

PRELIMINARY REPORT

BY A WORKING PARTY OF BRITISH RAILWAYS AND LONDON TRANSPORT

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A RAILWAY PLAN FOR LONDON

Preliminary Report by a Working Party of
British Railways and London Transport

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Foreword

1. The appended report on railway planning in the London area, prepared by a Working Party appointed by the Passenger Transport Planning Committee for London, is only a preliminary review of the problem. Nevertheless, the London Transport Board and British Railways Board have agreed that it should be made available at this time to Government departments and other authorities concerned for the reasons explained in paragraph 5 below.

2. The report is concerned with increasing railway passenger capacity to meet expected future demand; but this is only one side of the problem. In the two Boards' view, it is of at least equal importance that transport factors should influence the basic planning decisions on land use and the location of population and employment which will determine the scale and pattern of the future commuter demand. The reasons for this view are simple. First, additional large-scale railway capacity could be created fairly easily in some sectors (particularly on the north and north-west sides of London), but only with great difficulty and at great expense in others (particularly on the south-east side). Secondly, certain planning policies pursued since the war, without prior regard to their transport implications, have led to serious difficulty and waste in the transport field. Examples are :—

- (i) the massive shift of population, without a corresponding shift of employment, from the conurbation to the Outer Metropolitan Region and beyond, which has caused the heavy increase in long-distance commuting to Central London (and has also made it increasingly difficult to recruit and retain staff for public transport services, particularly in some parts of the inner area) ;
- (ii) the grant of permissions for major office developments at points where they cannot be easily or adequately served by public transport ; and
- (iii) insistence on the incorporation of extensive parking facilities in new office buildings, which has caused more car commuting and increased street congestion in Central London and on its approaches.

It is in the hope that similar mistakes may be avoided in the future that the two Boards have asked for full participation in the formative stages of planning policy, and for full consideration of the transport factors, before major planning decisions are taken.

3. What is true of the scale and distribution of the transport demand is also true of its timing. Successive campaigns for the voluntary staggering of working hours have only partially counteracted the growing concentration of peak-hour traffic since the war, and the time may be approaching when some degree of compulsory staggering should be considered.

4. No final and definitive plan has been prepared, because of the varying forecasts from different official sources of the extent of the future commuter demand arising from the additional population expected in the South-East, and uncertainty regarding the effect of present and future restrictions on office development in London. It is nevertheless clear that, despite such uncertainties, the London commuter demand will continue to increase in the next few years, by reason of the considerable new office space already available or committed to contract, the possibilities of increasing the use of existing offices, and developments other than those of offices, e.g. in education and service employments.

5. The report has been prepared on the basis of the best information on future demand at present available, so that :—

- (a) the Ministry of Transport and other authorities concerned may be apprised as soon as possible of the general nature and scale of the railway improvements considered necessary to handle the increased peak-hour traffic, and the decisions of principle which will be involved in implementing such a plan;
- (b) the implications of the report and of the resulting railway development proposals, though still as yet tentative, may be given their proper weight by the planning authorities in their general planning studies for the London area, and also considered in conjunction with road development plans in the London Transportation Study;
- (c) an indication may be given of such suggested railway developments as require future detailed study.

6. For the reasons set out in paragraph 4 above, and on the most realistic assumptions that can be made at this time, the Working Party consider that despite stringent control of development there is likely to be a demand for the carriage of some 200,000 more commuters to and from Central London by 1981, and the report has been prepared on that basis.

7. The schemes considered fall into two categories; viz:—

- (a) proposals for expansion of the Underground system, by the extension of lines in being or under construction (e.g. the Aldwych branch and the Victoria Line), and by the construction of a further new line (the Fleet Line). The purpose of these schemes is to provide extra capacity to distribute within Central London the increased commuter traffic arriving at British Railways' terminals; to relieve critical sections of existing Underground lines, and street congestion; and to relieve British Railways of traffic in the inner-suburban zone and so release line capacity to them for increased traffic from outside the conurbation.
- (b) measures to increase the capacity of British Railways for suburban traffic, including rationalisation of services, lengthening of trains, resignalling, provision of additional tracks at critical points, and further electrification. In some cases, such as retimetabling of the Southern Region suburban services, the work is already in hand; in several others, further study is being undertaken to establish the precise form of the works or other measures required.

8. The total cost of a plan of this kind might be of the order of £125 million (say, £100 million on the Underground, and £25 million on British Railways London lines). Rolling stock would account for some £31 million of that amount (£16 million Underground, £15 million British Railways). These figures exclude the cost of schemes such as the Great Northern suburban electrification, which require further study before recommendations can be made.

9. This expenditure of roundly £125 million on railway development in the London area over the next 15–20 years must be seen in the same context as the sum of over £500 million which it might cost to extend the radial motorways to within 3 or 4 miles of the centre of London and to provide the necessary connecting link. The railway improvement works can be carried out with relatively little disruption and loss of amenity. Individual major railway proposals requiring the authority of the Government will be submitted by the two Boards in accordance with the normal procedures agreed with the Ministry of Transport. In such cases, the submissions will normally include the results of social benefit studies, so that whatever the commercial prospects of any particular scheme may be, the project may also be judged in relation to its quantifiable benefits to the community as a whole. It would then be necessary to discuss with the Government the means by which such works are to be financed.

10. The report deals with railways only. Public road transport services will, however, continue to be needed for local journeys of all kinds, as

feeders to and distributors from suburban and terminal railway stations, and on routes where railway facilities could not be justified. The London Transport Board is studying the long-term requirements for bus and coach services, on the basis of the best available information about future demand and about the future road pattern; but it is clearly the railway system which must continue to bear the main burden of commuter movement to and from Central London. Attention is being given to problems of co-ordination of road and rail passenger transport in the London area, including such matters as the improvement of road-rail interchange facilities and the provision of parking accommodation at suburban stations.

11. It is proposed that the Working Party should continue their work in the light of all new developments in the planning field (including the future results of the London Traffic Survey) and in relation to the proposals for road improvements in the London Transportation Study, with the intention of producing a firm public transport plan which will form part of the overall transportation plan for London.

March, 1965.

A Railway Plan for London

Preliminary Report of the Working Party of the Passenger Transport Planning Committee for London

I. Introduction

1.1. Under the Transport Act of 1962 the London Transport Board has the duty 'to provide or secure the provision of an adequate and properly co-ordinated system of passenger transport for the London Passenger Transport Area'; the British Railways Board has the duty 'to provide railway services in Great Britain'; and both Boards are required to co-operate with each other to ensure that their services in the London Passenger Transport Area are properly co-ordinated. The machinery set up to carry out this latter duty includes the Passenger Transport Planning Committee for London, comprising Members and Officers of the two Boards. This Committee established the present Working Party which was required 'to review the demand for underground and suburban rail travel in the London area at the present time in relation to railway capacity, and to forecast traffic development over the next 20 years, having particular regard to the prospective growth and distribution of population, to the pattern and trend of employment, and to plans for transport development of all kinds'. In the light of this review the Working Party is required 'to prepare a plan for matching rail capacity in the London area to requirements, either by new physical works or other means, over the 20 year period'.

1.2. While the statutory requirement to co-ordinate activities is limited to the London Passenger Transport Area, the influence of London as an employment magnet extends over a much larger part of South East England, and this report covers this wider area of London commuting. It continues the process of co-ordinated transport planning begun with the establishment in 1933 of the London Passenger Transport Board. The first integrated programme of railway and other public transport development, the '1935-40 New Works Programme', was well under way on the outbreak of war. The postwar impetus to a fresh start in railway planning was given by Professor Abercrombie's plans for London, and in 1949 the Ministry of Transport published the 'London Plan Working Party Report' on further measures proposed by British Railways and London Transport. Those proposals, at a capital cost which might amount to £1,000 million at present day prices, were designed to modernise, integrate and expand the rail services, but were not required to have particular regard to the economic and financial consequences. Many of the electrification and other projects on British Railways have been completed and the 10 mile Victoria Line tube, out of about 100 miles of new tube recommended, is now being constructed.

1.3. In the present report, although the obligation to provide adequately for the expected demand has been the main consideration, it has been impossible to ignore the statutory financial duties placed on the two Boards under the 1962 Act. Specific investment projects will therefore have to be subjected to tests of their financial viability as well as assessments of their social benefits. But the opportunity now exists for railway and, indeed, all transport planning to be carried out in concert with the planning of population and employment distribution, and the London Transportation Study will provide the means for co-ordinating road as well as rail planning within the broader planning process.

1.4. These matters are further considered under the heading 'A Framework for Railway Planning'. It may be added that with the South East Study and London Traffic Survey projections of population and employment growth, the raw material for transport planning has become easier to obtain, though the speculative nature of these projections is recognised. This report has served to single out the places where population and commuter developments foreshadowed in the South East Study would either require the creation of greater transport capacity or leave existing spare capacity unexploited.

1.5. To this extent this report marks an interim stage in the general planning process and provides a contribution towards the assessment of the overall economic and social implications of continued growth in South East England.

II. A Framework for Railway Planning

2.1. The principles upon which urban railway planning in the South East should be governed were set down in the 1949 Plan (see App. 1), but it may be pertinent to restate them, lending emphasis in certain respects to take account of more recent developments both in urban and transport planning. The rail system can be used for high-speed limited-stop operation over long distances ('outer suburban' services), or for low speed operation with frequent stops over short distances ('urban services'). The two types of operation must be kept separate if high traffic volumes are to be handled. Typically, the first is the primary role of British Railways, which brings in commuters from the outer suburbs and dormitory areas to termini on the edge of the central employment concentration; and the second the function of London Transport, which provides a central area distribution network catering for inner suburban and urban traffic, including traffic passing between British Railways termini and workplaces.

2.2. The spread of the commuting area and the presence of the Green Belt emphasise this distinction, since tolerable journey times from 40 to 60 miles out require higher speed long distance operation. This can be accommodated on the existing network by reducing the frequencies of stopping trains, by closing stations on the approaches to the main line termini and transferring traffic to the short distance network, or even by the transfer of a whole service to the short distance network. Measures such as these have in the past provided effective relief.

2.3. The peak concentration and distribution of commuter demand produces poor utilisation of the assets needed to meet traffic growth. The more the pattern of population and commuter growth can be matched to the latent capacity of the rail system, the greater the likelihood that the demand can be met cheaply and profitably. This is obvious where there is idle capacity on one route and an investment requirement on another. It is perhaps less obvious that the profitability of investment can also be affected by the timing and concentration of growth in population in specific areas; additions to railway capacity are almost inevitably made in large steps on particular routes and rapid absorption of the resulting expansion will improve the case for the investment. These considerations must be seen against the background of the two Boards' duty to pay their way.

