Regional Transport Survey of Madras and Pondicherry



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Preface

FROM THE VERY beginning, the National Council of Applied Economic Research has been making a series of studies contributing to a better understanding of the role of transportation in economic development. The studies started with transport appraisals as a part of the Techno-Economic Surveys dealing with the needs of individual States. Apart from them, the NCAER has also made separate studies of specific transportation problems, such as, Traffic Surveys in the field of Inland Water Transport, Air Transport and Ports. From such studies, the study of integrated regional transportation requirements of specified areas was the next step. Such a study was first made in 1963 in connection with the transport requirements of the Iron and Steel Belt. It was, therefore, a happy coincidence that the Council was prepared, when the Planning Commission, early in February 1963, suggested to it that it take up a regional transport study in the Madras State embracing all forms of transport, with the assistance of the Government of Madras and the authorities of the Southern Railway.

The basic purpose of the Madras Survey was to assess the transport requirements of the region over the next 10 or 15 years having regard to its potential for economic development. The Survey had to provide answers to the questions:

(1) what is the probable volume of traffic in the region which will need to be handled by different modes of transport in the years 1970-71 and 1975-76?

(2) what are the character and the extent of deficiencies in the existing capacities in relation to current requirements; and in relation to anticipated traffic densities by 1970-71 and 1975-76?

(3) what physical assets will need to be created and the places where they will need to be put in to augment the capacities where deficiencies are expected in each mode of transport? and,

(4) the amount of investment that will be necessary to meet the cost of improvements and additions proposed.

And in answering these questions the comparative costs and suitability of each mode for the various types of traffic had to be kept in view.

The study of this region was intended to be a type study, which would throw light on suitable methods for studying transport problems in other parts of the country. It was thought also that a study of this character would help in determining the facts and criteria for public policy in the matter of development of transportation.

The work involved was not a mere study in transportation. As transportation has to serve the needs of agriculture, industry and trade, and the future needs of transport had to be predicted, it was necessary to predict in the first instance the growth in the different sectors of the regional economy—agriculture, mining, fisheries, forestry, industry and trade. To assess the future demand for passenger transportation and for transportation of consumer goods, the trend in population and in individual incomes in the past had to be studied and predicted for the future.

Certain basic difficulties had to be faced by us during the course of this study. Except for the railways, the roads and the ports, there is hardly any statistical data in regard to large areas pertaining to transportation. Over a wide range such as road transport of goods by trucks and bullock-carts either in the aggregate or by commodities, the density of road traffic in different types of vehicles at various points, along the length of even the major roads, the volume of passenger traffic by buses between specific points, etc., virtually no statistics are available. The situation had to be assessed by our field staff as best as they could and even the available statistics had to be subjected to substantial processing to meet the particular needs of the task in hand.

At the time we took in hand the task of predicting the future activities in the fields of agriculture, industry, mining, etc., the departments directly concerned were themselves unable even to indicate what the prospects were for the Fourth Plan period. We had to rely almost entirely on our own estimates, based on the existing potentials for expansion in each field.

Another major difficulty encountered was that in the case of a road network or of any of its sections, the concept and measurement of capacity, in the conditions prevailing in this country, had not so far been systematically studied. Movements of goods and passengers on the roads are neither scheduled nor coordinated by a unified authority as rail movements are. Further, road traffic is made up of many kinds of vehicles, such as bullock-carts, cycles and mechanised vehicles, each with its own characteristic range of speeds and with different effects on road capacity. To obtain workable, though only tentative measures of road capacity, a series of "speed-traffic density—traffic mix" road tests had to be undertaken in collaboration with the Highway Research Centre, Madras.

Certain findings of interest reached as a result of the analysis of the present situation may be first briefly referred to here:

(*i*) While in the past there were serious shortfalls in meeting the transportation requirements of the region owing to continuing restrictions in the bookings over the North-East line sections of the Southern Railway, via Waltair and via Vijayawada, the Survey has disclosed that the Region's transportation requirements are now being satisfactorily met.

(*ii*) The transport users in the region appear to have spent about Rs. 59 crores on transportation or about 6 per cent of the regional income. Of this expenditure, about 27 per cent was on rail transport and 73 per cent on road transport. Road transport thus holds unquestionably a predominant position in the area under survey.

(*iii*) The Madras State has achieved the fulfilment of the 1981 target as set by the Bombay Plan in respect of the total length of roads. Notwithstanding this there are areas of poor accessibility, such as in parts of Ramanathapuram District.

(*iv*) The traffic density on the roads, taking mechanical vehicles and the bullock-carts together, has more than doubled during the period 1951-61.

