	98,865	76,904	2,251,142

In the U.S.A. the growth of road transport has been remarkable, especially as regards the number of private motor-cars, and in 1929 there were more than $26\frac{1}{2}$ million motor vehicles registered in the various States. In other countries also road transport has made great strides, especially during recent years, though it has not been so rapidly developed as in the U.S.A. and Britain.

The Advantages of Motor Transport. The great development of mechanical road transport which has taken place during recent years has been due to the realization of the advantages which motor vehicles possess for certain kinds of transport work. They provide an extremely flexible means of transport, and can be used to provide door-to-door services, while only a comparatively small capital is required to inaugurate a road service. In Great Britain, with its extensive system of highways, the road goes everywhere, whereas railways and canals can provide facilities only at stations or along the line of route. Thus road transport is the most flexible of all methods of inland transport.

In the case of the private car, the advantages of having a vehicle which can be used when, where, and as the owner desires, are obvious. With the motor-bus, passengers can be taken up or set down at any point *en route*, while the vehicle has complete freedom on the road since it is not confined to a track as is the tramcar. Capital costs are low as compared with railway and canal costs, because there is no expensive permanent way to be provided for the exclusive use of the operating company. Experimental routes can be initiated without danger of complete loss of capital. If the service does not pay, the buses can be taken off and used elsewhere. Moreover, since the unit of operation is the single vehicle, capital expenditure can be more evenly proportioned to the available traffic than is possible with a railway system. Hence the motor-bus can be used to operate successfully with a light volume of traffic.

For goods traffic, mechanical road haulage has the advantage that consignments can be picked up and delivered under more diverse conditions than is possible with any other form of transport. Door to door services can be given, while carting to and from stations, wharves, etc., is eliminated, and small lots can be sent off at the most convenient time. Avoidance of transshipment means that liability to damage and pilferage is reduced, and thus packing is both less elaborate and less expensive, while troublesome claims for damage do not arise.

Many firms, such as large shopkeepers, manufacturers, and other traders, maintain their own private fleets of motor vehicles, which enable facilities to be arranged exactly as required. They are thus provided with a very flexible means of effecting collections and deliveries, while, moreover, there is very considerable

publicity value in the ownership of a fleet of smart motor vehicles.

The Sphere of Road Transport. The exact sphere of road transport for the carriage of goods and merchandise is not easy to fix with any exactitude as so much depends on the particular conditions. Generally speaking, however, mechanical road transport is most suitable where distances are greater than 3 or 4 miles, but less than 40 or 50 miles. Greater distances can be economically covered where traffic goes in van loads or where return or back loads can be arranged. Transport between manufacturing centres, cities or ports, if not too far apart, is well suited to road transport, since return loads are easier to obtain. Competition with the railways is easier in the case of the higher classes of commodities, since the railway companies enforce higher charges for these. Mechanical road transport is especially suited to the carriage of perishable or very delicate articles. In certain cases traffic may go by road even if charges are higher than by rail, because of the advantages of the door-to-door services, the elimination of terminal delays, saving in packing costs, and less risk of pilferage. Rail transport is, however, still able to hold its own, especially where distances are long, where loads are heavy, where goods are bulky, or where low-grade traffic is concerned. On the long haul the road cannot compete with the railway except in a few special cases, such as the transport of furniture. The speed of heavy commercial vehicles is limited by their own inherent mechanical nature, while legal speed restrictions have to be enforced in the interests of public safety and to prevent undue damage to the roads. On railways much higher speeds are possible and tractive effort is more economically utilized. At the other end of the scale, horse transport has still some advantages

where distances are very short, where delays in loading and unloading are considerable, and where time is wasted by congestion in narrow streets, at docks, etc., or where short delivery rounds with frequent stops are the rule. A motor vehicle represents a considerable capital outlay, and it must be kept working if it is to prove remunerative.*

The Tramway. The construction and operation of tramways involve a large capital outlay per route mile, and overhead charges constitute a very large proportion of the total cost of transport. Their great advantage lies in their capacity for handling heavy traffic. During recent years tramways have had to meet severe competition from motor-buses, but it appears that a modernized tramway can still hold its own when traffic conditions are favourable. By law, tramways are responsible for maintaining an extensive portion of the roadway, and contribute considerable sums to local rates through assessments on their track and overhead equipment. They claim that this is a severe handicap in their competition with buses.

Road Construction and Maintenance. In Great Britain there are about 179,000 miles of roads, of which 25,000 miles are in Scotland. A comparison of road mileage per square mile of area illustrates how well off Britain is as compared with other countries.

ROAD MILEAGES PER SQUARE MILE OF AREA

England and Wales .	2.6 miles	Scotland . . .	0.8 miles
France	2.0 ..	Germany . . .	0.8 ..
Ireland	1.9 ..	Austria . . .	0.3 ..
Italy	1.2 ..	Canada . . .	0.2 ..
Japan	1.0 ..	Spain	0.14 ..

* See Fenelon, *Economics of Road Transport*, Chapter IV.

Since the War there has been a great improvement in British roads, and they are now unsurpassed by those of any other country. The demand for better and better roads is still strong, however, as traffic on them is increasing day by day. In other countries there is also a noticeable movement towards the betterment of roads, and a great deal is being done to provide for the new requirements.

TOTAL EXPENDITURE ON ROADS AND BRIDGES IN
GREAT BRITAIN*

(Including expenditure out of loans but excluding loan charges)

Year	£	Year	£
1910-11	14,631,097	1920-21	43,047,686
1913-14	18,040,917	1921-22	49,328,609
1914-15	18,138,872	1922-23	50,165,104
1915-16	14,309,698	1923-24	50,556,085
1916-17	12,213,606	1924-25	56,484,803
1917-18	12,525,506	1925-26	59,093,489
1918-19	13,601,722	1926-27	58,636,994
1919-20	26,630,428	1927-28	58,798,707

In Great Britain the maintenance and repair of *main* roads and bridges is within the jurisdiction of the County Authorities, other roads being maintained by the Borough, and Urban, Councils. Grants are made from the Road Fund—moneys collected by means of motor taxation—towards the cost of maintenance of roads and bridges. For Class I roads a grant of 50 per cent is made (75 per cent for certain roads in Scotland), for Class II roads 25 per cent, and, in addition, some money has been given for the upkeep of rural roads. Grants are also made for the construction of new and important arterial roads, many of which

* Compiled from the Report on the Administration of the Road Fund for the year 1929-30.

have been expedited during recent years as unemployment relief works.