2.4. In this report one future population pattern has been taken as a starting point, but there should be nothing immutable about this particular pattern or, indeed, in the employment pattern that has been taken. To the extent that transport limitations and opportunities are given their due weight in the development planning process, the capital cost of transport expansion can be reduced and profitability enhanced. There will nevertheless be

investments which the two Boards would have to reject on commercial grounds, but which would be justified on broader planning criteria. Some other way of financing such investments will have to be found.

2.5. There is therefore a demonstrable need to examine more fundamentally the problems of expanding commuter capacity. If transport planning is to be integrated, as it should be, with the planning of population distribution and land use, the planning authorities must be made aware of the transport implications of their land use dispositions and of the broad order of magnitude of capital costs involved. In the light of these findings, there will be a need to explore the possibilities of changing the land use plan so as to make the best and most economical use of the transport facilities. In particular, it will be important to ensure a correct phasing of population growth in different areas.

III. The Basis of the Report

3.1. The preparation of the report proceeded in three main stages. First a measure was required of the development of commuter demand. Quantitative assumptions had therefore to be made of the growth of population and its distribution over the catchment areas of British Railways and Underground lines, and of the growth of employment in central London and elsewhere. More important, assumptions were required of the effects of these developments on rail commuter traffic on the various services to central London. Consideration was also given to the effects on future traffic patterns of new motorway and road construction and of growing car ownership and use. Secondly, detailed assessments were made of the existing and potential capacities of the services, lines and termini on the British Railways and Underground networks, which in turn necessitated assumptions regarding the levels of passenger standing to be allowed for.

3.2. These two forecasts, corresponding to the demand and supply sides respectively, were then compared so as to throw into relief those points on the networks which would be critical because of overloading or would require a rationalisation of facilities for economic operation.

3.3. These preparatory stages are further elaborated in the following paragraphs of this section. In the light of the findings, proposals were formulated for developing and rationalising the rail and Underground services. These proposals are described in Section IV of the Report. Where further information or study of particular problems is required before firm proposals can be made, this is stated. In this connection much work is still being done, particularly into the commuter traffic patterns on the complex network of British Railways' Southern Region services and into the distribution of this traffic over the central area network.

(a) The Pattern of Demand

3.4. The present pattern of commuter demand is shown in Chart 1. On London Transport the peak hour flows out of the central area in the evening peak form an arc north of the Thames, with the British Railways routes in the same sector comparatively lightly loaded. The heavy British Railways flows are to the south and east, with little penetration by London Transport to the south. It can be seen that the total commuter flow out of the central area remains heavy only over the first 10 to 15 miles, and that with few exceptions (such as the Brighton line) the long distance commuting flows are at present of comparatively modest proportions.

3.5. The 'South East Study: 1961-1981' described the recent patterns of development within the South East Region, estimated future trends, and made certain proposals regarding the distribution of population and

employment. The broad conclusions of the Study were that over the next 20 years the population of the London conurbation is likely to remain at its present level of 8 million, but that the population of the remainder of the Region is likely to increase by up to $3\frac{1}{2}$ million, settled partly within existing communities and partly in a second generation of new and expanding towns. About $2\frac{3}{4}$ million of this increase would be located within the London commuting area (see Chart 2).

3.6. This means that the population within the catchment areas of the inner suburban services is expected to be relatively static, whilst that in the catchment areas of the longer distance suburban services will increase very considerably. Of the total increase, some 64% is expected north of the river (including the new and expanded towns) and 36% south of the river (see Chart 3). For the purposes of this report it has been assumed that the Government's current review of the South East Study is not likely appreciably to alter this broad picture.

3.7. There are no agreed estimates of the future growth of commuter traffic to central London. In the South East Study it was concluded that the peak hour capacity for additional commuters that could be provided by British Railways (450,000), with certain modernisation works, would be enough to meet demand for many years to come, but the Study contained a forecast of commuter travel only to 1971, namely, that at the then current rate of growth, at least 200,000 more commuters would be travelling than in 1961. Other population and employment projections are available from the London Traffic Survey but not, as yet, estimates of future traffic volumes by mode of transport.

3.8. Since the publication of the South East Study there has been the Government restriction on further growth of office accommodation within a radius of 40 miles of central London. It is not expected that this restriction will affect the situation in the short term; commuter demand will continue to increase by reason of the considerable office space already available or committed to contract, and because of other developments, for example, in education and service employment. Moreover, office growth in the long term is unlikely to come to a complete stop.

3.9. For these reasons, it is considered imprudent to reckon on fewer than 200,000 additional commuters to central London over the next 20 years, as a basis for planning. This is approximately half the present growth rate. The total figure masks a probable decrease in commuting to central London from the inner suburbs (caused by increased employment opportunities at suburban points), offset by other commuters from more distant areas.

3.10. To allocate the change in the total volume of commuter traffic to individual routes is clearly speculative, but is a necessary step in the development of a transport plan. In arriving at the figures adopted, the central and local planning authorities have been consulted and both Boards have been assisted by the information available to them through their representation on the committees of the London Transportation Study and the Standing Conference on London Regional Planning.

3.11. In arriving at estimates of the effects of the total additional commuter load on British Railways and the Underground, it has been necessary to consider, as far as it is possible, the effects of:

- (a) the continued growth of car ownership, which will favour private transport at the expense of public transport;
- (b) street congestion and parking difficulties, which will counteract the increase in the use of cars and favour railways and the Underground, but at the expense of buses;
- (c) the tentative plans being developed in connection with the London Transportation Study for an urban motorway network for London, which include a motorway ring between the London ends of the radial motorways and the main trunk routes, at a distance of 3-4 miles from central London;
- (d) increasing employment in the inner suburbs of local residents formerly commuting to the centre will reduce the load on the inner-suburban rail, Underground and bus services. The reverse effect seems likely on the outer-suburban rail services;
- (e) planning restrictions on the number of additional jobs within easy walking distance of the main rail terminals, which will cause a more than proportionate rise in commuters using the Underground and buses for in-town travel. These planning restrictions are undesirable from the transport standpoint; in terms of overall cost to the community, it would be better if these additional jobs were as close as possible to the main line terminals, or even on top of them.

3.12. At best the effects of such influences must be largely conjectural. They are, however, unlikely to cause significant deviations from the trends which are already evident and which show considerable consistency. On the basis of the foregoing assumptions and reasoning, the following table shows the present and estimated future patterns of commuter traffic, envisaged as leaving the central area in the evening between 16.30 and 19.00 hours (the pattern assumes that the Victoria Line will be in use between Victoria and Walthamstow).

	<i>'Present'</i>	<i>'Future'</i> <i>20 years</i> <i>hence</i>	<i>Expected</i> <i>increase or</i> <i>decrease</i>
Underground* then British Railways	125,000	220,000	+ 95,000
Bus then British Railways	85,000	130,000	+ 45,000
Private transport or taxi then B.R.	5,000	10,000	+ 5,000
Walking then British Railways ..	215,000	260,000	+ 45,000
Total British Railways	430,000	620,000	+ 190,000
Underground all the way	345,000	375,000	+ 30,000
Bus all the way	185,000	150,000	- 35,000
Private transport all the way ..	110,000	125,000	+ 15,000
Total	1,070,000	1,270,000	+ 200,000
Corresponding modal split of in-town traffic:			
Underground*	470,000	595,000	+ 125,000
Bus	270,000	280,000	+ 10,000
Private transport and taxi ..	115,000	135,000	+ 20,000
Walking	215,000	260,000	+ 45,000
Total	1,070,000	1,270,000	+ 200,000

* Including the Waterloo and City Line.

3.14. The broad prospect for public transport is thus one of growing pressure on British Railways (where the expected net increase of 190,000 corresponds to a 45% increase on the present traffic), a comparatively modest increase on through commuter travel on the Underground (30,000), and a decrease in through commuting by bus (-35,000). Within the central area, a substantial increase in in-town Underground traffic (+95,000) and in-town bus feeder traffic (+45,000) is considered likely. The present and future patterns are shown in Chart 4. The contrast between the decline in bus commuting and the growth of bus feeder traffic to the main line terminals within the central area has implications which will need separate study by London Transport as part of a long-term plan for their road services.

(b) Capacity and Loading Standards

3.15. The planning of future railway capacity in the London area must of necessity be governed by the needs of the commuter, and the scale is set by the peak hour demand. Commuter flows are so concentrated that a great deal of capacity has to be built into the transport system solely for one hour in the morning and one hour in the evening. Whilst an overall growth in commuter traffic of the order of magnitude expected would not cause much concern outside the peak 60-minute period, a substantial part of the growth will in fact fall within it. Despite all efforts at staggering office hours, an increasing proportion of the total commuter traffic is likely to travel within the peak hour. In this study it is assumed that 65% of the total commuter movement will travel in the peak hour, compared with a range of about 50 to 70% at the present time.

3.16. On British Railways, the peak hour in the morning tends to be slightly more acute than that in the evening but the problem of providing peak hour capacity is more difficult in the evening (except on the Southern Region) because long-distance express trains must share the available track capacity. On the Underground, the evening concentration is the heavier. These circumstances have been taken into account by basing the survey of present and future traffic needs on the evening peak hour both on the central Underground system and on the various sectors of British Railways.

3.17. In determining the capacity that needs to be provided to meet future commuter demand, assumptions must be made regarding loading standards. No definition of an 'acceptable' loading standard can be very precise. A high standing-to-seating ratio may be acceptable for a short journey in a train designed for this purpose, but becomes unacceptable on longer suburban journeys with rolling stock of high seating capacity. It must also be borne in mind that the selection of a 'critical' standing-to-seating ratio for a whole hour implies the acceptance of a higher ratio during the shorter 'peak-within-the-peak' 15 or 20 minutes and on individual trains, although there are seats to spare on other trains within the hour.

3.18. The following one-hour loading standards have been used in assessing the capacities of individual lines:—

- (a) Underground (except Metropolitan Main Line), Waterloo & City Line, and British Railways sliding door stock:
100 standing per 100 seats;
- (b) Metropolitan Main Line and inner-suburban services of British Railways:
50 standing per 100 seats;

- (c) British Railways outer-suburban services ('corridor' stock):
25 standing per 100 seats.

These standards relate to the inner trunk sections on which traffic builds up to its maximum, not over the entire length of the lines, and are substantially better than the conditions experienced on some services today.