(*v*) The fact that about 94 per cent of the length of the railways is parallel to roads and that road transport in the region is well-organised in respect of both goods and passenger traffic, explains why there should be, and in fact there is, strong competition between the two forms of transport. The railways cannot hope to attract as much patronage as the road transport is having, unless in respect of attractiveness, frequency and convenience they match fairly the services and the satisfaction given by the road services.

Broad findings of the future traffic potential are indicated below:

The availability of the principal factors influencing the growth of the economy in the Region augur well for the future. Given the necessary financial input, an annual rate of growth of over 6 per cent in regional income can be expected; the industrial growth can be around 10 per cent; and the agricultural about 4.9 per cent (the lower figure being due to diminished prospect of further sources of irrigation). The per capita income can be expected to go up to Rs. 412 in 1970-71 and to Rs. 605 in 1975-76, both in terms of 1961 prices.

In the light of these anticipated trends the aggregate passenger traffic by trains and by buses by 1970-71 and 1975-76 is expected to increase to 1.9 times and 2.6 times of that in 1962-63.

Regarding goods traffic, the trend of decline in high-rated traffic and increase in low-rated commodities, observed in recent years so far as the railways are concerned, is expected to continue. The total regional goods traffic by rail and road is expected to go up from 16.75 M. tonnes in 1962-63 to 32.77 M. tonnes in 1970-71 and 51.37 M. tonnes in 1975-76. The aggregate traffic is

expected to be shared approximately equally between road and rail on about the present pattern over the different lengths of haul. The anticipated rate of increase in road and rail traffic works out to approximately about 12 and 14 per cent respectively in 1970-71 and about 11 and 13 per cent respectively in 1975-76.

In order to deal with these anticipated increases, the Council's findings are that additional section capacity will be needed over all the metre gauge and broad gauge main lines within the region and over the Tiruchirapalli-Erode BG section and the Tiruchirapalli-Karaikkudi MG section. Further, when the Steel Plant envisaged near Salem materialises, the Vridhachalam-Salem section will need additional capacity.

The Council's view is that so far as the main line sections are concerned, the additional rail capacity needed should be created by conversion of the metre gauge lines to broad gauge rather than by doubling the lines. Also that there is a good case for a new broad gauge line connecting Salem with Dindigul via Namakkal.

So far as roads are concerned, it is anticipated that the traffic density will exceed capacity over a number of sections calling for widening of the roads.

The investment considered necessary under new lines and improvements of railways and roads and road transport, is placed at Rs. 124.5 crores during the Fourth Plan period; and Rs. 122.7 crores during the Fifth Plan period.

The present study is unique in some respects. It is the first of its kind in the country. So far as I am aware, this is also the first time, when aggregate dimensional and locational forecasts have been attempted of the transport requirements, based on anticipated industrial, agricultural and commercial developments. An integrated view has been taken of transportation as a whole including all forms of transport. Predictions of production for important industrial, and agricultural commodities were made by specific locations, by taluks or districts, together with forecasts of population, income and income distribution, and of demand for various commodities; and the transport projections rest on these analyses.

One of the serious deficiencies at the present time relates to the concept of road capacity—single lane and double lane. The Council's work in the course of this Survey in this field of research has, I am glad to state, led to the revision of previous ideas, leading to a more realistic appraisal of road capacity. Further, it will not be out of place to mention here that besides offering a positive contribution in the field of transportation planning for Madras, the Survey has also supplied a model for the methodology for the appraisal of transport needs and transport developments generally.

The entire work was done under my direction and guidance. It is a pleasure

to record here the valuable assistance of Mr. S. R. Kalyanaraman, Transport Consultant, during almost the entire period of the work; Mr. C. D. Foster a Colombo Plan Consultant from Oxford University for two short spells for giving the Council the benefit of his advice on a number of aspects of the study; Mr. M. Narayanaswamy, the Project Leader, who bore the brunt of actual work in the field and later in the processing of the material and drafting of the Report with the help of a small team of officers and assistants, as given in Appendix 1.

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P. S. LOKANATHAN
Director-General

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Chapter 1

Introduction

Aims of the Survey

THE AIMS OF this Regional Transport Survey are two-fold : First, to give guidance on transport planning in the region selected for study, and, second, to work out a methodology for such a study so that it can be used for making similar studies in other regions of the country.

1.2 The 'region' covered by this survey comprises nine out of the thirteen districts of Madras State, namely, South Arcot, Thanjavur, Tiruchirapalli, Salem, Coimbatore, Madurai, Ramanathapuram, Tirunelveli and Kanyakumari and the contiguous Centrally-administered territory of Pondicherry.[1] Its time horizon is ten years from 1965-66.