The increased cost of roads in the post-War period is not all due to increased motor traffic, as costs have been swelled by the rise in general prices, and by arrears of maintenance postponed during the War. To set against the increased costs of maintenance there has been an increased yield from motor taxation—

MOTOR TAXATION RECEIPTS

Year	Gross Receipts, £	Year	Gross Receipts, £
1921	10,042,000	1926	18,685,000
1922	11,480,000	1927	23,000,000
1923	13,124,000	1928	25,002,000
1924	15,190,000	1929	25,586,000
1925	16,961,000		

The Road Fund, out of which grants are made to local authorities by the Ministry of Transport, is credited with the revenue from motor vehicle licences *less* one-third of the duty paid on private motor-cars and motor-cycles, which share is retained by the Exchequer for general revenue purposes.

In addition there is a tax on petrol, but the receipts from this go to general revenue, not to the Road Fund. For the year 1929-30 the Petrol Tax yielded over £15 million, of which about £14 million represented the taxation of petrol used by motor vehicles. In 1931 the tax was raised from 4d. to 6d per gallon.

Road Transport Rates and Fares. In general, road transport rates and fares are determined under competitive conditions. Competition tends to fix charges according to the cost of service, so that receipts, after all working expenses have been met and an allowance made for depreciation, will afford ordinary profits and

interest on capital. Sometimes, however, competition becomes acute, and complaints are then heard of "rate cutting." This cannot continue indefinitely, and in time the weaker concerns will be forced out of business. At other times monopolies may be obtained, and where this is the case rates will be based on "what the traffic will bear." Undue exploitation of the public, however, is usually prevented by the fear of attracting competitors if profits are too large, and by the competition of other forms of transport.

Tapering rates are usually charged for the transport of merchandise by road, though after a certain mileage the rates become flat rates. Thus, for 3 miles the rate might work out at 3s. per ton-mile, but as the distance increased, the rate per mile would fall till the scale became a flat rate scale at about 10d. per ton-mile. Some firms taper their rates by the device of distributing their overhead expenses as a terminal charge, and quoting so much per mile for the distance carried. Tapering charges are justified in that, on the long haul, terminal expenses are reduced and delays are avoided. They also enable traders to compete at longer distances from their bases. In passenger fares the principle of a tapering charge is sometimes adopted by motor-bus companies, while taxi fares are so much for the first mile and generally somewhat less for the later miles.

Goods rates usually vary with the amount of the consignments, a higher charge per ton being enforced for small lots, because it is more difficult to secure a satisfactory load from a number of small packages, and because it is more expensive to collect and deliver numerous small consignments. Lower rates may also stimulate larger loads. There are frequently three scales in operation, one for small lots, a lower rate for

larger consignments, and a yet lower rate for full lorry loads.

What appear to be discriminatory or differential charges are sometimes to be found even under competitive conditions, and different prices per ton-mile may be charged for different classes of goods or for different journeys. An interesting case is that where return loads are involved. The cost of such a service is of the nature of a joint cost, as the two loads together must meet the cost of the run out and back. A lower rate is justified for the return journey if otherwise the lorry would have to return empty, and the outgoing load would have to meet the whole expense for the two trips. Other examples of discriminatory ton-mile charges are: (1) Merchandise bulky in proportion to weight, where the unit of charging might be more properly the lorry space occupied than the weight; (2) valuable or very fragile articles are properly charged at a higher rate per ton as a kind of insurance premium, though alternatively an owner's risk rate might be quoted.

The Problem of the Return Load. Though in certain circumstances a lower rate is justified if a return load can be thereby obtained, the problem of the return load is beset with difficulties. From the economic point of view, just as it is essential that vehicles should be kept standing idle for as short a time as possible during the working day, so it is desirable that vehicles should be kept fully loaded all the time they are on the road. In this way unnecessary waste would be eliminated and a reduction in costs per ton-mile would be effected. With this object in view, attempts have been made to build up an organization throughout the country of return load bureaux or freight exchanges, which would put road hauliers in touch with traders

requiring transport facilities in the required direction. So far, however, the freight exchanges have not been very successful, though some such organization seems to be required. Many road hauliers dislike the exchanges because they fear that the establishment of such institutions may have the result of beating down return rates and that this will react upon ordinary rates in those districts where return loads are sought. One man's return load may be another man's outgoing load, and any reduction in charges for back loads, though justifiable from the individual operator's point of view, may lead to "rate cutting" where competition for loads is keen. This would be disadvantageous to the industry as a whole if it brought rates below an economic level.

Motor Transport in Undeveloped Countries. Where roads are bad or non-existent, there would seem to be great possibilities for "creeper track" or "roadless" vehicles of a type similar to the mechanized vehicles of the Army. Instead of destroying the roadway, these vehicles tend to consolidate and harden it. The problem in undeveloped countries is to find a mode of transport more efficient than the human porter, the pack animal, or the bullock cart, which does not require an expensive highway. In many parts of Africa the tsetse fly prevents the use of animal traction, while elsewhere epidemic diseases such as East Coast fever or rinderpest may cause interruption in its use. In Africa it is said that the cost of getting produce to the railways even with good animal transport is frequently as much as five to nine times the cost per ton-mile by railway. Roadless vehicles could be used to provide feeders to the railways, and should thus prove of considerable importance in opening up new regions to trade and commerce.

CHAPTER VII

THE RELATION OF ROAD AND RAIL TRANSPORT

A GREAT deal of controversy has recently centred around the question of road and rail competition. It would seem best, therefore, to attempt no more than to state as fairly as possible the main arguments on either side, so that the reader may be in a position to draw his or her own conclusions.

It is generally admitted that road transport can offer attractive facilities for certain types of traffic, both passenger and goods, and that in consequence a great deal of traffic now passes by road which might be carried by the railways. Some of this is new traffic created by road transport, while part has been captured from horse transport. Road transport has brought some traffic to the railways by putting stations in touch with outlying districts, and, moreover, the railways have benefited by increased traffic in petrol, roadstone, tar, etc. A certain amount of traffic has, however, undoubtedly been captured from the railways. Some of this the railways could probably regain by improvements in operating, such as speeding up trains, running more frequent services, adopting autocar trains, curtailing delays due to transshipment, increasing the use of containers, and extending facilities on the passenger side.

The railway companies, however, used to assert that road competition was "unfair," because local rates paid by them went, at least in part, to the upkeep of the roads which their competitors used, though now the position has been somewhat modified by the De-rating Act of 1929.

Railways, moreover, were, until recently, debarred from using roads for the direct transport of their traffic, though carting to and from stations was allowed. They complained that in some districts they paid the greatest proportion of the local rates, and that they got little or no return on this expenditure, in those parishes where they have no stations, depots, or other buildings. It is also asserted that the special taxation of motors does not cover the cost of the damage which these vehicles do to the roads, whereas the railways have to meet the entire cost of their permanent way. Under the 1921 Railways Act, it is provided that railway rates are to be raised if the "standard revenue" is not earned, but if the valuable high-grade traffic is taken by road transport, rates would have to be raised on lower grade commodities such as coal and iron, which are so important to industry.