3.19. There may be criticism of a plan which is deliberately based on the inclusion of a limited allowance for standing by long-distance passengers. The justification is that by so doing very heavy additional expenditure on major works—which would mean substantially higher fares—may be avoided or at any rate postponed for many years. Alternatively, a much higher level of peak-hour comfort could be given, and the economics of the services improved, if the expected future demand could be better distributed in relation to the availability of latent capacity, both geographically and in time.

3.20. It will be realised that at present the shortage of capacity in the super peak imposes a form of staggering of journey times. An attempt to provide more and more capacity could generate a self-defeating deterioration of the situation. It would also cause a marked deterioration in the economics of the services.

3.21. Rail capacity must be considered not simply in terms of passengers per train, but also in terms of trains per pair of tracks and per terminal platform. The maximum number of trains per pair of tracks depends on the type of service. On the 'urban' Underground lines, where (with few exceptions) all trains stop at all stations, a large number of trains—up to 40 per hour—in each direction can be operated. On British Railways, with high speed 'outer-suburban' services and longer trains, a target figure of 24 trains per hour is reasonable, but a mixture of stopping and through trains will reduce this potential. This is why growth in long distance commuter traffic can make it imperative to reduce the number of stopping trains which have to be worked between fast services and, in some cases, eliminate certain stations on the approaches to the main termini.

3.22. The adjoining table shows the potential rail capacity on the lines to the main London termini together with the present passenger loading and the train capacity provided for commuter travel. It will be seen that on the basis of the assumed loading standards, capacity could be made available by British Railways for an additional 450,000 passengers during the peak hour; the broad order of cost of the works and rolling stock to achieve this was given in the 'South East Study' as £100 million. This assumes that passengers would be travelling at the right times and from the right areas to take up this extra capacity, which would be unevenly distributed.

LONDON COMMUTER SERVICES

Peak Sixty Minutes from London Termini

Region	Division or Station	Present			Future		
		Trains	Carryings (000's)	Capacity (000's)	Trains	Capacity (000's)	Margin over present Carryings (000's)
Southern	South-Western	57	39.5	57.3	78	100	60
	Central	81	54.9	81.6	112	140	85
	South-Eastern	75	73.5	89.7	115	140	67
Total	South of Thames	213	167.9	228.6	305	380	212
Western	Paddington	12	5.8	9.5	20	24	18
London Midland	Euston/Broad Street	21	6.9	15.9	49	66	59
	St. Pancras	11	4.7	8.1	42	62	57
	Marylebone	11	3.4	7.0	24	33	30
Eastern	Liverpool Street	67	46.3	62.6	69	76	30
	Fenchurch Street	21	15.5	23.4	24	32	16
	Great Northern	22	9.1	13.0	51	55	46
Total	North of Thames	165	91.7	139.5	279	348	256
TOTAL		378	259.6	368.1	584	728	468

3.23. The terminal capacity on British Railways also provides a limitation on capacity, and in certain cases this applies also on London Transport. On British Railways, with a pair of tracks into a terminal used by 24 trains each way per hour, four platforms are required to allow the whole potential track capacity to be absorbed, with adequate time for the unloading and loading of passengers and for junction movements. The distribution of train and terminal capacity, together with the present and expected future volume of commuter traffic in 20 years' time through the main London termini, are shown in Charts 5 and 6.

3.24. In Chart 5 the load leaving the northern commuter termini in the peak hour has been set against the capacity provided on peak hour trains at present (upper panel), and the projected future loads against the maximum capacity that could be provided (lower panel) within the limitations of tracks and termini. In Chart 6 the same factors have been portrayed for each Division of the Southern Region, where the routes can be served from more than one terminal, but the approaches to the different termini impose more severe constraints on capacity than on the simpler northern network.

3.25. These Charts illustrate the wide margin of spare peak hour capacity north of the river that will still exist and that whilst south of the river there is also spare capacity overall, the margin, especially on the South Eastern Division, is very slender and on particular routes and at particular times non-existent.

3.26. In identifying the critical future points on the networks, and fields requiring rationalisation, the prospect on particular routes and services into each terminal has been examined in order to take account of local pressures within the overall picture described in the foregoing paragraphs.

(c) Problem Points on the Networks

(i) Underground

3.27. On the basis of the assessed future demand on the central area Underground system, reinforced by the Victoria Line, but in the absence of relief works, the assumed loading standards are likely to be exceeded on a number of sections (see Chart 7). The following are the more important sections that will need relief:—

Bakerloo Line

- Need 1. Piccadilly Circus, and especially Oxford Circus, to Paddington and Finchley Road;
- Need 2. Charing Cross to Waterloo;

*Northern Line**

- Need 3. Moorgate, and especially Bank, to London Bridge;
- Need 4. Leicester Square to Waterloo;
- Need 5. Kennington to Stockwell;

Central Line

- Need 6. Holborn to Liverpool Street;

Hammersmith and City Line

- Need 7. Euston Square to Paddington;

Piccadilly Line

- Need 8. Holborn to King's Cross.

(* The capacity of the in-town branches of the Northern Line depends on the reversing points and the relative use of each branch).

The Waterloo & City Line will also need relief.

3.28. On certain other sections of line the margins would be narrow. These include short sections of the District and Circle Lines east of Tower Hill, the Hammersmith and City Line east of Liverpool Street, the northern side of the Circle Line and the Victoria Line (Green Park to Victoria and Oxford Circus to King's Cross).

(ii) **British Railways**

3.29. The latent commuter capacity on British Railways as a whole, as has been shown, is adequate for the expected total growth in peak hour traffic. There is therefore no question of expensive construction of new routes into London or of new termini. The main requirements are a greater provision of capacity for longer distance commuting and a reduction in the capacity provided for inner suburban traffic. There is also the need for rationalisation in certain areas to eliminate excess capacity.

3.30. The lines and points on the British Railways network which raise problems meriting particular study are:

Southern Region

- (a) Charing Cross and Cannon Street to London Bridge;
- (b) East Croydon;
- (c) Waterloo to Woking.

Western Region

- (d) Paddington to Hayes.

London Midland

- (e) Marylebone/Baker Street to Aylesbury;
- (f) Euston/Broad Street to Watford.

London Midland/Eastern Region

- (g) St. Pancras and King's Cross to Moorgate.

Eastern Region

- (h) Moorgate/Broad Street to Finsbury Park;
- (i) Lea Valley Line.

3.31. There are also certain problems arising on the Underground which might require changes in the pattern of British Railways services.

IV. Proposals

4.1. The following proposals are put forward to resolve the major problems outlined in the previous section and to accommodate the additional commuter traffic. Charts 8 and 9 illustrate the main items.

(a) *Underground*

4.2. *New Works.* From a consideration of the sections of the Underground system expected to be overloaded in 20 years' time it is concluded that new tube construction will be essential. The proposals are:—

The Fleet Line. This would be a new tube route crossing the central area from the north-west at Baker Street to the south-east near New Cross. This new tube railway would be linked with the Stanmore branch of the Bakerloo Line in the north-west and would then run via Baker Street, Bond Street, Green Park, Trafalgar Square/Strand, Aldwych, Ludgate Circus, Cannon Street/Monument (where a new double-ended station to replace the two District Line stations could be included) to Fenchurch Street; in the south-east it would be linked with the East London Line and, beyond New Cross, either with the Bexleyheath Line of British Railways as far as Barnehurst or with the Mid-Kent Line to Hayes. This tube line is hereafter referred to as the 'Fleet Line'.

4.3. Preliminary engineering studies indicate that the Fleet Line as conceived is practicable. An alternative alignment via St. Paul's instead of Ludgate Circus would provide an interchange facility with the Central Line and possibly Holborn Viaduct Station. Apart from engineering factors, the decision will depend on the value of the interchange with the Central Line, for which a special traffic study will be needed. East of Fenchurch Street, the most promising alignment from an engineering standpoint seems to be a direct tube to Surrey Docks, an underground station at New Cross giving interchange with the Southern Region South-Eastern Division services, and an underground station at Lewisham Clock Tower. The East London Line would be converted to a shuttle service between Surrey Docks and Whitechapel or possibly Shoreditch and the service to New Cross Gate would be abandoned.

4.4. The decision whether this line should be linked to the Bexleyheath Line or the Mid-Kent Line to Hayes and Addiscombe is fairly evenly balanced. Both lines extend a little beyond 12 miles from the centre of London, i.e. a little farther out than is desirable for an 'urban' type of service; but if an existing branch is to be absorbed into the Fleet Line, it must be one which can be severed from the Southern Region network without undue difficulty, and which allows scope for stabling and reversing

facilities. The Mid-Kent Line is the more self contained. The Bexleyheath Line carries a heavier traffic volume to all the in-town areas which would be served by the Fleet Line, whilst traffic on the Mid-Kent Line is somewhat lighter. Residential areas near the Mid-Kent Line would continue to be served by the Southern Region giving a faster run to the London termini although, in terms of journeys to central London destinations which involve transfer to the central Underground system, a Mid-Kent Line tube service could still be competitive. In arriving at a decision on this point, an important factor will be the extent to which the Southern Region could close stations and withdraw services on other lines in the catchment area of the Mid-Kent Line, which would be in keeping with the streamlining of services on the approaches to British Railways termini to give faster long-distance journeys. The transfer of either line would involve certain problems of accommodation for stabling trains.

4.5. The new line would:

- (a) relieve the Bakerloo Line (need 1 in para. 3.27 above) and contribute to the relief of the Central Line (need 6) and the District Line;
- (b) relieve the hard-pressed South-Eastern Division of the Southern Region by taking over a branch line, and releasing capacity on the London Bridge bottleneck;
- (c) assist directly in distributing and collecting commuter traffic via subway interchange facilities at Charing Cross, Cannon Street and Fenchurch Street terminals;
- (d) assist indirectly in distributing and collecting commuter traffic at Paddington (and Marylebone) by permitting the doubling of the Bakerloo Line service there;
- (e) assist indirectly in distributing and collecting commuter traffic at present using London Bridge Station, by tapping the South-Eastern Division services at New Cross.

A full traffic study of the new tube is proceeding.

4.6. *Victoria Line Extension.* This extension would run from Victoria via Vauxhall (interchange with the Southern Region) and Stockwell (interchange with the Northern Line) to Brixton to relieve the under-river section of the Bakerloo Line (need 2) and the West End branch of the Northern Line (need 4) as well as the south end of the Northern Line (need 5). The stub end of the tube at Brixton should be aligned so as to facilitate a further projection to Crystal Palace. This further extension might be justified in the long-term if:—

- (a) the Southern Region find it possible to withdraw their service between West Norwood and Crystal Palace so that the tracks could be devoted exclusively to tube use; this would assist the expansion of their long-distance capacity;
- (b) it is decided to establish a national exhibition and conference centre at Crystal Palace in addition to the present sports centre.