1.3 The central purpose of this survey is to answer the questions:

(*a*) What will be the volume of traffic in the region by the various means of transport in the years 1970-71 and 1975-76?

(*b*) Where and by how much will the deficiency be in the present capacity in relation to the anticipated traffic densities at the end of each five-year period?

(*c*) What type of physical assets will have to be created, in what quantities and where, to augment the capacity where deficiencies are anticipated in each mode of transport? and

(*d*) What will be the necessary investment?

1.4 While this is, no doubt, a regional transport survey, it is possible to make sensible projections of the demand for transport only on some basic estimates about the regional economic growth, the future location of industries

1 Madras City and the districts of Chingleput, North Arcot and the Nilgiris are excluded from this study as the traffic problems there are more complicated and as it was thought desirable to take up that area after first working out the approach and methodology on the relatively simpler problems of the region analysed in this volume.

It has since been decided to take up the survey of the Metropolitan area and the rest of the State and the work is in hand.

and the distribution of population. It would, therefore, be more correct to say that the study here is of the anticipated economic growth of the region, of which the prime object is to give guidance on transport planning. But such a study naturally has implications also in respect of policy decisions on the general regional economic planning, industrial location and migration of population within and outside the region.

1.5 The survey investigates the present situation in the transport of goods and passengers in the region and makes an appraisal of the growth potential of the regional economy during the Fourth Plan period, and, to the extent possible, in the Fifth Plan period. In the light of these twin investigations, the impact of growth potential, in terms of traffic flows, on the densities and pressures on the transport system of the region is assessed. Finally, investments are suggested to create new capacity, to modernise technology and equipment, and to coordinate, more effectively, the different forms of transport in the region as a phased programme for the Fourth and the Fifth Plan periods.

1.6 A clear picture up to the end of the Fourth Plan is sought to be given; and, understandably, only less sure indications have been given for the five years from 1971-72 to 1975-76.

Methodology of the Survey

1.7 Broadly the method adopted here has been to consider initially passenger and goods traffic separately, rather than to adopt the more usual course of dividing the discussion between road and rail. This is for the reason that both for the analysis of the existing situation and for projections, the closer inter-relationship is between the problems of passenger traffic by road and rail, on the one hand, and the problems of goods traffic by the two modes, on the other. It is only when we come to consider the relationship between traffic flows and capacity, as they are now, and as they will be in 1970-71 and in 1975-76 that we deal with the distribution of the traffic between road and rail and the aggregates of passenger and goods traffic by each of these modes separately.

1.8 The approach to the problem of traffic forecasts in this survey is by a series of approximations. The first step has been to take up passenger traffic by road and rail and to estimate it as it now is and to plot these flows on maps. Those characteristics which are relevant to making projections on to the future are taken note of. The next step has been to estimate what the flows of traffic will be in the aggregate by both the methods of transport in 1970-71 and 1975-76. To do this, projections have been made of population and income on to 1970-71 and 1975-76; and also of the proportions of household income

likely to be spent on passenger travel. Business travel is separately estimated and added. By this process the aggregate passenger traffic is estimated for each district separately.

1.9 Broadly, the same stages are then gone through for goods traffic: assessment of the present traffic and its division between road and rail and the other modes; analysis of its characteristics most relevant to the projections; forecasting the growth of traffic based on the anticipated growth of the regional economy and what it is likely to mean to the production, consumption and distribution of commodities. There is, however, one basic difference between passenger traffic and goods traffic. Whereas passenger traffic is dealt with as one integrated item, in the case of goods traffic each major commodity has had to be dealt with as a separate item for making projections.

1.10 At the next stage, the *anticipated* traffic flows are compared with the *existing* capacity of the transport system. Necessarily this comparison must be made for each mode of transport separately, at any rate, in the first instance; that is, the distinction now is between rail and road traffic and not between passenger and goods traffic. This involves, as a first step, the allocation of the anticipated aggregate goods and passenger traffic as between the railway and the roads. This has been done bearing in mind largely the pattern of the present division.[1]

1.11 Flow maps for 1970-71 and 1975-76 are drawn up, for each mode of transport separately, for the division of traffic envisaged. The survey discusses what is meant by capacity and in what units it is measured in the case of each mode of transport. A comparison is made between the capacity of the present road and rail systems and the flow maps that have been prepared for the respective systems, for 1970-71 and 1975-76, to ascertain where and when there is likely to be any overloading and to what extent.