The railway companies also complain that they are restricted in a variety of ways by Governmental regulations and legal disabilities, e.g. the law of undue preference, law of common carriage, Ministry of Transport Regulations, whereas their road competitors suffer from very few restrictions. The position, however, has recently been somewhat altered by new legislation, e.g. Road Traffic Act, 1930, and the remission of the Railway Passenger Duty.

These arguments are controverted by the road transport interests, who point in the first place to the economic and social advantages conferred on the community by the use of motor transport. New areas have been opened up, people have been encouraged to live outside congested towns, while the amenities of the towns have been brought within the reach of the rural dweller.

It is pointed out that the highways are used by the

general public (including pedestrians and cyclists), horse traffic, cattle, and other live stock, all of which pay no special tax for their use of the highways. Even the railways rely on the roads for collecting and distributing their traffic. The highway is the universal way-leave provider for telegraph and telephone posts and cables, gas, water, and electricity mains, and for sewers and drainage. Roads provide access to property, and in towns enable light and air to reach buildings. Local rates for road upkeep are, therefore, not imposed alone for the benefit of motor vehicles.

It is maintained that in the aggregate the rates paid on garages, petrol stores, and the offices, etc., of road transport companies, amount to a considerable sum. Under the present system of taxation, it is asserted that the motor transport concerns pay heavily for the use they make of the roads. Of the sums thus raised one-third goes to the general purposes of the State, and in 1926 the accumulated surpluses of the Road Fund were appropriated by the Chancellor of the Exchequer.

In evidence before the Royal Commission on Transport, Mr. H. H. Piggott, C.B., C.B.E., representing the Ministry of Transport, estimated that the total all-in cost of roads and bridges per annum including police duties was £61 millions. The total revenue from vehicle duties and petrol used for motoring purposes amounted to just over £36 millions. To this should be added £7 millions from the increased petrol tax of 1931, leaving a balance of about £18 millions.

Railways and Road Powers. A kindred question which has aroused much discussion is that of road powers for railways. Until recently, the railway companies were prevented from using the roads to provide direct road services. It was argued by the railway

companies that considerable economies could be introduced if such powers were obtained. Collection and delivery services could be extended with beneficial results, as has been proved at Hull, where goods are brought direct by road to a central transshipment depot of the L.N.E.R. Road services would offer an alternative to the "Pick Up" goods train or the railway "Road Van" system, and quicker services could be given. Opposition, however, was strong, as it was feared by many persons that the big railway groups with their great capital resources might obtain a virtual monopoly of the means of inland transport. Thus competition from road carriers would be eliminated, and the stimulus afforded by that competition would disappear, though it would still be open to traders to employ their own private fleets and thus maintain a certain amount of competition.

In the summer of 1928, after protracted proceedings before a Select Committee of the Houses of Parliament, the four large railway companies obtained the power to operate road vehicles, which they sought. Stringent regulations, however, were inserted in the Acts to prevent any monopoly being obtained by the railway companies.

The Road Traffic Act, 1930. The Road Traffic Act, 1930, constitutes the most important piece of legislation which has yet been passed for the regulation and control of road transport in Great Britain. During the past ten or fifteen years mechanical road transport has developed out of all recognition. New legislation was long overdue, as the law had not kept pace with technical and economic developments.

The Road Traffic Act, 1930, is extremely comprehensive, and it lays down numerous regulations regarding both private and public vehicles. It regulates the

speed permissible for various types of vehicles; sets up new licensing authorities known as Traffic Commissioners: establishes strict regulation of public passenger road services; regulates the hours and conditions of road transport employees, confers important new powers on municipalities operating passenger services; provides for compulsory insurance against third-party risks; and lays down that the wages of road transport workers shall be fair wages. Among the most important innovations of the Act is the setting up of eleven Traffic Areas in England (including the Metropolitan Traffic Area) and two in Scotland. In each area three Traffic Commissioners are responsible for the licensing of public passenger vehicles. Before the Acts came into force there were 1,100 separate licensing authorities in England and Wales and 234 in Scotland, while the regulations concerning licensing dated back in England to 1847 and 1889, and in Scotland to 1892. It should now be possible to take a broader view of road passenger services as a whole, and to take further steps to co-ordinate all forms of passenger transport under the regulations of the Act.

When the Act comes fully into operation one phase in the development of mechanical road transport since the War will be definitely concluded, and a new era will be inaugurated in which a much greater degree of State control will be a characteristic feature.

Co-ordination of Road and Rail Transport. As a possible solution of the roads versus rail controversy there has been an increasing tendency to search for some compromise whereby the two methods might be co-ordinated. Under such an arrangement, each form of transport would work in the economic sphere best suited to its characteristics. The railways would hand over traffic which they obtained for short hauls if that

could be better carried by the roads, and *vice versa*. Services would be worked in conjunction, through rates and fares would be quoted, and there would be regular methods for effecting this transference. Railway goods sheds and transhipment depots could be utilized for the purpose and as receiving depots for both kinds of traffic, and for this service the railways would be entitled to a fee.

Such co-ordination might be achieved in a variety of ways. *Firstly*, co-ordination might take the form of *voluntary co-operation* between road and rail companies, each maintaining its separate identity. In this type of co-ordination road and rail would be more or less equal partners. *Secondly*, co-ordination might be achieved through the provision of road motor services by railway companies or through financial control of road concerns by railway companies. In this form of co-ordination road transport would be definitely subsidiary or auxiliary to the railways. *Thirdly*, co-ordination might be quasi-legal in character. The various transport concerns would be required to compose their differences and to evolve a system of co-operative working. Failing voluntary agreement, authority would step in and set up a compulsory scheme of co-ordination. This species of co-ordination would mean the recognition of some form of monopoly, of compulsory participation in the scheme, and of some measure of control in the public interest.

Recent Development in Great Britain. In great Britain, as a result of various agreements and mergers effected by the railway companies with important motor bus firms, there is now a large measure of co-ordination as regards road and rail passenger transport. For example, road and rail tickets are inter-available on certain routes; bus and train time-tables have been

dovetailed into each other; unremunerative branch lines have been closed to passenger traffic and motor bus services substituted; and through-booking by road and rail is available in certain districts.