4.7. *Aldwych Line Extension to Waterloo.* This extension of the Holborn-Aldwych Line would assist in the distribution and collection of the expected heavy additional commuter traffic by Southern Region services terminating at Waterloo and relieve the West End branch of the Northern Line (need 4), the Bakerloo Line (need 2) and the congested interchanges at Charing Cross and Leicester Square. In view of the short journey time, a higher loading standard would be acceptable so that capacity could be expanded to the maximum at minimum cost.

4.8. *Platform and Train Lengthening.* On the Metropolitan Hammersmith and City and possibly also Circle Lines, trains would be lengthened from 6 to 8 cars. Certain platforms on the Hammersmith and City Line would need to be lengthened; similar work on the Circle Line would be more difficult. The effect on train stabling accommodation would need to be studied. This work would relieve the Metropolitan Line, especially between Euston Square and Paddington (need 7) and between King's Cross, Liverpool Street and Barking.

4.9. *Problems requiring further study.* In addition to the works recommended, there are other potential problems to which the Working Party is unable at this time to offer solutions. These comprise:—

4.10. *London Bridge (Northern Line).* Because of the estimated increase in suburban traffic at London Bridge, the Northern Line between London Bridge, Bank and Moorgate will become overloaded. It will not be practicable to increase the capacity of the Underground service more than marginally. As already suggested, however, the Fleet Line will divert some traffic from London Bridge main line station and if some Southern Region services could be diverted from London Bridge to Holborn Viaduct, material relief would be afforded to the Northern Line at London Bridge.

4.11. *Liverpool Street (Central and Circle Lines).* The growth of traffic at Liverpool Street (main line) is expected to cause overloading on the Central Line and Circle Line west and south-east of Liverpool Street. Diversion of a portion of the Liverpool Street suburban service to Fenchurch Street, where the Fleet Line would offer a wide range of in-town connections, would largely solve these problems. The four-tracking of a length of viaduct

between Gas Factory Junction and Stepney East, and the enlargement of Fenchurch Street terminal would be necessary at a cost which, though heavy, could be less than that of providing new tube facilities at Liverpool Street. The problem requires detailed study.

4.12. The effect of extending the Victoria Line from Walthamstow to the catchment area of the Central Line has been examined. The relief to the Central Line at Liverpool Street would be slight, and the proposal cannot be recommended on traffic grounds at this time.

4.13. *Camberwell Extension of the Bakerloo Line.* Although Parliamentary work powers have been relinquished, London Transport is still safeguarding, so far as practicable, the possibility of extending the Bakerloo Line from Elephant & Castle to Camberwell; but there has been no change of circumstances to justify the extension to Camberwell on traffic grounds. It would be necessary for the line to be extended beyond Camberwell, e.g. towards Peckham, to pick up a worthwhile traffic and this would probably facilitate some rationalisation of Southern Region services in the locality. Any extension of the Bakerloo Line beyond Elephant & Castle, however, must necessarily be short because of the limited capacity of the 'bottleneck' section under the river, even after allowing for the fact that an extension would provide better terminal facilities and thus enable the peak service throughout the line to be somewhat increased. The Working Party is therefore at present unable to go beyond recommending the continued safeguarding of the scheme.

(b) British Railways

4.14. As already shown, the great bulk of the 200,000 additional commuters to central London will perforce be carried by British Railways but, in contradistinction to the road situation, no civil engineering programme on a scale comparable with the road programme will be needed to cater for the additional traffic.

4.15. The main considerations fall into two broad categories: the rationalisation of services and terminal facilities north of the river, where capacities exceed demand today and will still be considerably in excess of future requirements on current expectations regarding commuter and employment trends; and the rationalisation of services south of the river in order to separate more clearly the two functions—the inner-suburban stopping movements and the fast outer-suburban services—and thereby improve both the capacity and the quality of the latter.

4.16. The principal requirements are dealt with in the following paragraphs. They consist in the main of a series of localised measures to resolve the problems on particular lines, including retimetabling on the Southern and Eastern Regions, the provision of more and longer trains with high-capacity rolling stock, etc. On the assumptions made, and with the exception of the Southern Region's South-Eastern Division and the Western Region service to Hayes, the relinquishment to London Transport of further inner-suburban services in order to free capacity for outer-suburban traffic is not considered necessary.

SOUTHERN REGION

4.17. A substantial proportion of this additional peak demand is expected to fall in the area of the outer-suburban services of the Southern Region. Most of these services are overloaded today, and in some trains on some lines there is standing over long distances. The problem of increasing capacity would be eased if the population to be settled in this area of Southern Region territory could be reduced and future demand thereby lessened.

4.18. This Region has recently decided on a complete revision of its timetables involving all three Divisions, based on an origin and destination census of present traffics. It is expected that the new timetable will reduce conflicting movements, enable services to be redistributed in accordance with present-day need and increase capacity. The new timetables should be introduced in 1966 and 1967. Capital expenditure will be needed for additional rolling stock, but its extent cannot yet be precisely estimated. Against this background the outlook on the three Divisions of the Region is reviewed below.

4.19. *South-Eastern Division.* These commuter services operate in an area devoid of Underground facilities directly serving the central area. The bottleneck sections of the lines through London Bridge must be shared by intense, heavily loaded inner-area commuter services and by increasingly important outer-suburban services. In the areas served by these services population is expected to grow by upwards of 25 per cent, giving rise to 30,000 or more additional commuters. The postwar programme of lengthening certain platforms and trains, and the forthcoming increase in the number of non-stop trains through London Bridge, together with further retimetabling efforts, will exhaust the possibilities of increasing line capacity by comparatively minor measures.

4.20. Other measures for examination include a deliberate attempt to transfer certain suburban services from London Bridge to Victoria and Blackfriars/Holborn Viaduct; the effect on in-town traffic distribution by Underground would require detailed study. The attractions of the Holborn

route could be improved by double-ending St. Paul's Underground Station, thereby bringing an entrance within reasonable walking distance of Holborn Viaduct station; interchange with the Metropolitan (Circle) Line could be made by projecting Southern Region trains through the existing tunnel to Farringdon, although this might be contingent upon the withdrawal of the present Eastern Region and London Midland Region peak hour services via the City Widened Lines. Any increase in the Blackfriars-Holborn services beyond the capacity of one pair of tracks would call for extensive repairs to all four of the tracks on the approach viaduct from Loughborough Junction. In the longer term, the most effective single measure of providing major relief will be the proposed transfer of either the Bexleyheath Line or the Mid-Kent Line to the Underground (Fleet Line).

4.21. These measures should be sufficient to cater for the worst present problems and provide for the future growth expected in the outer suburbs at the standards quoted in para. 3.18. The full impact, however, of the major housing developments proposed by the London County Council at Woolwich (70,000 people), Erith (25,000 people) and Kidbrooke (9,000 people) have yet to be assessed. It is proposed to open direct discussions with the Greater London Council on these questions.

4.22. *Central Division.* These services are composed of comparatively lightly loaded inner-suburban services to areas with a more or less stationary population, and heavily loaded outer-suburban and long-distance services, especially on the Brighton Line and, to a lesser extent, on the East Grinstead Line where population increases from 15 to 25% are expected. It will therefore be necessary to intensify the outer-suburban services and reduce certain inner-suburban services. Improvement of the bottleneck sections of the outer-suburban services will be required, notably at East Croydon where the addition of one track through the station and some resignalling will be necessary. In the Mitcham Junction and West Croydon areas some minor signalling improvements will also be required. The possibilities of Underground railway extensions over existing surface branches so as to enable certain inner-suburban services to be withdrawn would require separate examination (the possibility of extending the Victoria Line beyond Brixton has been referred to in para. 4.6; the prospect of extending the Bakerloo Line was examined in para. 4.13).

4.23. *South-Western Division.* As in the case of the Central Division, these services are composed of inner-suburban services with comparatively light traffics and little growth potential and more heavily loaded outer-suburban and long-distance services to areas where major population increases are expected, ranging from 10% in the Woking area and 20% west of Staines to 70% on the Basingstoke line which is in course of electrification. The peak hour flow through Waterloo is expected to increase by

half. Again, the expected shift of emphasis from inner-suburban to outer-suburban traffic will have to be catered for mainly by retimetabling. The elimination of the Hounslow loop stopping trains may be necessary, but requires separate examination. In the long term, a flyover at Woking and an extra track on a section of the approach to Waterloo may have to be built.

WESTERN REGION

4.24. *Paddington*. To a greater extent than on other suburban railway sectors, commuter services from Paddington are required to interwork with fast long-distance services, specially during the evening peak period. Whilst middle and long-distance commuter traffics are expected to show a considerable increase, traffic on the short-distance service to Hayes is small and is not rising. Apart from further resignalling of the London to Didcot line, at present in progress, and possibly modernisation of the signalling at Paddington itself, the most effective means of increasing line capacity would be the elimination of the uneconomic inner-suburban service, and the closure of Acton, West Ealing, Hanwell and Southall stations. The traffic potential of this service is too small to warrant replacement by an Underground service. Preliminary examination suggests that an express bus service between Hayes and a railhead at Ealing Broadway might be capable of meeting the need.

LONDON MIDLAND REGION

4.25. *Marylebone to Aylesbury*. The suburban services from Marylebone have adequate capacity to cater for the expected doubling of the peak hour traffic from a population growth of some 25% on the Princes Risborough line and about 80% on the Aylesbury line. The problem lies in the excess capacity of the terminals and lines involved on present expectations of traffic growth. When the Euston-Birmingham electric service is introduced the Paddington-Birmingham service will be reduced and the Princes Risborough commuter services could be re-routed from Marylebone to Paddington (implying the closure of the lightly used stations Wembley Hill to Northolt Park). The expected Aylesbury line traffic, though shared by the Metropolitan Line, could not be wholly absorbed by the latter without overloading that line, lengthening journey times to stations north of Rickmansworth by at least 7 minutes and extending the electrification beyond Amersham. The alternatives of installing connections to the Euston or St. Pancras lines would be costly. Further study of the problem is required, including the question of whether additional population might be settled on the Aylesbury Line so as to make the Aylesbury service from Marylebone viable.