1.12 The next problem considered is what advice to give where overloading is visualised. In some cases it may be possible to increase capacity sufficiently with little or no expense; for example, by using selective rates or by regulation, to divert traffic from a crowded road into a less crowded railway or *vice versa*. In other cases it might be possible and economically desirable to avoid a bottleneck by changing the location of a new industry—suggesting, for example, that a new factory would throw less strain on the transport system if it were located at *A* rather than at *B*.

1 It was proposed initially to allow also for the likely changes in future on account of: (1) changes in technology and costs and therefore in the rates charged, and (2) changes in transport-users' preferences affecting distribution of traffic. But the idea had to be given up owing to the absence of adequately reliable statistics of cost and owing to our consumer preference studies not yielding concrete results. Paragraphs 4.27 to 4.32 may be seen in this connection.

1.13 Even after such adjustments, there may be other instances where it would be necessary to have investment. These are isolated. First, 'desire maps are drawn. For instance, in Figure 1, if the roads between *A* and *C*, both via *B* and via *D*, are predicted to be heavily overloaded, should the improvement be of both, or of one, or is the building of a new road *AC* to be considered? It is probable that from *A* some traffic now goes to *C* via *B* and others via *D*. A desire map is a method of showing between which towns (or areas) exactly people (or goods) desire to move, irrespective of the actual route they are taking now. These desire maps[1] give an insight into the possible investments to satisfy the demand.

1.14 In the case of ports, inland waterways and airports also, the same approach, the same pattern of estimation of flows in the base year and in 1970-71 and 1975-76 and the same method of comparison with the present capacity, leading to a discussion of investment, is adopted.

Tentative Nature of the Conclusions Reached

1.15 By the very nature of the subject under study the transport projections that have been made are tentative. They are variable according to the agricultural and industrial production in the region and elsewhere nearby.

1.16 There are at least three reasons for which those in authority may differ from the conclusions following the projections here. The first is that resulting from the time lag. By the time this Report is published and subsequent to it, before the actual decisions to invest are taken, the facts may have changed in such a way as to affect the projections significantly. But this is an inherent feature of every survey of consequence. Secondly, there may be changes of the Plan with similar effect. Lastly, decision makers may have different values from those used here. For example, it may have been recommended here that a certain transport investment is best from the point of view of maximising the gross regional product; but the Government may decide that, even so, it is better to choose another on the ground that it would tend to equalise incomes. No one would quarrel with this decision. All that might be stated is that the structure and conclusions here must be regarded as conditional on certain assumptions of fact and value.

1.17 Arising out of this is also an important point of methodology. The assumptions on which the conclusions here are based have been made clear at every stage so that it would be easy to bring about suitable changes in these

1 Map 12 may be seen as an example. It is a "Desire Map" for the predicted movements of cement in the years 1970-71 and 1975-76.

SKETCH EXPLAINING DESIRE MAPS[1]

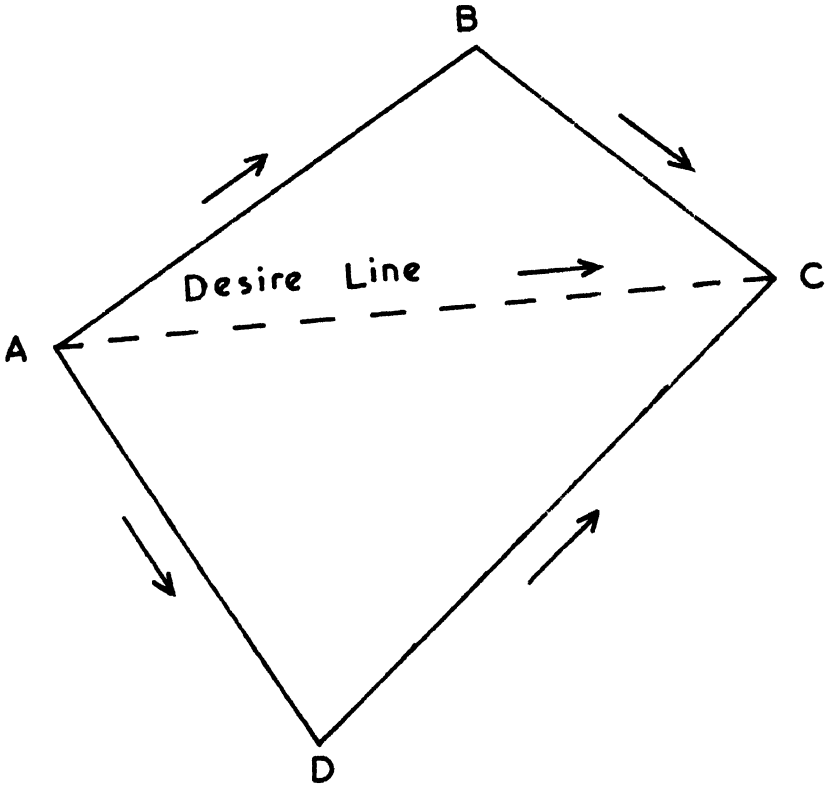


Fig. 1

1/ Refer para 1.13

conclusions to fit in with any altered situation. An example may be given. Suppose agricultural production in Thanjavur district should turn out to be much lower than that assumed here. It would then be possible to trace through the consequences of this for the transport system, i.e., where the flow would be less and where else more because of imports from elsewhere to meet the shortfall.