As regards goods traffic there has not been the same tendency towards amalgamation between road and rail interests. This difference has been partly due to the desire of the railway companies to organize road services for goods as a definite auxiliary to their rail services, and partly to the differences of economic organization of passenger and goods transport by road. Recent developments such as railhead deliveries, rural lorry services, radial motor services, and the increased use of containers, have all been introduced with the object of securing that part at least of the journey will be made by rail whenever possible. Where local road haulage facilities are provided by railway companies in connection with these services, this is merely subsidiary and is not the main object of the services. The new facilities afford excellent examples of adequate road and rail co-ordination. Railhead distribution in particular combines the advantages of bulk transport at high speed which is given by the railways, with the advantages of door-to-door services at times and in quantities most suitable to the needs of each individual consignee, which are possible only by using the flexible motor vehicle.

CHAPTER VIII

AIR TRANSPORT

AMONG modern inventions there is none which appeals more to the imagination than the conquest of the air. For ages man has dreamed of flight, and now, after countless experiments and much heartbreaking research, not only has flight been achieved, but its possibilities as a commercial mode of transport have been clearly demonstrated.

Air transport possesses the great advantage of speed. One hundred miles an hour is a possible average speed for commercial aircraft, and this represents a considerable gain over other methods of transit. Moreover, unbroken journeys over land, sea, desert or difficult country are possible, and the delays, expense, and inconvenience of transshipment are thereby avoided.

During the War, rapid strides were made in the production of aeroplanes, highly efficient for war purposes. Attention was devoted, however, not so much towards the increase of aerodynamic efficiency as to the building of machines carrying powerful engines and, therefore, possessed of great speed and climbing capacity as well as having considerable weight-lifting powers. But in commercial working the main factors are safety, economy, and ease of operation. Cost was of secondary importance during the War, but in commercial operation it is a vital question.

The first commercial air service, apart from pleasure trips or the carriage of mails, was that inaugurated between London and Paris in August, 1919. In November a duplicate service was started by another

AIR TRANSPORT BETWEEN GREAT BRITAIN AND THE CONTINENT
(Excluding Channel Islands)

Year	British		French		Dutch		Belgian		Others		Total		Percentage British Total	
	Flights Carried	Pass. Carried	Flights Carried	Pass. Carried	Flights Carried	Pass. Carried	Flights Carried	Pass. Carried	Flights Carried	Pass. Carried	Flights Carried	Pass. Carried	Flights %	Pass. %
1920	2,854	5,799	657	486	3	—	104	98	4	—	3,622	6,383	79	91
1921	993	5,256	1,565	4,352	366	480	421	630	52	13	3,397	10,731	29	49
1922	2,891	9,490	1,463	2,306	580	562	2	1	3	—	4,939	12,359	59	77
1923	2,559	11,947	1,066	2,198	548	957	390	12	12	22	4,575	15,136	55	79
1924	2,794	10,456	1,347	5,619	563	1,559	4	8	130	216	4,838	17,858	58	59
1925	2,891	10,602	1,640	7,753	684	2,163	—	—	75	203	5,290	20,721	55	51
1926	2,879	15,450	1,517	6,368	726	2,352	243	1,105	155	249	5,520	25,524	52	61
1927	2,489	16,533	1,534	5,199	807	3,586	353	1,466	631	1,980	5,814	28,764	43	57
1928	3,120	24,810	1,865	8,562	1,114	5,611	610	2,064	901	2,132	7,610	43,179	41	57
1929	3,244	26,182	2,869	11,031	1,531	6,837	610	2,085	982	2,118	9,236	48,253	35	54

British company. In 1920 two additional British companies began operations, and new routes were opened up between London and Brussels, Amsterdam and Copenhagen. Competition with subsidized French lines became keen in subsequent years, and subsidies had to be given by the British Government. In October, 1921, owing to financial difficulties, a reorganization was effected by which each of the four British companies was allotted a separate route. Avoidance of competition, it was hoped, would bring prosperity to the companies. Financial stability, however, was not secured thereby, and in 1924 all the British companies engaged on Cross-Channel services were united into a single concern—Imperial Airways, Ltd.—to which a loan of £1,000,000 was advanced by the Government, free of interest, over ten years. Amalgamation, it was expected, would promote economy in working, and put the air lines in a better position for future developments. In return for the loan and other subsidies, Imperial Airways, Ltd., agreed to fly a certain mileage each year. The routes flown at present are: London—Paris; London—Paris—Basle—Zurich; London—Brussels—Cologne; London—Karachi—Delhi; and London—Africa. The first of the Imperial Air Routes, that between England and India, was commenced in 1929 by a service to Karachi, and towards the end of the same year this route was extended to Delhi. A saving of from 5 to 9 days in transit has been effected, and the air mail services provided have proved very popular.

The policy of Imperial Airways, Ltd., has been to reach the self-supporting stage as soon as possible, rather than to adopt the more spectacular though short-sighted policy of increasing mileage and the number of routes flown without due regard to the traffic available. British aviation has now obtained

a position second to none in regard to efficiency and safety.

BRITISH AIR TRANSPORT ON REGULAR ROUTES
(Internal, Continental and Imperial)

Year	Machine Flights	Machine Mileage	Passengers Carried	Cargo Carried (Tons)
1920	2,854	644,000	5,799	137.0
1921	993	225,000	5,256	19.4
1922	3,625	717,000	10,393	214.6
1923	4,765	943,000	15,552	328.1
1924	4,859	936,000	13,601	542.8
1925	4,424	862,000	11,193	550.0
1926	4,777	840,000	16,775	679.0
1927	4,856	873,000	19,935	593.3
1928	6,322	1,136,000	28,483	817.6
1929	6,923	1,386,000	29,312	938.9

BRITISH COMMERCIAL FLYING OTHER THAN ON THE
REGULAR AIR ROUTES*

Year	Machine Flights	Machine Mileage	Passengers Carried
1920	23,949	315,000	36,497
1921	22,159	226,000	37,424
1922	14,009	127,000	25,933
1923	20,114	108,000	34,683
1924	23,491	137,000	43,621
1925	33,061	169,000	66,503
1926	42,843	215,000	81,909
1927	44,445	222,000	90,695
1928	48,910	236,000	97,619
1929	53,825	328,000	123,497

British aircraft, flying on regular routes, has been remarkably free from accident. Between August, 1919, and December, 1929, there were only nine accidents involving fatal casualties and five involving non-fatal

* *N.B.* All firms do not render returns, and figures are, therefore, somewhat lower than they should be, especially for 1926.

injury. In this period well over eight-and-a-half million miles were flown. In all, 25 passengers have been killed and nine injured. Between August, 1919, and December, 1924, the average distance flown per accident resulting in death or injury to the occupants of the machines was 357,000 miles. For the years 1925 to 1929 it was 1,279,000 miles, thus showing a very great increase in the margin of safety.