4.26. *Euston/Broad Street to Watford.* On these services the problems again arise less from lack of capacity than from an excess of facilities. The forthcoming high-voltage electrification with fast multiple-unit services making stops at Watford Junction and Harrow & Wealdstone, combined with the Victoria Line facilities to the West End through the interchange at Euston, will lead to some abstraction of traffic from the d.c.-electrified Euston, Broad Street and Bakerloo services on the Watford Line which are not fully loaded. Whilst British Railways desire to maintain the Euston service, the merits of any proposals for curtailing or withdrawing the Bakerloo Line service over the Queens Park-Watford section can only be assessed in the light of traffic patterns after completion of the main line electrification and the Victoria Line. There may well, however, be a case for withdrawing the Watford-Broad Street service which would, in turn, strengthen the case for closing Broad Street station. Other prerequisites to closure of Broad Street are the diversion of the Great Northern services using that station to the Northern City Line (see para. 4.28) and reasonable alternative provision for such essential traffic as uses the Richmond-Broad Street service, which is lightly loaded and makes no contribution to the solution of the London commuter problem.

4.27. *St. Pancras.* On the services from this station the necessary increase in capacity to cater for the expected doubling of the peak hour load can be provided by increasing the number of trains and resignalling. There would be spare capacity after these measures have been taken, and additional population could be served. The projection of some existing trains from St. Pancras to Moorgate via King's Cross cannot be justified on financial grounds, and their withdrawal is planned.

EASTERN REGION

4.28. *King's Cross/Moorgate/Broad Street to Finsbury Park.* On the Great Northern lines the operating and economic efficiency of the present services is impaired by the multiplicity of in-town termini—King's Cross, Moorgate (Widened Lines) and Broad Street—and the existence of motive power and stock of different types, imposed by certain physical restrictions. Commuter traffic is expected to show a moderate increase on the inner-suburban services and to treble on the outer-suburban services, requiring additional trains which can be formed of surplus main line rolling stock. Earlier a.c. electrification plans provided for the withdrawal of Great Northern services from Broad Street and from the City Widened Lines and their replacement through a physical connection with the Northern City Line by direct services to Moorgate, with cross-platform interchange with the Victoria Line at Highbury. This scheme would provide not only an improved and shorter route to the City but exceptionally convenient access through the

Highbury exchange to the West End. The operating and economic improvements expected from such a rationalisation scheme could equally be obtained by adopting a modified form of fourth-rail d.c. electrification (in which case the traction system on the Northern City Line would not need to be changed). The alternative of a link with the Southern Region Blackfriars/Holborn services via King's Cross and the City Widened Lines might entail acceptance of rolling stock of restricted capacity because of the physical limitations of the Widened Lines, and is not favoured. It is considered that the future pattern of the Great Northern line suburban services requires further study. The prospect of an economic scheme of electrification would be enhanced if additional population could be settled in the Great Northern territory, thus absorbing the latent capacity of the system.

4.29. *Liverpool Street Services.* In the 'Cambridge Group' of the Liverpool Street services, the Enfield and Chingford inner-suburban services are not used to capacity, and their traffic is not expected to show much growth, so that some trains might eventually be transferred to the Bishop's Stortford Line where commuter traffic is expected to more than double. The handling of this outer-suburban traffic would be assisted by the electrification of the Lea Valley Line and there would be capacity for further expansion.

4.30. In the 'Colchester Group' the inner-suburban services to Shenfield, operated with high-capacity sliding door stock, are very heavily loaded, and the Southend outer-suburban services too carry substantial loads today. Commuter traffic is expected to show minor increases on the inner-suburban services and fairly considerable increases on the Southend and Colchester outer-suburban services. The expected traffic increase could be catered for by lengthening more trains, but any further increase in traffic would necessitate costly works.

4.31. *Fenchurch Street Services.* On the London, Tilbury and Southend lines, the recently electrified services would be able to cater for the anticipated growth of a third in commuter traffic, if necessary by lengthening more trains to 12 cars (which would, on the Tilbury line, call for platform lengthening). Further growth of traffic could be handled in the same way.

WATERLOO & CITY LINE

4.32. The expected overload on this line can be met, in part, by a slight increase in train frequency. In addition, on such a short shuttle line, the complete removal of seats to create more standing accommodation could be justified as a cheap means of providing additional capacity. The possibility of extending the Waterloo & City Line northwards to Liverpool Street has been examined, but found to be physically impracticable.

RAIL SERVICE TO LONDON AIRPORT

4.33. The problem of a railway connection to London Airport, whether by extension of the Underground or of a British Railways suburban line, can be considered separately from the proposals which have been put forward for the solution of the commuter problem, although the extra demand on scarce constructional resources might affect priorities and the timetabling of works. The airport problem is being studied by a group led by the Ministry of Aviation which has not yet reported.

V. Financial and Other Considerations

5.1. On the basis of the work so far and of the loading standards set out in para. 3.18, the Working Party believe that the foreseeable traffic demands arising over the next 20 years can be catered for by an additional investment programme of comparatively modest scope, comprising expansion of the tube system by some 10 or 12 miles and the addition of rolling stock and some moderate engineering projects on British Railways. It would be premature to undertake at this stage any detailed estimates of costs, but the following notional figures serve to indicate the scale of the railway investment needed to provide the required increase in capacity, over and above expenditure which will be incurred in any case for the purpose of maintaining and improving service quality generally.

	<i>London Transport £ m.</i>	<i>British Railways £ m.</i>
Civil Engineering, etc.		
Fleet Line	57	—
Victoria Line Extension	15	—
Aldwych Line Extension	6	—
Platform Lengthening	1	—
British Railways	—	6
Total: Railway Works	79	6
Rolling Stock	16	15
Total	95	21
	say £100 m.	say £25 m.

5.2. This expenditure on railway works at the rate of some £4½ million a year may be compared with planned expenditure on roads by the Greater London Council of £20 million a year (exclusive of the cost of urban motorways).

5.3. To the extent that plans for the growth of population and employment can be adjusted to take advantage of the various, and in some cases considerable, latent capacities of the present transport system, the cost of providing additional facilities will be reduced. The above figures exclude the capital costs of further schemes (such as the Great Northern electrification) on which recommendations cannot at present be made. Some of these might involve expenditure in the next 20 years.

5.4. It would also be premature to assess the financial consequences of the works proposed. On past experience, it is certain that at any rate the new tube and other major works will not cover all costs, even though they may be shown to confer a social benefit on the London community, or be needed to deal with the sheer weight of the increased demand. It will therefore be necessary to find a solution to the problem of reconciling the execution of works of public transport improvement, urgently needed on social and traffic grounds, with the statutory duty of the undertakings to pay their way.

5.5. The order of priority for the recommended projects will be considerably influenced by the solution found to this problem. However, on British Railways there is an immediate need:—

- (a) to eliminate the uneconomic Hayes service from Paddington;
- (b) to determine the future form of traction to be employed on the Lea Valley Line;
- (c) to resolve the future of the Aylesbury line commuter services.

In addition, it will be necessary to re-examine and decide upon the future pattern of services to be operated from Euston/Broad Street within one year of the high-voltage system into Euston and the Victoria Line becoming operative. The case for electrifying the Great Northern suburban lines, on the basis of studies to date and on present official population plans, is financially unattractive. The future modernisation of these lines appears, therefore, to depend on the planned location of more population on the route and possibly on the acceptance of different financial criteria.

5.6. On the Underground the practical maximum rate of tube construction represents an annual expenditure of about £8 m. (at 1965 values), so that the new tube works proposed would take a minimum of 10 years to complete. Whilst, among the works recommended, the Fleet Line is undoubtedly deserving of the highest priority on traffic grounds (and probably also on social benefit grounds), priority between the new tube works proposed is likely to be largely determined by engineering factors. Planning of the Victoria Line and Aldwych Line extensions is more advanced; powers are being sought, or are about to be sought, and once obtained must be exercised within reasonable time. Planning of the Fleet Line has not yet even reached the stage when a firm alignment can be recommended. It is highly desirable, however, that a rolling programme of work should be authorised so that the specialised plant for tube construction now being used for the building of the Walthamstow/Victoria Line can be put to continuous use and the teams of skilled engineers, draughtsmen and engineering labour can be kept in being. On that assumption the Aldwych and Brixton extensions should be taken first in convenient order to be followed by the Fleet Line.

5.7. Early decisions on the proposals are necessary also to ensure that the proposed tube works are not prejudiced or obstructed by building developments or road works along the line of route. It is also necessary to ensure that the possibility of combining tube station construction with road works, and property developments with working site needs, is given early consideration; and that lands for depots are safeguarded. These needs will make it necessary to work in close co-operation with the Greater London Council, other planning authorities and Government departments. Consultation will be necessary between British Railways and London Transport regarding any surplus lands to be sold by the Railways Board on the routes proposed for new tube railways, and on any branch lines which it is proposed should be absorbed by the tube system. A tentative list of land requirements will be prepared by the London Transport Board as soon as possible, on the understanding that the inclusion of particular lands does not imply authorisation of the project to which they relate. The importance of safeguarding lands which may be required, until decisions on the schemes have been reached, must however be emphasised.

**EXTRACT FROM THE 1949 LONDON PLAN WORKING PARTY REPORT
TO THE MINISTER OF TRANSPORT
ESSENTIALS OF PRACTICAL RAILWAY PLAN**

15. In designing a practical scheme for railway development, the Working Party think it desirable to indicate certain broad principles by which any major railway plan for the London region must be conditioned. First and foremost, it is necessary to distinguish clearly between the two main types of railway service required in the London region.

On the one hand, there is what can be called the 'urban' service, the primary functions of which are the distribution of traffic in detail over the in-town area, involving heavy simultaneous in and out traffic at busy stations, and the transport of passengers between the inner suburban area, *i.e.* within a radius of the order of 10-12 miles from the centre, and the central area. The main characteristics of an 'urban' service are high frequency all day (up to a maximum of 40 trains per hour), frequent stops, and high over-load capacity provided by ample standing room. Short station stops, not exceeding 30 seconds, even at stations where there is heavy traffic boarding and alighting simultaneously, are essential for the maintenance of the high frequency. This necessitates special design of rolling stock, involving ample door openings and standing capacity at the expense of seats. The present urban type railways in London are of necessity largely underground in the central area, and considerations of cost have involved the adoption of a smaller loading gauge for some of these railways (the 'tubes') than adopted for Metropolitan or District stock. But the design of the seating arrangement and door openings for an urban type railway is independent of the loading gauge. The same design is required whether the tunnels are of 12 ft. diameter, the conventional 'tube' size, or of 17 ft., the size necessary to accommodate Metropolitan or District stock, which is practically of main line dimensions.

On the other hand, there is the 'outer suburban' service, the main purpose of which is rapid movement of traffic in bulk between the central area and the outer suburbs, and towns further afield but still within the sphere of influence of the metropolis. The heavy traffics are uni-directional, and there is little simultaneous boarding and alighting at stations. The main characteristics of such a service are comparatively high speed, and a high seating capacity, but a lower frequency than is requisite for an urban service.