1.18 In addition, room will necessarily and rightly have to be left to local initiative for making changes to suit the local conditions. Most of the conclusions in the survey are based on district averages. A rough prediction of how much the real income per head will rise in a particular district has been made, but no separate predictions for each taluk or village. The assumption is that real income per head rises at the same rate in each taluk or village and recommendations are made accordingly. Now this may be untenable as only those with local experience will know. Taluk *A* will have a higher increase in real income per head than Taluk *B*, perhaps for a variety of reasons—the nature of the soil, receptivity of the people to new ideas and so on. In consequence the flow on road *X* will be higher and that on road *Y* will be lower than envisaged. Those who have local responsibility and knowledge should take the flow maps and modify them accordingly.

Chapter 2

Economy and Transportation : The Regional Background

BEFORE PROCEEDING TO predict the economic activity in the region under study in the years 1970-71 and 1975-76 and therefrom deriving projections of the volume and pattern of the future aggregate passenger and goods traffic, it will be useful to give a picture of the regional economy as at present and of the transportation facilities now available.

Regional Economy

Area Covered

2.2 As has been stated in Chapter 1, the region under study is made up of nine out of the thirteen districts of Madras State and the Centrally-administered contiguous territory of Pondicherry. The districts within Madras State, covered by this survey, contain roughly 82 per cent of the area of the State and 78 per cent of its population.

2.3 The total area of the region is about 1,06,000 sq. kms. It extends 512 kms from north to south (from Hosur, Salem District to Cape Comorin, Kanyakumari District), and 344 kms east to west (from Tranquebar, Thanjavur District to Coimbatore). It has a land boundary of approximately 1,280 kms and the coastal length is about 832 kms. There are no natural harbours and the slopes near the coast are so gradual that ocean-going vessels have to be moored out at sea at distances between 3 and 8 kms at the various ports.

Population

2.4 The region is densely populated. The average density (as per the Census 1961) is 250 per sq. km as against 146 per sq. km for the country as a whole. The total population of the region is 26.6 million (26.2 million in the districts of Madras State within the region and 0.4 million in Pondicherry). Signi-

ficant variations from the average density of population of the region are noticed only in the districts of Ramanathapuram, Thanjavur and Kanyakumari. Ramanathapuram district, with its arid plains, has a population density of 195 only as against the regional average of 250. The district of Thanjavur, fertile and fed by the Cauvery, has a density of 339, while the smallest district in the region, Kanyakumari, has the highest density of 602 (Table 1).

2.5 During the last three decades, the population of the region (excluding Pondicherry) has been growing at a somewhat lower rate than the State percentage of increase. Whereas for Madras State the growth rates are 1.13, 1.38 and 1.13, the corresponding rates for the region are 1.09, 1.27 and 1.04 respectively. These rates are indicative of the steady migration going on from the districts to the State capital and elsewhere. A significant feature is that the rates of growth of population in the region and in the State have in the latest decade been substantially lower than the corresponding rate for the country as a whole which is 1.96 per cent.

2.6 Only 23 per cent of the regional population is urban, even though the urban population has been growing at a faster rate than the rural. Between 1951 and 1961, the urban population rose from 20.6 per cent to 22.9 per cent of the regional population. The increase in urban population was due to the growth of existing towns and the rise of new urban localities. The number of towns increased from 241 in 1951 to 282 in 1961 (vide Table 2). An interesting point to be noted is that generally the number of towns with larger populations has increased at a higher rate than that with comparatively less population.

Agriculture

2.7 The regional economy, like that of the State, is essentially agricultural. In 1960-61, 46.1 per cent of the regional income was generated in the agricultural sector and 62.6 per cent of the working force was engaged in it. The comparative figures for the State as of that year are 49.5 per cent and 60.5 per cent respectively, and those for all-India are 48.7 per cent and 69.5 per cent.