Ground Organization. Ground organization is the term used to designate all those services and facilities that are essential for the preparation of machines for flight and for their taking off, landing, and control when in the air. Ground organization includes not only the aerodromes, landing grounds, hangars, repair shops, etc., but also the wireless and meteorological stations, control towers, day and night wind indicators, search-lights, floodlights, lighthouses, and neon beacons for use during fog, besides the ordinary facilities necessary for passenger and goods traffic, such as waiting-rooms, custom and immigration offices, etc. Many of these items are very expensive to provide and maintain and, indeed, ground organization is the most costly part of an air line. Expenses do not, however, increase in proportion with an increase of traffic, and, consequently, it follows that intensive operation—provided that traffic can be obtained—is more economical.

Ground organization is an essential factor in the successful operation of an air fleet. On it depend the safety, regularity, and reliability of the machines, and the possibility of flight during fog and at night. Improved ground organization has enabled the air transport lines to provide services which would have been impossible in the same weather a few years ago.

The Sphere of Air Transport. The high speeds possible by air transport—passing without interruption

over both land and sea—give it a definite place among the various methods of transport.

Passenger traffic, though seasonal, has been of greatest importance during the earlier years, though more recently there has been a larger comparative increase in goods traffic. Many persons are willing to pay high fares for rapid journeys. In part, however, the higher fares are offset by savings in tips, Pullman and sleeping car surcharges, etc. On the Paris-London route both British and French companies give cheaper fares to passengers travelling early in the morning, as it has been found that those able to afford higher rates will avail themselves of a more convenient hour, later in the day. Passengers are normally allowed 30 lb. of luggage free., but any excess above this has to be paid for.

As regards goods traffic, it is natural that owing to the higher costs only expensive articles or samples will be sent by air. During the past years the chief articles carried have been gold and other precious metals, securities, paper money, gems and jewellery, ladies' dresses, millinery, furs, newspapers, electrical apparatus, wireless valves, loud-speakers, motor-cycles, perfumes, live stock, mails, and a great variety of salesmen's samples. Bullion, securities, and financial documents are now generally sent by air between London and Paris and other centres as a considerable saving in interest can be effected. Thus, if the time of transit be shortened by only one day there will be a saving of £5 on every £36,500 if the rate of interest be 5 per cent. The danger of damage to delicate articles such as wireless valves and scientific instruments is greatly reduced, and the risk of pilferage is practically eliminated when articles are sent by air transport, as there is no handling except at the terminals. In consequence,

insurance premiums are lower than by surface transport. Between London and Amsterdam freight insurance premiums amount to 3s. per cent by air, but by surface transport the rate is 6s. 8d. per cent. Between London and Paris the difference in favour of air transport is as much as 4s. 8d. per cent, and between London and Cologne 3s. 6d. per cent.

Another important factor telling in favour of air transport is the acceleration in Customs examinations effected by mutual national agreements, as compared with the normal methods of examining consignments sent by surface transport. Terminal delays are also minimized by the fact that the air companies provide motor transport to and from aerodromes.

Freight rates are based on a sliding scale according to the weight of the consignments. Classifications are not in force, though *ad valorem* rates, which include compulsory insurance, are charged on precious metals, jewellery, furs, etc. Special rates are applicable to regular large consignments and to deferred traffic, while bulky articles may be charged according to cubic capacity at the option of the company.

The Limitations of Air Transport. At the present time air transport suffers from certain limitations, of which the following seem to be the more important.

1. Only articles which can afford a high rate for speedy transport can be sent by air.

2. The useful load per machine or per horse-power is small, and bulky articles cannot be accepted for transit. The size of machines, however, has tended to increase during recent years, and some British commercial aeroplanes can carry 40 passengers and 1,200 lb. of luggage, and are fitted with refreshment buffets.

3. Operating costs, both running expenses and fixed charges, are high, though they are being gradually

reduced. Machines, which are not yet standardized, rapidly become obsolete.

4. Fogs interfere considerably with commercial operations, and surface transport may have to be utilized at such times.

5. Night flying is only in the experimental stages, mainly because ground organization is not yet sufficiently developed.

6. British commercial air routes to the Continent, partly because of international complications, are too short to give any great advantage in the case of letter mails.

Considerable developments are taking place from year to year, and, indeed, in certain directions the technical progress that is being achieved is astonishing. It is probable, therefore, that as time goes on the limitations under which air transport at present labours will be considerably reduced. Danger from engine failure is being lessened by the introduction of large three-engined or four-engined aeroplanes which can reach their destination even if one of the engines entirely fails. In this development Imperial Airways, Ltd., are the pioneers. The use of air-cooled engines, the introduction of the all-metal aeroplane, the use of directional wireless, lighted airways for night flying, neon beacons, and the introduction of better navigating instruments, are some of these recent improvements which are being utilized to better the services. Improvements in recent years, it is said, have reduced costs per ton-mile from 4s. 2d. in 1922 to 1s. 10d. in 1926. This is a very remarkable achievement.

Subsidies. Subsidies have been granted by practically all nations to encourage air transport development. It has been held (except in the U.S.A.) that subsidies are necessary in the early years of experiment before

traffic is built up. In Great Britain, however, the policy has been to encourage the air lines to reach the self-supporting stage as soon as possible. In 1926-27, Imperial Airways, Ltd., covered about 48 per cent of their costs by earnings, whereas in Germany only about 30 per cent was met. Subsidization is also advocated for military reasons, as the commercial air fleets provide a reserve, and the development of ground organization adds to the value of service aircraft. Foreign governments have given heavy subsidies, and this has made it inevitable that British air lines should have a countervailing subsidy. Finally, air transport forms an invaluable link in Empire communications, and for this reason it has been encouraged by governments. Thus steps are now being taken to build up a complete system of air communications for the British Empire, and already a start has been made on the London-India route and on a London-Capetown route.

Types of Subsidies. Subventions to commercial air transport have taken many forms. In Great Britain, after several types had been tried, a horse-power mileage basis for the payment of the subsidy has been adopted, as this, unlike the earlier method of basing payments on mileage, does not encourage the use of small machines in preference to large. In Germany subsidies are paid on the kilometric basis, and in addition the State provides grants for ground organization. There local authorities and local commercial interests have also done a great deal to encourage air transport, and the remarkable development of the German air lines, since the post-War restrictions were withdrawn, is largely due to this encouragement. Germany, indeed, has become the centre for air routes in Europe.

Air services are now operated in most European

countries, including Britain, Germany, France, Holland, Italy, Belgium, Austria, Denmark, Poland, Soviet Russia, and Sweden, and in practically every case a subsidy is granted by the Government concerned.

Commercial Flying Other than on Regular Air Lines.