16. Bearing in mind this distinction, the general principles accepted by the Working Party are set out below:—

- (a) An urban type service must not extend too far outwards from the central area.

Owing to the frequent stops, the average speed of the urban service is, of necessity, comparatively low. If the service extends too far from the central area, the journey time becomes excessive and congestion is increased. An example of an over-long urban service is the present Bakerloo service

to Watford. (Journey time between Watford and Oxford Circus is 50 minutes.) A reasonable radial length for an urban service is about 12 or possibly 14 miles from the centre, giving a journey time of about 35 to 40 minutes. Any greater distance than this should be catered for by a service with a higher average speed obtained by non-stopping.

- (b) An outer suburban type service cannot at the same time fulfil efficiently the function of an urban type service in the in-town area.

One of the main difficulties lies in the design of rolling stock. For a satisfactory outer suburban service, there must be a high seating capacity. In the in-town area, however, as already mentioned, there must be a high over-load capacity requiring ample standing space, which can only be obtained at the expense of seats, and it is necessary for the door arrangement to be such as to permit rapid loading and unloading simultaneously at stations, so as to ensure a short station stop time. Experimental rolling stock has been designed by London Transport for the Metropolitan (Aylesbury) Line on a compromise basis, but the result is that neither the 'outer suburban' function nor the 'urban' function is performed with full efficiency. Furthermore, the frequent stops in the central area necessary for urban operation militate against the provision, in one and the same service, of a satisfactory fast outer suburban type service. There is also the risk of short-distance passengers crowding off the long-distance passengers if one service attempts to fulfil both functions. Again, the maximum frequency for a successful in-town route, if it is to make any contribution towards the relief of street congestion, must be of the order of 40 trains per hour, whereas the maximum frequency for outer suburban services will be of the order of 25 trains per hour. The presence of junctions, greater braking distances for higher speeds, and the need for tracks to be available, in the outer sections at any rate, for diversionary purposes would prevent a much higher frequency than this from being worked with this latter type of service.

- (c) Any new system of lines in tunnel across London must as far as possible be integrated with the present tube and underground system, but there is a limit to the number of lines meeting at one point for which an interchange station can be designed so as to be satisfactory for passengers.

In a properly integrated system interchange must be convenient; cross-platform interchange of appropriate design to conform with operating requirements should be aimed at where practicable. It is a matter of some difficulty in practice to arrange convenient interchange even between three pairs of lines at one point. The superimposition of further pairs of lines in the central area which, in all probability, will have to be below the level of existing tube lines will be a task of such difficulty that it may be that no satisfactory solution will be practicable, bearing in mind the very great increase in the number of interchange traffic flows for which provision must be made with the addition of every new pair of lines.

- (d) There is a limit to the space available for new tubes in the central area of London in the neighbourhood of the main traffic focal points, taking into account limitations upon curves, gradients and the distance between street and platform acceptable to passengers.

Detailed survey will be required to determine the space available at individual points, but it is doubtful whether there would be room for more than one or two new tubes, with their associated large diameter station tunnels, escalator shafts and circulating areas, in such areas as the neighbourhood of the Bank, Kings Cross and Charing Cross.

- (e) Close-interval, high-frequency urban services must, for efficient operation, be self-contained and must not be subject to interference from freight or long-distance passenger services in their outer sections.

This segregation is necessary in order to preserve the precision of the services required in the in-town area, in view of their frequencies of up to 40 trains per hour upon one pair of tracks. Even a slight delay to the service at its outer end, measured in seconds rather than minutes, will have repercussions upon the regularity of a high-frequency service throughout its whole length, and involve a loss of capacity in the service. During the peaks, delays build up cumulatively, since any abnormal concentration of passengers, brought about by even a short delay, prolongs the station stop time and blocks back the service.

As an example, an unsatisfactory feature of the interworking between the present Metropolitan electric services to Watford and Rickmansworth and the Eastern Region main line trains is their liability to delay each other where they have to share the same tracks north of Harrow. As another example, delays to the London Transport District trains on the section between Bow Road and Barking, caused by conflicting movements of freight trains, upset the regularity of the passenger services over the whole of the District system, to places as far afield as Wimbledon, Richmond, Hounslow and Ealing.

- (f) Some regard must be paid to the economics of new railways in tunnel across London.

It is desirable that any new railways constructed in tunnel across the central area of London should be so aligned as to have a reasonable prospect of carrying a good off-peak traffic, which is necessarily dependent upon shopping and amusement objectives on the line of route.

- (g) New urban railways across London should be sited so far as possible to make a substantial contribution towards the relief of road congestion.

- (h) Any new scheme must be of such a nature that, on balance, a marked benefit accrues to the travelling public.

In meeting planning requirements where these involve the destruction of some existing traffic facilities, especially those that are long-established,

the Working Party consider that it is not sufficient merely to replace those facilities, like with like, but that the opportunity should be taken to afford some improvement.

17. The Working Party have devoted some attention to the question of high-speed relief lines. They recognise that there are cases to-day, such as the Bakerloo service to Watford, where some reduction in journey time is required. They have carefully considered the possibility of relief lines exactly paralleling existing lines right through the central area, with a limited number of stops in that area, but have reached the conclusion that relief in this particular form is not entirely appropriate for conditions in London. The central area of London, where the heaviest traffics arise by reason of the superimposition of the suburban and local passengers, is not more than two or three miles across, so that the saving in journey time within that area, achieved by means of a new railway alongside an existing tube line but with stops at only every third or fourth station, would be very small. Moreover, most of the stations in that area are of such importance, either as traffic objectives or as interchange points, that the opportunities for non-stopping are very limited. It is perhaps of interest to note that on Manhattan Island, south of Central Park, the area which roughly corresponds with the central area of London, the 'express' lines themselves make a large number of stops so that the saving in time is small. Such duplicate railways would serve no purpose outside the peaks, and the Working Party consider that, in the central area at any rate, a new urban type railway should be on a new alignment, where it can make a contribution to the distribution facilities throughout the day, rather than be an exact duplication of an existing railway. Outside the central area, however, as in New York, the Working Party see every advantage in arranging services, where appropriate, with non-stop runs so as to reduce journey time, on the model, for example, of the fast Metropolitan services to Wembley Park and Harrow.