2.8 The per capita income generated in the agricultural sector is Rs. 246 compared with Rs. 209[1] for India. Heavy pressure on land and low earnings from agriculture are persistent characteristics of the regional economy. The availability of cultivated land per head of agricultural population is less in the region (0.76 acre) and the State (0.73 acre) than in India (1.0 acre).

2.9 The total area of the region is 26.42 million acres. The pattern of

1 In contrast, the per capita income from agriculture in Pondicherry is as low as Rs. 95, mainly due to the heavier pressure of the population on the land, and the relative predominance of urban area and population.

utilisation of land as obtaining in 1960-61 is set out in Table 3. The area sown accounted for 12.6 million acres, i.e., 47.7 per cent of the regional area. The acreage sown more than once was only about 9.7 per cent of the total land area but 16.9 per cent of the total sown area.

2.10 In 1956-57 the region had 1.58 million acres of cultivable waste and 3.58 million acres of fallow land including current fallows. Together these constituted land tracts which could be reclaimed for cultivation. The progress in reclamation has been hampered due to difficulties in obtaining tractors and bulldozers and in maintaining them in a proper state of repair. Between 1956-57 and 1960-61, the acreage of cultivable waste and fallows was reduced from 5.16 to 4.81 million acres (vide Table 4).

2.11 The region has no adequate resources for any further development of major irrigation. The irrigation potential of the major rivers, such as the Cauvery and Tambaraparani, has been fully utilised. The area irrigated by canals, tanks and wells and other sources rose from 4.57 million acres in 1956-57 to 5.08 million acres in 1960-61. Particulars of acreage irrigated by different sources are set out in Table 5. It will be seen from Table 5 that the increase in the area sown more than once has been larger than that in the net area sown and this is on account of additional irrigation facilities.

2.12 The index of cropping intensity in 1960-61 (i.e., ratio of gross sown area to net sown area), was 128.2 in the region in the irrigated areas and 115.2 in the unirrigated areas, as compared with an index of 114.4 in irrigated and 114.8 in unirrigated areas in all-India. The emphasis in the State's Second Plan was more on the use of improved seeds and fertilizers than on irrigation for raising the agricultural output of the State and of the region, as additional irrigation resources were marginal. There is, however, a possibility of increasing the irrigated area in the region by diversion of certain west-flowing rivers in Kerala to irrigate areas in Ramanathapuram and other districts to the extent of 0.57 million acres.

2.13 Compared with all-India, the region (like the State) has a large proportion of the total cropped area under the more valuable crops. In the cropping pattern of the region paddy is the single largest crop accounting for 31.4 per cent of the acreage under cultivation. The area under other cereals (which is a composite item including jowar, bajra and ragi) is 31 per cent; groundnut, cotton and pulses follow in that order with about 10.4 per cent, 6.5 per cent and 6.3 per cent of the total cropped area. The area under sugarcane is much smaller, 1.1 per cent only, which is comparatively low having regard to the available irrigation facilities in the region; but the signs are that the area under this crop will make big strides in the future. Maize is only a marginal crop grown mainly for use as fodder.

2.14 The paddy crop, which a decade ago was insufficient to meet the State's needs, now not only does so, but proves to be a growing source of exports to the adjacent State of Kerala. From the point of transport, rice and paddy along with cotton, sugarcane and oilseeds are important. Also, the State and the region have a persistent deficit in grams and pulses calling for their transportation from far off sources of supply such as the Punjab.

2.15 The figures of agricultural production (major agricultural crops) in the region in 1951-52, the first year of the First Plan and in 1960-61, the last year of the Second Plan, are set out in Table 7. It is seen that rice takes the pride of place among the different crops both in terms of absolute tonnage and in terms of its rate of increase during the period. Other crops showing fair increases in production are jowar, other cereals and chillies. Groundnut, cotton and tobacco have increased by about 26 per cent each.

2.16 From Table 8 it will be seen that the acreage under cultivation has been practically stationary; but the increase in agricultural output in physical terms (i.e., tonnages) is about 19.7 per cent during the period 1956-57 to 1960-61. The average yield per acre of a number of important crops has been going up during the period in question.

2.17 Compared with all-India, the average yield per acre of the different crops in the region was substantially higher in 1960-61, as may be seen from Table 9.

Forests

2.18 The forest resources of the State are small compared with those of other States or with the average for the country. While 22 per cent of the area of India is under forests, the corresponding proportion for the region is about 13 per cent. In relation to population there are 0.13 acre of forests per capita in the region as against 0.40 in India. The forests are of a poor quality. The main forest products are firewood, casurina fuel, sandalwood and bamboos. Recently, there has been an attempt to push up cashew plantations.