Aeroplanes have been successfully employed on numerous types of work in addition to regular air line transport. Aerial survey and photography—a branch of aviation of great service in wartime—has proved very successful for commercial and Government purposes. The best results are obtained from vertical photographs, but as these are expensive, oblique photography is utilized where detail is not essential, as a wider area is covered in each photograph, and this method is, therefore, cheaper. Air surveys have proved their worth in Canada, the U.S.A., Siam, and in a survey of the Irrawaddy Delta. Aerial photography has been found useful for town planning, archaeological research, advertisement, preliminary surveys for railways, power lines, water power development, classification of timber, etc. In Canada regular forest fire protection patrols are in operation, and experience has demonstrated that in certain circumstances these aircraft patrols are the most efficient method of forest protection.

Among other uses of aircraft may be mentioned the prevention of smuggling in Vancouver Harbour, fishery protection in Canada, ambulance and medical services in New Zealand, British Guiana, and Siam, and dusting of cotton and other crops for protection against insect pests in the U.S.A. Aeroplanes have been used largely by prospectors and gold-mining concerns in out-of-the-way places. For example, gold was discovered at Edie Creek (Bulolo) in New Guinea, but owing to the difficult nature of the country the cost of ground transport was found to be almost

prohibitive. The goldfields are situated some 65 miles inland, at an altitude of 10,000 feet. There is no road, and part of the track is so steep that men have to haul themselves up by means of a rope. On foot the journey takes 8 days, and only 40 lb. can be carried by each man. The aeroplanes take one hour, and each machine can carry 1,500 lb. of useful load. The goldfields are almost entirely dependent on aeroplanes for supplies, mails, passenger services, and the carriage of their product.

The Commercial Airship. Up to the present the progress of commercial lighter-than-air machines has been slow. During the War the aeroplane overshadowed the airship, and those large lighter-than-air machines that were built were evolved on empirical lines from their predecessors, and were not the fruit of further research work. Moreover, they had to be able to reach high altitudes, and this meant a certain sacrifice of structural strength. In Great Britain since the War, airship development has had a somewhat chequered history. For reasons of economy, in 1920 the Government decided to suspend all experiments and research on airships. In 1924, as a result of agitation, the matter was reconsidered, and, in view of the importance of air transport development to the British Empire, it was decided to adopt an experimental programme spread over a period of years. Two large airships of 5,000,000 cub. ft. capacity were commenced, one by the Government (R101), and another by the Airship Guarantee Company (R100), but, unfortunately, as the result of an accident, the R101 was completely destroyed on a flight to India in 1930.

Though it has still to be proved by practical experiment that airship fleets can be operated with commercial success, the technical experts see no insuperable

difficulties in the way of carrying out regular long-distance flights. Considerable experimental work has been undertaken in this country and in Germany. Moreover, the larger the airship the greater is the safety factor, as structural parts can be strengthened. The modern mooring mast has revolutionized airship operation, since airships need not now be brought into their sheds at the end of a voyage, and large squads of 200-300 men are no longer required.

If the experiments in airship building should bear fruit in the future, a great step forward in imperial communications could be effected, the importance of which it is not easy to exaggerate.

CHAPTER IX

THE COMMUNICATION OF INTELLIGENCE

The Post Office. Regular posts were instituted at an early date to serve the needs of government and administration, but it was not until the mediaeval period that public services were introduced by private individuals to serve the needs of merchants and university students in certain European countries. In England postal history commences in the sixteenth century, when both government and private posts were established. Gradually, however, the private posts were absorbed by the State, and it came to be accepted that the letter post ought to be a government monopoly, as only in this way could a cheap and uniform service be maintained between all parts of the kingdom. It was, therefore, made illegal for anyone to undertake the carriage of *letters* for hire, though no restrictions were placed on the carriage of parcels.

The Penny Post. The modern British postal system is the result of the epoch-making reforms introduced in 1840 through the influence of Rowland Hill. Before this time postal rates were very high, and varied with the distance over which letters were sent.

Rowland Hill's name is popularly associated with the introduction of the "Penny Post," though he is also to be credited with an important series of reforms of which the penny post is but one.

The essential features of the reforms of 1840 were (1) uniformity of charge whatever the distance, (2) penny postage, (3) prepayment, and (4) use of adhesive stamps.

At first prepayment was not popular, but it was

essential, as it did away with the need of elaborate accounts. Rowland Hill relied on an increase of correspondence to make up for the reduction of charges, and he was so far justified in that the number of letters posted increased from 82 millions to 169 millions per year. Despite this increased turnover, however, a loss of revenue occurred for several years. The penny post was retained and, eventually, it proved very successful. During the War, rising costs led to an increase of rates, and at present the minimum charge remains at $1\frac{1}{2}$ d.

Uniform rates have the advantage of simplicity and convenience, while, moreover, they are both possible and justifiable because the heaviest part of the cost of providing postal facilities is not transport but the expense of collections and deliveries. This fact was perceived by Rowland Hill, who stated: "I found, first, that the cost of conveying a letter between post town and post town was exceedingly small; secondly, that it had little relation to distance; and, thirdly, that it depended much upon the number of letters conveyed by the particular mail." In 1857 uniform postal rates were adopted by the United States, while in 1874 the International Postal Union was formed, and this convention has been the means of greatly facilitating the transit of letters from one country to another.

The following figures illustrate the work carried out by the British Post Office during recent years—

	1928-29	1929-30
Letters, etc.	6,230,000,000	6,400,000,000
Parcels	154,500,000	160,500,000
Registered letters and packets	59,300,000	59,600,000
Express delivery	1,894,000	1,977,000

Post Office Charges. Postal charges are based partly on values and partly on cost of service. There is some analogy to railway methods, since the value of the article transported determines the differentiation in rates, as, for instance, between letters, circulars, parcels, and newspapers. To some extent cost of service enters into the fixation of charges, as rates increase with weight, e.g. the parcel scale, or there may be higher charges for speed, e.g. the express letter surcharge.

The Telegraph. The electric telegraph was first utilized on a large scale by the railways. Later, companies were promoted to provide public services, and by 1850 one of these companies—The Electric Telegraph Company—had some 1,500 miles of wire in Britain connecting the more important towns. At first charges were heavy, and as much as 12s. was exacted as a minimum for a message sent from London to Edinburgh. As time went on, costs were reduced, and by 1870 rates (then based on a zone system) had fallen to 1s. up to 20 miles, 1s. 6d. up to 200 miles, and 2s. beyond 200 miles. In 1870 the private companies were bought out by the Government, following the example of France, Prussia, Austria, and Switzerland, and, at the same time, shilling telegrams for any distance were instituted. In 1885 sixpenny telegrams were introduced, and in 1897 it was decided to deliver telegrams free of charge up to three miles from the terminal post office. (Since the War, rates have been raised to compensate for increased costs of operating.) Reduction of charges led to a great increase of traffic, in which business messages and the distribution of market prices bulked large, but during recent years the growth of the telephone has tended to reduce the use of the telegraph. In 1927-28 the number of telegrams transmitted was some 59 millions and in 1929-30 nearly 57 millions.