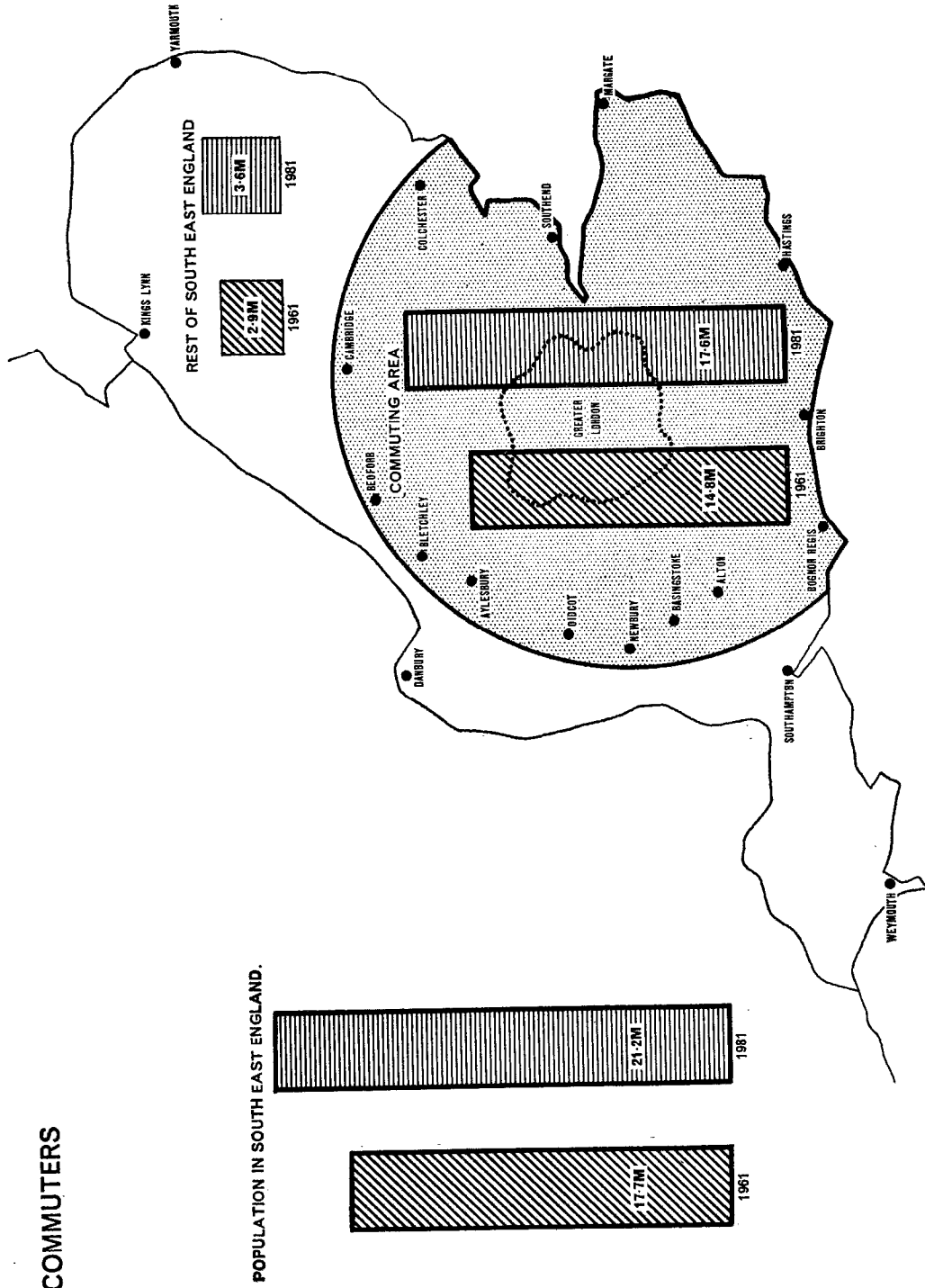
CHART 1

London Commuters: PRESENT PEAK HOUR TRAIN LOADS



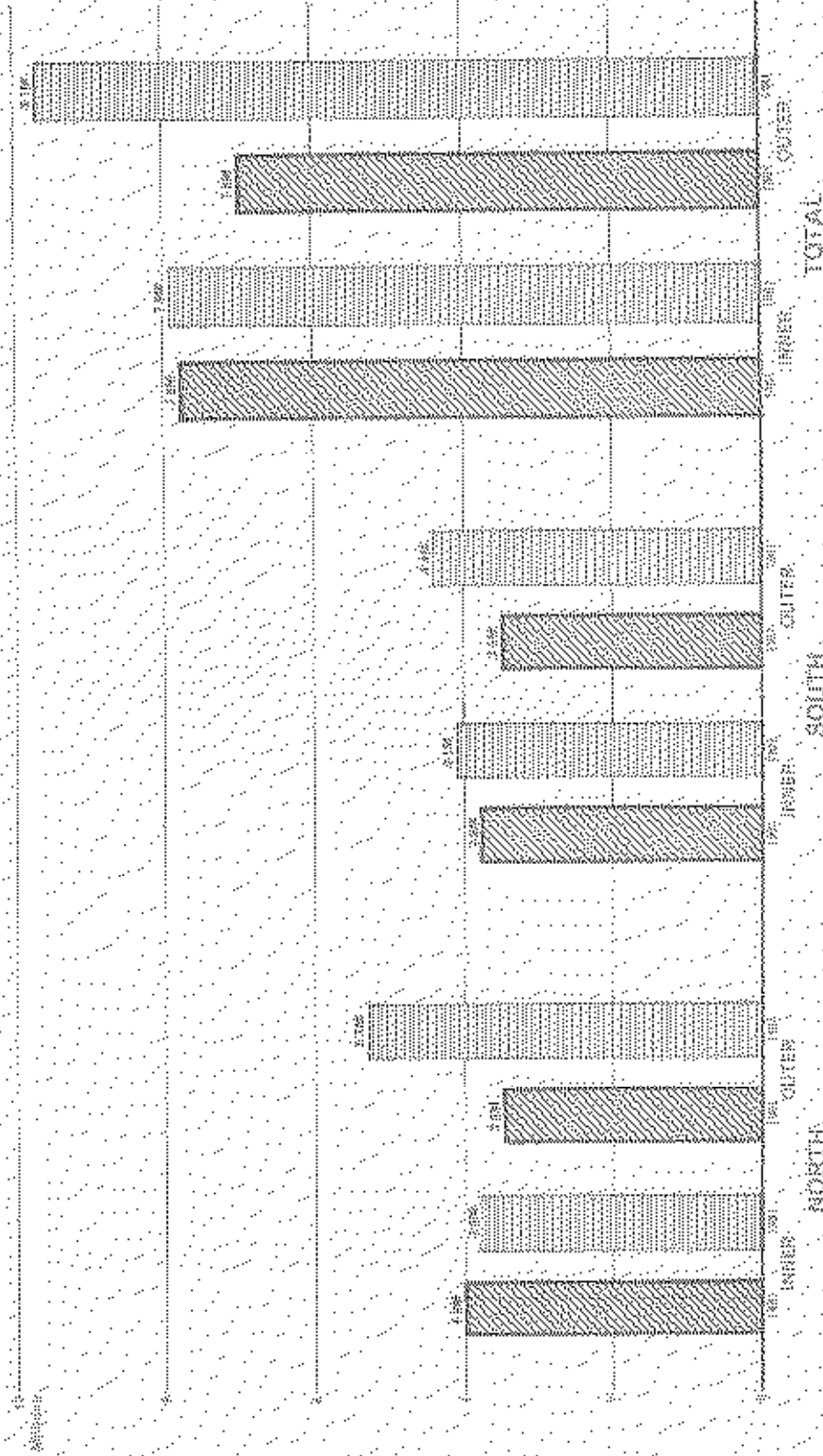
SOUTH EAST ENGLAND — THE COMMUTING AREA
 POPULATION 1961 AND 1981

LONDON COMMUTERS



POPULATION CHANGES 1961 TO 1981

LONDON COMMUTERS



Source: population and density for 1961 from 1961 Census; for 1981 from 1981 Census.

IN-TOWN DISTRIBUTION TO BRITISH RAILWAYS TERMINI

LONDON COMPUTERS

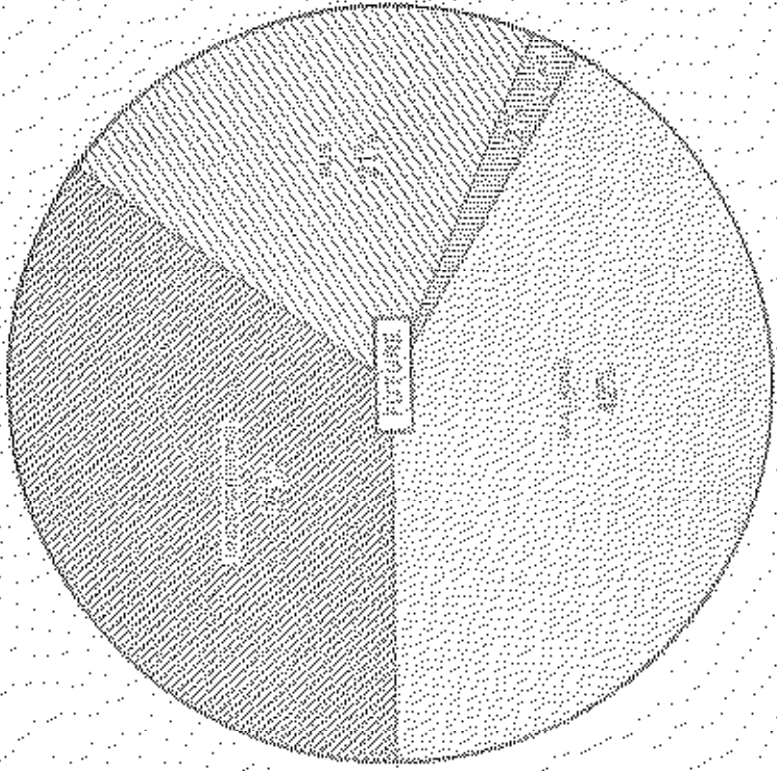
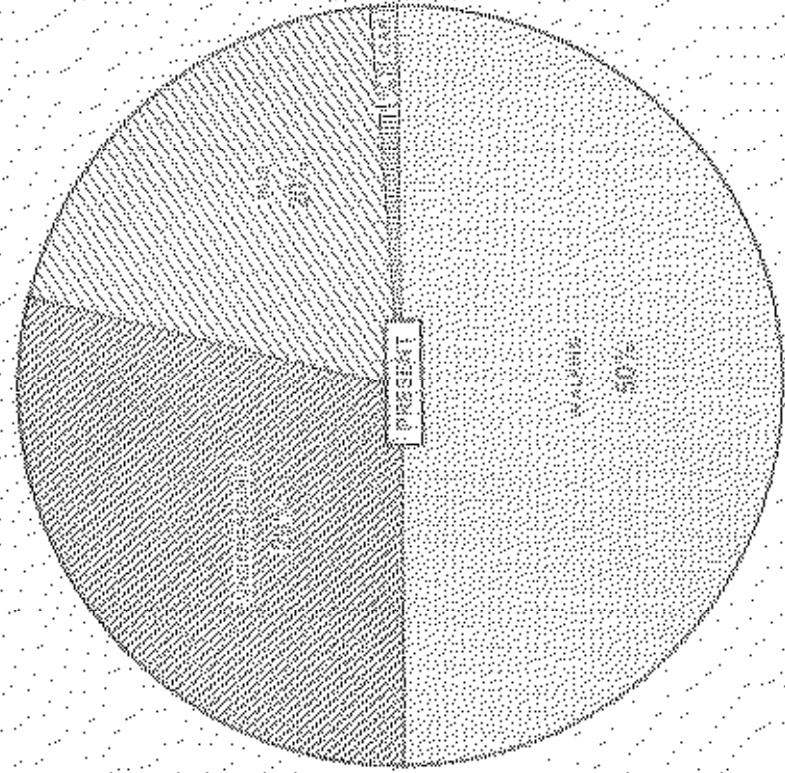