2.19 During the years 1958-59 to 1962-63, the production of firewood in the region has doubled. The sandalwood production has been about eight times what it was in 1958-59. The output of bamboo has shown a substantially declining trend and that of casurina fuel has remained stationary (vide Table 10).

Fisheries

2.20 Madras State is next only to Maharashtra and Kerala as a fish producing region in India. Within Madras State the region under study is predo-

minantly a fish producing area. Except for Chingleput District, the rest of the marine fishing grounds are in the region. Thanjavur, Ramanathapuram, Tirunelveli and Kanyakumari contribute as much as 88 per cent to the total marine fish output of the State. In respect of inland fishing also the region is important: Thanjavur followed by Tiruchirapalli and Salem districts are the major inland fish producing areas. Although Madras State is an important fish producing region in the country, the average output per fisherman in 1957 was 0.8 tonne, the average for all India being more than double this figure. Besides marine and inland fishing, the region has the distinction of being the only pearl and chank fishing area in the country.

2.21 Fish production in the region has gone up from 97,000 tonnes in 1956-57 to 1,86,000 tonnes in 1962-63, i.e., an increase of 92 per cent during the period of six years, the annual growth rate being of the order of 11.5 per cent (vide Table 11).

Minerals

2.22 The region under study is the mineral area of Madras State, containing the State's deposits of iron ore, lignite, magnesite, limestone, gypsum, ilmenite and most of the bauxite. It produces most of the salt also.

2.23 Among the mineral resources, magnesite, gypsum and lignite are significant. With nearly 80 per cent of the known resources of India, the region accounts for 97 per cent of the all-India magnesite production. It occupies a similar position with regard to gypsum in South India. The lignite and limestone resources are large. The better grade bauxite in the State is confined to the region. Also a small but fairly rich base metal deposit (copper, lead and zinc) has been discovered recently in the South Arcot District of the region.

2.24 The bulk of mineral production in the region, in terms of value and at 1961 prices, consists of salt 48.1 per cent, limestone 31.3 per cent, magnesite 15.3 per cent, gypsum 4.0 per cent and ilmenite 1.0 per cent. The figures of production and the rate of growth for individual mineral products in terms of tonnes, are shown in Table 12—fireclay, corundum and magnesite recording the most sizable increases.

2.25 Mineral production, whether in the State or in the region (relatively to India), is still very small, though in recent years, due to the mining of lignite and limestone in larger quantities, the share is steadily going up. The value of all the minerals produced in the State in 1961 was Rs. 260.75 lakhs and constituted about 1.5 per cent of the value of India's mineral production, while that of the minerals produced in the region was Rs. 226 lakhs, i.e., 86.5 per cent of the State's production.

Industry

2.26 In recent years and more particularly since the inception of the Third Plan, the region has witnessed a quickening of the tempo of industrial development. A good beginning has been made in the dispersal of industry away from Madras and Coimbatore with the starting of the lignite project at Neyveli, the high pressure boiler plant and the rerolling plant at Tiruchirapalli, aluminium manufacture at Mettur and caustic soda production at Attur and Mettur. This trend is also likely to be reinforced in future by the proposed setting up of a fertilizer unit at Neyveli, and by the installation of a steel plant near Salem.

2.27 The regional income from industry rose from Rs. 106 crores in 1955-56 to Rs. 147 crores in 1960-61 (both at 1960-61 prices) the average annual rate of growth being 6.6[1] per cent. During the same period, the industrial sectoral income in the State rose from Rs. 145 crores to Rs. 227 crores[2] the average annual rate of its growth being higher than in the region, that is, 9.6 per cent per annum. In the country as a whole the income from industries rose from Rs. 2,157 crores to Rs. 2,600 crores, the annual rate of increase being 4.2 per cent.

2.28 The income from industry constituted 16.6 per cent of the regional income in 1955-56 as well as in 1960-61. The relative percentages for the State were 16.9 per cent and 19.6 per cent, and for the country 18.5 per cent and 18.4 per cent.

2.29 As stated earlier, during the Third Plan period the tempo of industrialisation in the State and the region has gone up as a result of the developments mentioned in para 2.26. It is expected that by the end of the Third Plan the progress would be such that the sectoral income from industry for the State and the region would be Rs. 358 crores and Rs. 222 crores respectively, and that the annual rates of growth of income from industry would be 9.6 per cent and 8.6 per cent respectively.