The Telephone. Invented in 1877 by Edison and Bell, the telephone rapidly became popular in the United States. Elsewhere development was slower and was limited to relatively short distances. In Britain competing companies sprang up and, in consequence, the usefulness of the system was restricted, since subscribers found difficulty in getting calls through to another company's exchanges. A process of consolidation followed and, eventually, the National Telephone Company absorbed practically all its rivals and established a monopoly stretching over all parts of the country. In 1913 the Government purchased the business of the company, though in the United States, it may be of interest to note, the telephones remain in the hands of private enterprise. In Britain there has been a marked increase in the number of subscribers since the War, and, as the number of subscribers grows, the usefulness of the system is naturally enhanced.

TELEPHONE CALLS IN THE UNITED KINGDOM

	1922-23	1923-24	1926-27	1928-29	1929-30
Local calls	730,000,000	832,000,000	1,101,000,000	1,265,000,000	1,322,000,000
Trunk calls	59,500,000	70,300,000	95,700,000	111,300,000	119,000,000

A comparison of the number of telephones in proportion to the population in different countries yields some interesting results, as can be seen from the statistics given on page 94.

The Submarine Cable. As far back as 1840 Morse experimented with submarine cables, but it was not until 1858 that the first partial success was achieved in transmitting messages across the Atlantic. Before complete success was obtained, great expense was incurred and considerable technical difficulties had to be overcome.

NUMBER OF TELEPHONES PER 100 PERSONS, AS AT 1ST JAN., 1930

U.S.A.	16.9	Great Britain and	
Canada	14.4	N. Ireland	4.2
New Zealand	10.8	Netherlands	3.7
Denmark	9.4	Finland	3.4
Sweden	8.3	Austria	3.2
Australia	8.2	Belgium	3.2
Norway	6.6	France	2.6
Switzerland	6.5	Argentina	2.4
Germany	5.0		

NUMBER OF TELEPHONES PER SQUARE MILE ¹

Netherlands	22.8	France	5.0
Belgium	22.0	Sweden	3.0
Denmark	21.4	New Zealand	1.5
Great Britain	21.2	Norway	1.5
Switzerland	18.0	Canada	} Under 1
Germany	17.0	Australia	
Japan	7.0	Finland	
Austria	6.7	Argentina	
U.S.A.	6.6		

In the operation of cables it is essential that all delays in forwarding messages should be reduced to the minimum, and that at the same time charges should be moderate. In the years just after the War there were some grounds for complaints in regard to speed and regularity, when, owing to terminal delays, messages often took several days to transmit. Traffic was congested, alternative routes had been suspended, and war-time arrears of maintenance had not been overtaken. Some years ago these difficulties were overcome, and messages are now quickly and expeditiously dispatched. Considerable developments have been made during recent years in the technique of cable telegraphy, and from among these may

¹ Statistics obtained from the *Telegraph and Telephone Journal*, April, 1931.

be instanced the use of amplifiers and automatic relays.

Cable Tariffs. The tendency has been to introduce cheaper facilities during recent years by offering lower rates for deferred, week-end, and night-letter cablegrams, and these have proved very popular as the charges are moderate. This traffic is remunerative to the companies since it helps to attract new users and spreads the work over the 24 hours of the day, while the cheaper facilities do not appreciably reduce the receipts from full rate, coded cablegrams.

Wireless. Wireless telegraphy and telephony—characteristic inventions of the present century—have recently developed with remarkable rapidity. Wireless offers a solution of the problem of communicating between points where all other systems are impracticable and, in consequence, wireless has proved of incalculable value to shipping and air transport. Wireless telephony has provided an entirely new method for the dissemination of news, entertainment or instruction, and “broadcasting” has now become an accepted institution in practically all countries.

In addition, wireless offers a means to supplement and widen the existing channels of communication. A few years ago it did not seem likely that wireless would supersede the older methods of cable telegraphy, but recently the almost sensational success of wireless beam services has caused much concern to the cable administrations. Co-ordination between British-owned cables and wireless has been secured to some extent by the transfer of Imperial Cables (formerly operated by the Post Office) to a company known as *Imperial and International Communications, Ltd.*, which also operates a number of long-distance wireless stations.

Great Britain is very well-off in regard to wireless

communications. A high-powered station was completed at Leafield, near Oxford, in 1921, for communicating with Egypt and the Near East, while in 1923 a super-power station was built at Rugby capable of communicating with any part of the globe. This latter station broadcasts the British Official News, and is used for communications with ships at sea.

In 1927 the programme authorized by the Cabinet in 1923 for linking up the Empire by means of wireless was completed, and now short-wave "Beam" services are working from British stations operated by Imperial and International Communications, Ltd., to Canada, Australia, South Africa, and India. The Dorchester Beam Transmitting Station owned by this company consists of seven Marconi Short-wave Beam Transmitters, and is the largest beam wireless station in the world, communicating directly with the United States of America, Brazil, the Argentine, Syria, Egypt, Japan and the Far East.

In recent years the most striking accomplishments of wireless engineering have been the inauguration of a wireless telephone service across the Atlantic in 1927, and the broadcasting of a message to the whole world by His Holiness Pope Pius XI from the Vatican City wireless station in 1931.

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INDEX

ACWORTH, W. M., 39
 "Additional net cost," 40
 Aerial survey and photography, 87
 "Agreement system," 18
 Air mails, 80
 ——— transport, 78-89
 ——— ——— safety, 81-82
 ——— ——— sphere, 82-83
 ——— ——— subsidies, 85-87
 Aire and Calder Navigation, 56, 57, 58, 59
 Airships, 88-89
 Amalgamation, air transport, 80
 ———, canal, 53, 57, 59
 ———, railway, 32-33.
 Ancillary business, 26, 34
 "Appointed day," 29, 34, 41
 Ass, 2

 BALFOUR Committee, 12
 Barème belge, 42
 Beam wireless, 95-96
 Belgian railways, 42
 Birmingham Canal Navigations, 58
 Bonus mileage, 30, 47
 Bridgwater Canal, 59
 Broadcasting, 95
 By-traders, 51

 CABLES, 93-94
 Calcutta Conference, 15
 Camels, 2
 Canals, 3-4, 49-60
 Cargo liners, 10
 Cart, origin of, 2-3
 Casual labour, 24-25
 Chamberlain Committee, 54
 Cheap Trains Act, 45
 Classifications, air, 84
 ———, canal, 50-51
 ———, railway, 29-30, 34, 36, 41, 46
 ———, road, 68-69
 Clearing House, 58