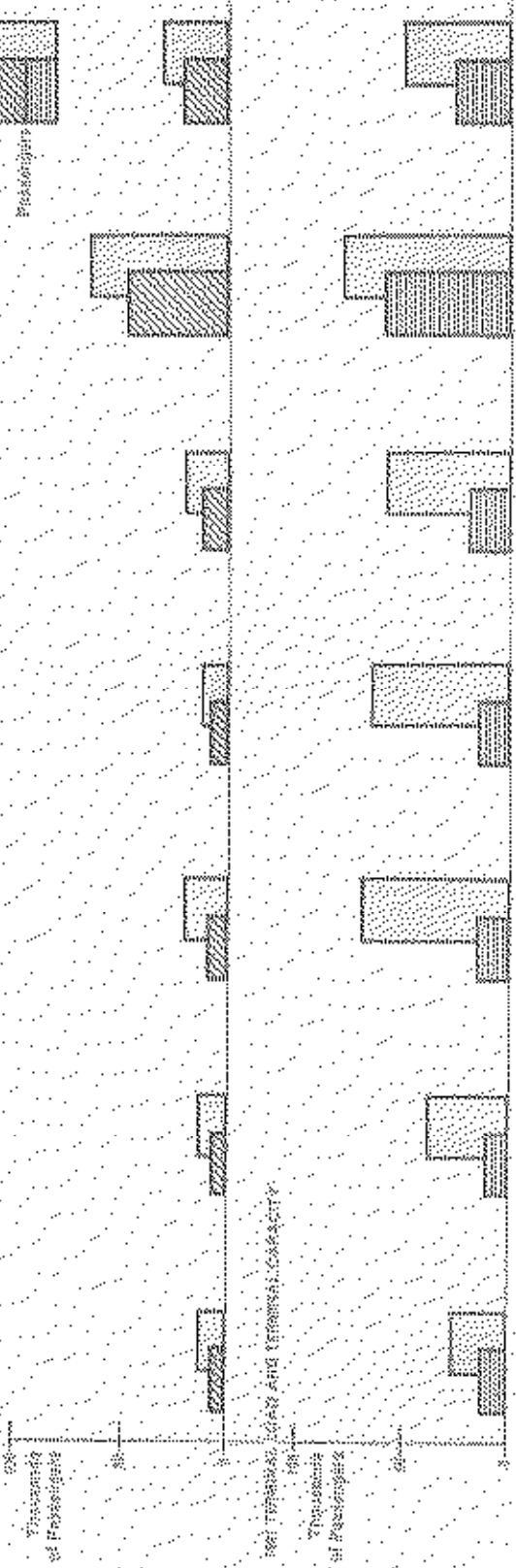
CHART 4

PEAK HOUR LOAD AND CAPACITY AT BRITISH RAILWAYS TERMINI

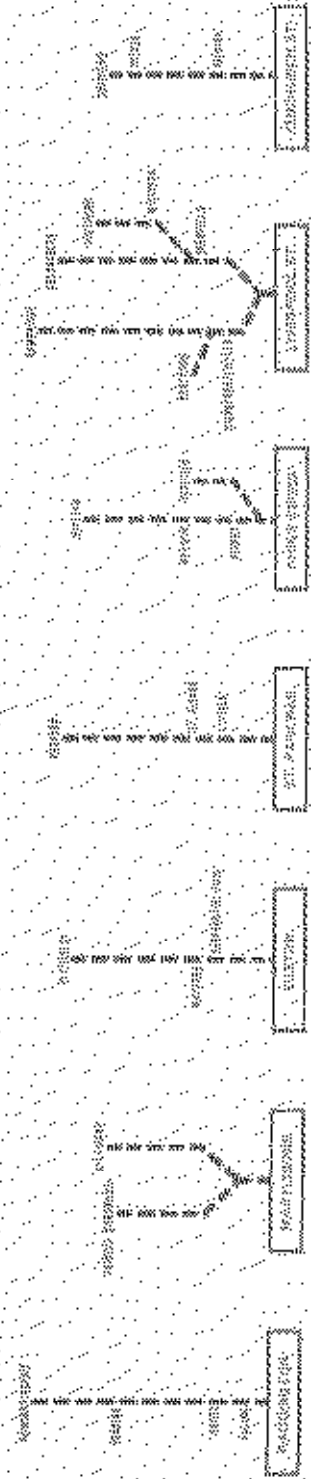
24

LONDON COMMUTERS - NORTH

see TRAIN LOAD AND YEAR CAPACITY

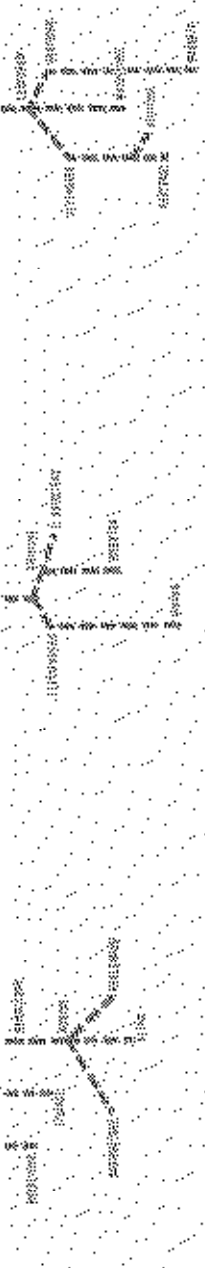
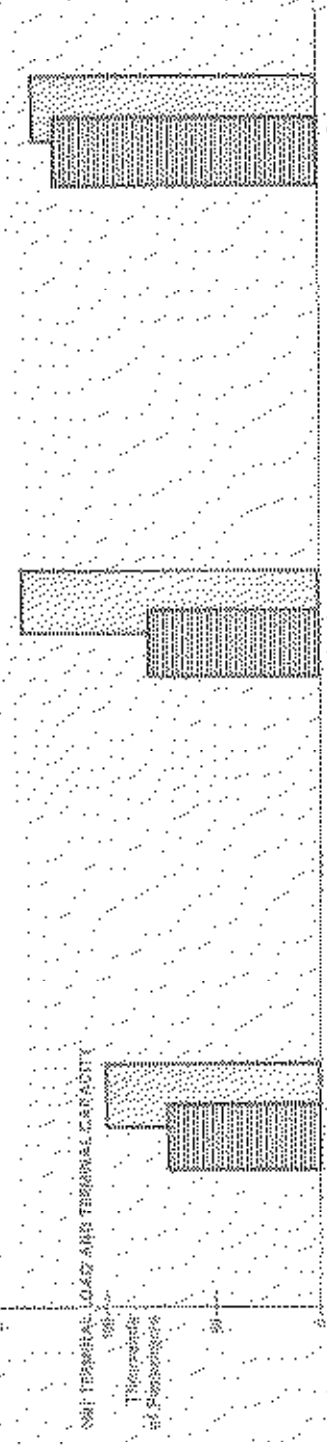
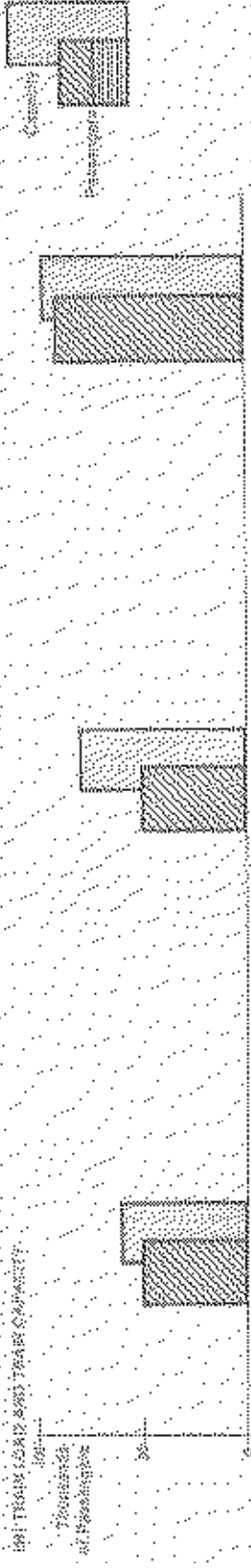
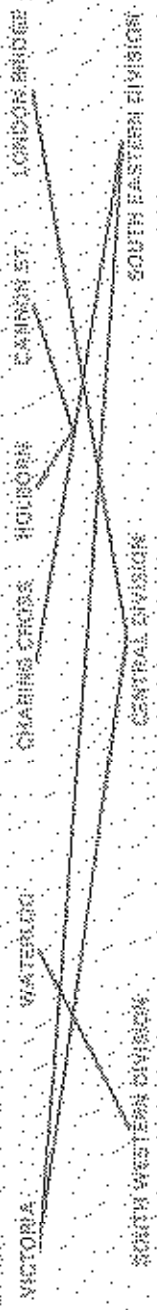


see TRAIN LOAD AND YEAR CAPACITY



PEAK HOUR LOAD AND CAPACITY AT BRITISH RAILWAYS TERMINI

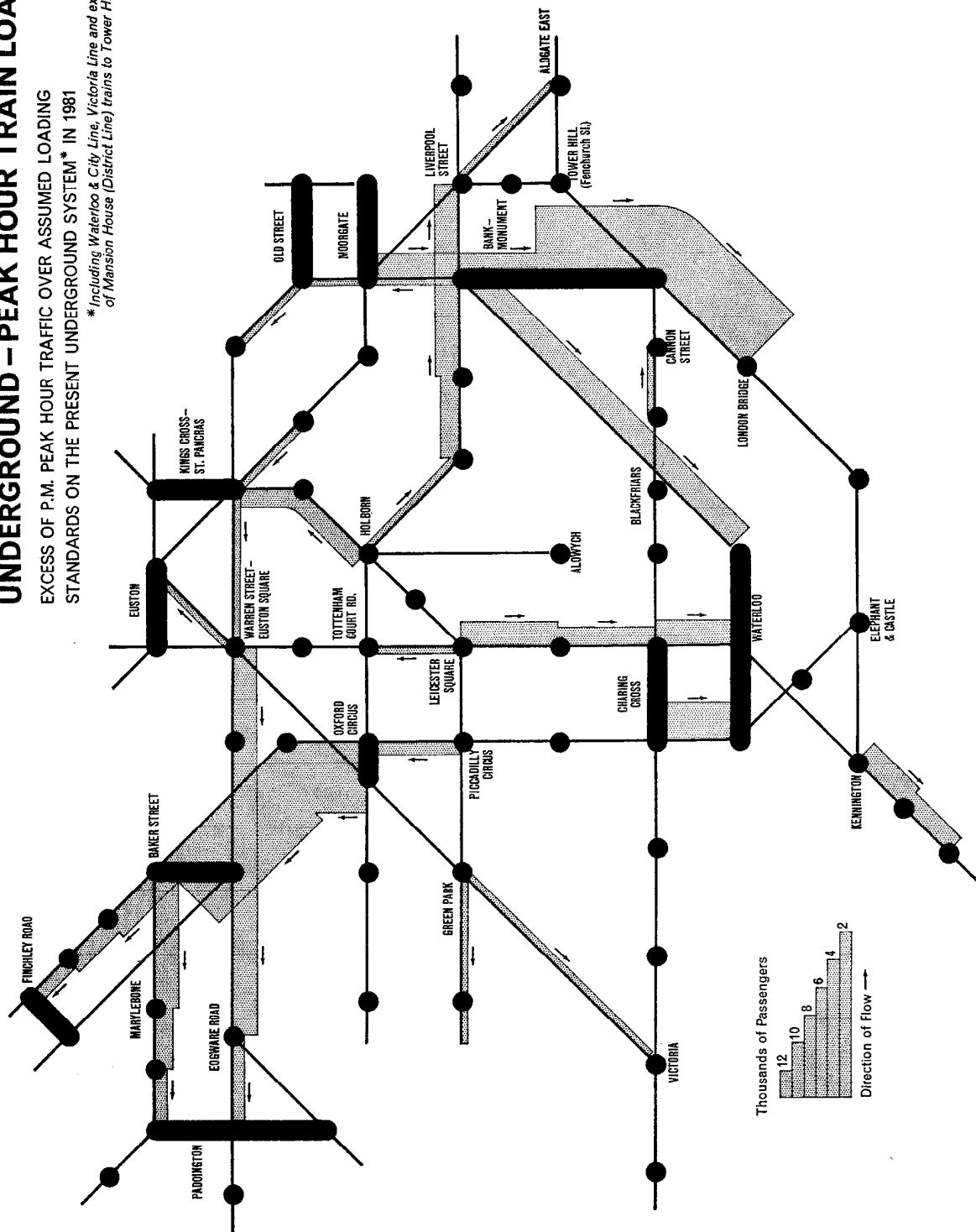
LONDON COMMUTERS - SOUTH



UNDERGROUND - PEAK HOUR TRAIN LOADS

EXCESS OF P.M. PEAK HOUR TRAFFIC OVER ASSUMED LOADING STANDARDS ON THE PRESENT UNDERGROUND SYSTEM* IN 1981

*Including Waterloo & City Line, Victoria Line and extension of Mansion House (District Line) trains to Tower Hill



PROBLEMS AND POSSIBILITIES CONSIDERED -- CENTRAL AREA