Coasting trade, 11-12
 Communication of intelligence, 90-98
 Competition, road and rail, 71-73
 Conciliation councils, 35
 Conferences, liner, 14, 15-18
 Containers, 71, 77
 Co-ordination, 60, 75-77, 95
 Cost of service, air, 85
 ———, canal, 51
 ———, Post Office, 91, 92
 ———, rail, 41
 ———, road, 67-69
 Cranes, 20, 22
 Cumulative rates, 30

 DECREASING cost, law of, 37, 40, 82
 Deferred rebates, 15, 18
 Demand for transport, 39-40, 46, 82-83
 Differential prices, 39, 41, 69
 Discrimination, 14, 29-30, 40, 50-51, 69, 92, 94
 Docks, 19-25
 Dogs, 2

 ELECTRIC railways, 38
 Elephants, 2
 Elevated railways, 38
 Emigrant traffic, 10-11
 "Exceptional rates," 30, 34, 41, 42, 45
 ———, liner, 14

 FARES, railway, 45-48
 Freight exchanges, 69-70
 ——— index numbers, 8
 French railways, 32

 Gas industry, 39, 73
 General railway classification, 29-30
 German railways, 28, 31-32
 Government regulation, 28-30, 72, 74-75

Grand Junction Canal, 59

— Union Canal, 59-60

Grande vitesse, 44

Great Southern Railway, 31

Ground organization, 82

G.W.R., 32, 36

HADDON, Dr., 2

Hill, Rowland, 90-91

Horse transport, 2, 64-65, 73

Hydraulic power, 20

IMPERIAL air routes, 80

— Airways, Ltd., 80, 85, 86

— and International Communications, Ltd., 95, 96

— Shipping Committee, 17

Inland water transport, 49-60

— — — — —, advantages,
55-56

— — — — —, British, 57-60

— — — — —, limitations, 56-
57

— — — — —, mechanical
haulage, 56,
57, 60

— — — — —, organization,
58-60

International Postal Union, 91

KIRKALDY, A. W., 4

LABOUR, port, 24-25

L.C.L. rates, 43

Licensing authorities, 75

Liners, 10-11

— — — — —, conferences, 15-18

— — — — —, rates, 12, 14-16

Llama, 2

L.M.S.R., 32, 36

L.N.E.R., 32, 36, 74

Local rates, 36-37, 72, 73

M'ADAM, 4

Mail steamships, 10

Market values, 40-41

Marshall, A., 3*n*

Maximum rates, 29

Metcalf, 4

Metropolitan Railway, 48

Milk rates, 44

Ministry of Transport, 67, 72, 73

"Monkey boats," 50-58

Monopoly, 16-17, 32-33, 39-40,
68, 74, 76

Motor ships, 6

— taxation, 61-62, 67, 72, 73

— transport, 61-65, 67-70,
71-75

Mule, 2

"NARROW canals," 49

Navigations, 49, 56, 57, 58

Nile, 3

OCEAN freight rates, 12

— routes, 9-10

Owner's risk rates, 42, 69

PACK animals, 2, 70

"Parcels" rate, 44

Passenger fares, 8, 10-11, 45-48,
67-68, 83

Penny post, 90-91

Petite vitesse, 44

Petrol tax, 67, 73

Piggott, H. H., 73

Pius XI, Pope, 96

Place values, 40

Pliny, 3

Porters, 2, 70

Ports, 19-25

— — — — —, labour at, 24-25

— — — — —, ownership of, 23

— — — — —, rates and charges, 21-23

Post Office, 90-92

— — — — — charges, 44, 92

Primitive transport, 1-3

Private bill legislation, 28

RADIAL motor services, 77

Railhead deliveries, 77

Railway and Canal Traffic Acts,
29, 30-31

— capital, 27-28, 37-38

— Clearing House, 29

— collection and delivery, 74

— expenditure, 38-39

— — — — — mileage, 26-27

— — — — — rates, 39-45

— — — — — Tribunal, 12, 33-35,
42, 45

— — — — — reorganization, 31-32

— — — — — transshipment, 74

Railways Act, 1921, 12, 31, 32-
37, 42, 72

- Railways and de-rating, 36-37, 71
 — and road powers, 73-74
 —, foreign, 27, 28, 31, 32, 37, 43, 47
 Rate books, 34, 41
 "— cutting," 70
 Regent Canal, 59
 Release system, 21
 Return loads, 69-70
 River transport. (See Inland Water transport.)
 Road and rail competition, 47, 71-73
 — construction and maintenance, 65-67, 73
 — fund, 66, 73
 — Traffic Act, 72, 74-75
 — transport, 61-70
 Royal Commission on Canals, 53-54, 59
 — on Shipping Rings, 16-17
 — on Transport, 12

 SAILING vessels, 8
 Sea routes, 9-10
 Shannon Navigation, 54
 Shaw Committee, 25
 Shipping, 3, 4, 6, 18
 — freight rates, 8, 11, 12-16
 — ownership, 6, 7
 — rings, 16-18
 Sledge, 2
 Speed of transit, 43-44, 78, 82-83
 S.R., 32, 36
 "Standard revenue," 33-34, 66, 72
 State regulation, 28-29, 75
 Submarine cable, 93-94
 Subsidies, 85-87
 Suburban traffic, 38

 TAPERING fares, 47-48, 68
 — rates, 30, 42-43, 51
 Taxation, motor, 67, 72, 73
 Taxi fares, 68
 Telegraph, 39, 73, 92
 Telephone, 39, 74, 93, 94
 Terminal charges, 42, 44, 68
 — expenses, 42, 43, 48, 68, 82
 Third class travel, 11, 45, 46
 Time charter rates, 8, 13
 Tolls, waterway, 50-51, 53
 Trade and transport, 1, 3, 4
 — depression, 8, 35, 36, 50
 Traffic Commissioners, 47, 75
 Train and traffic control, 21
 Tramps, 10, 11, 12-13
 Tramways, 63, 65
 Transportation Act, 31
 Trent Navigation, 54, 56, 57, 58
 Trip rate system, 13, 51
 Tsetse fly, 70

 UNDERGROUND railways, 38
 Undue preference, 41, 72

 VATICAN City wireless station, 96

 WAGES Board, 35
 Wagon loads, minimum, 29, 43
 Waterways Board, 53, 54
 Way-leaves, 39, 73
 Weaver Navigation, 56
 Wheelbarrow, 3
 Whitley Councils, 35
 Wireless, 80, 85, 95, 96
 Workmen's tickets, 46, 47

 YAMMA, 2

 ZEBRA, 2
 Zone rates, 44