2.30 About 72.6 per cent of the registered factories in the State are to be found in the region, but only 32.8 per cent of the large scale units. The industrial work force in the region (factory and non-factory), is about 1.57 million, or 77.4 per cent of the State's work force in industry. Of these only about 2,24,000 workers are employed in factories. The number of workers in industry per 1,000 of population is 60 in the region and in the State, and 41 in India. The output per industrial worker (factory and non-factory), in 1960-61 was

1 The figures given exclude the income from industry in Pondicherry for which information is not available for the period in question. In 1961-62 the income from industry in Pondicherry was Rs. 3.05 crores, being about 25 per cent of the total income of Pondicherry.

2 Based on the Madras Government's estimate, vide *Abstract of Statistics for Madras State*, 1963. NCAER's recent estimates are that the industrial income of the State rose from Rs. 124 crores in 1955-56 to Rs. 171 crores in 1960-61, at an annual rate of 6.6 per cent.

Rs. 930 in the region, compared with Rs. 1,113 in the State and Rs. 1,056 in India.

2.31 The setting up of the lignite project at Neyveli is an industrial event of first rate importance in the region as in the State. It makes good (modestly though) the State's deficiency in mineral fuels. It provides a promising centre for an industrial complex, helping to disperse industry from the traditional centres of Madras and Coimbatore. The capital outlay is of the order of Rs. 100 crores and the employment potential 10,000. Between May 1961 and March 1964, 1.16 million tonnes of lignite were mined. The thermal station based on it has now[1] a capacity of 250 MW. Up to December 1963, 950.5 million kWh of power was generated by the station. The clay washing plant is already in production and is supplying washed clay to the ceramic and paper mills in the State and the region. The briquetting unit, the carbonising plant and the fertilizer plant are expected to go into production shortly. Also there are prospects of lignite mining capacity being raised to 6.5 million tonnes if a second cut is made.

2.32 The textile industry is the most important of all in the region judged by the number of workers engaged in it. There are 1.04 lakh workers employed in the industry in the region, that is, 46 per cent of the region's factory workers. Out of the 214 textile factories in the State, 188 are in the region. Cotton yarn production in the region has increased from 104 thousand kgs in 1955-56 to 134 thousand kgs in 1961, an increase of 28.8 per cent (vide Table 13).

2.33 Next in importance is the cement industry. The six units of the State in production are all in the region. Cement production in the region went up from 0.71 million tonnes in 1956 to 1.28 million tonnes in 1963, an increase of 80.3 per cent during the period, against an installed capacity of 2.3 million tonnes.

2.34 Thirteen out of the seventeen sugar factories of the State are in the region. In terms of crushing capacity, the region has (as in 1963-64) a daily capacity for 8,700 tonnes of cane, as compared with the State's 9,500 tonnes. Sugar production has gone up in the region from 60,000 tonnes in 1956 to 94,485 tonnes in 1963, that is, an increase of 57.5 per cent; the State's production went up during the same period from 64,227 to 1,16,767 tonnes, an increase of 80.8 per cent. Even as during the last decade the State had turned from an importer to an exporter of rice, the developments in sugar production in the region and in the State promise a similar achievement in the case of sugar during the coming decade.

2.35 The only two caustic soda producing units of the State are in the region. The production has gone up from 2,519 tonnes in 1961 to 43,084 tonnes in

1 As in 1961-62. The capacity has since been increased to 400 MW.

1963. The production is only about 50 per cent of capacity which is 93,000 tonnes.

2.36 Paper production which commenced in the region in 1962 with 668 tonnes is now (1963) about 14,400 tonnes, against a capacity of 20,000 tonnes (Table 13).

2.37 The aluminium factory at Mettur, recently set up with a capital investment of Rs. 13 crores, is just going into production. It has a capacity of 10,000 tonnes of ingots and alloys,[1] and 7,500 tonnes of aluminium rods, bars and sheets.

2.38 With this regional economic background in population, agriculture and industry, one may now look at the regional setting in transportation, as a prelude to a study of its future course of development.

Transportation Facilities in the Region

2.39 Facilities for the transportation of goods and passengers are afforded in the region by the following:

1. Railway, 2,942 kms long, of which 2,420 kms are in metre gauge, and 522 kms in broad gauge.
2. A road network, 34,817 kms long, of which 24,760 kms are surfaced and 10,057 unsurfaced.[2]
3. Inland waterways, over a small stretch of 57 kms.
4. Four ports, namely, the intermediate port at Tuticorin and the minor ports at Nagapattinam, Cuddalore and Pondicherry.
5. The airports at Coimbatore, Madurai and Tiruchirapalli.

The location of these transportation facilities is depicted in Map 1.

2.40 The region under study is not an area facing any acute transport problem such as in the coal or the iron and steel belt. None the less, it has its own local problems which are stated in their appropriate places in what follows.

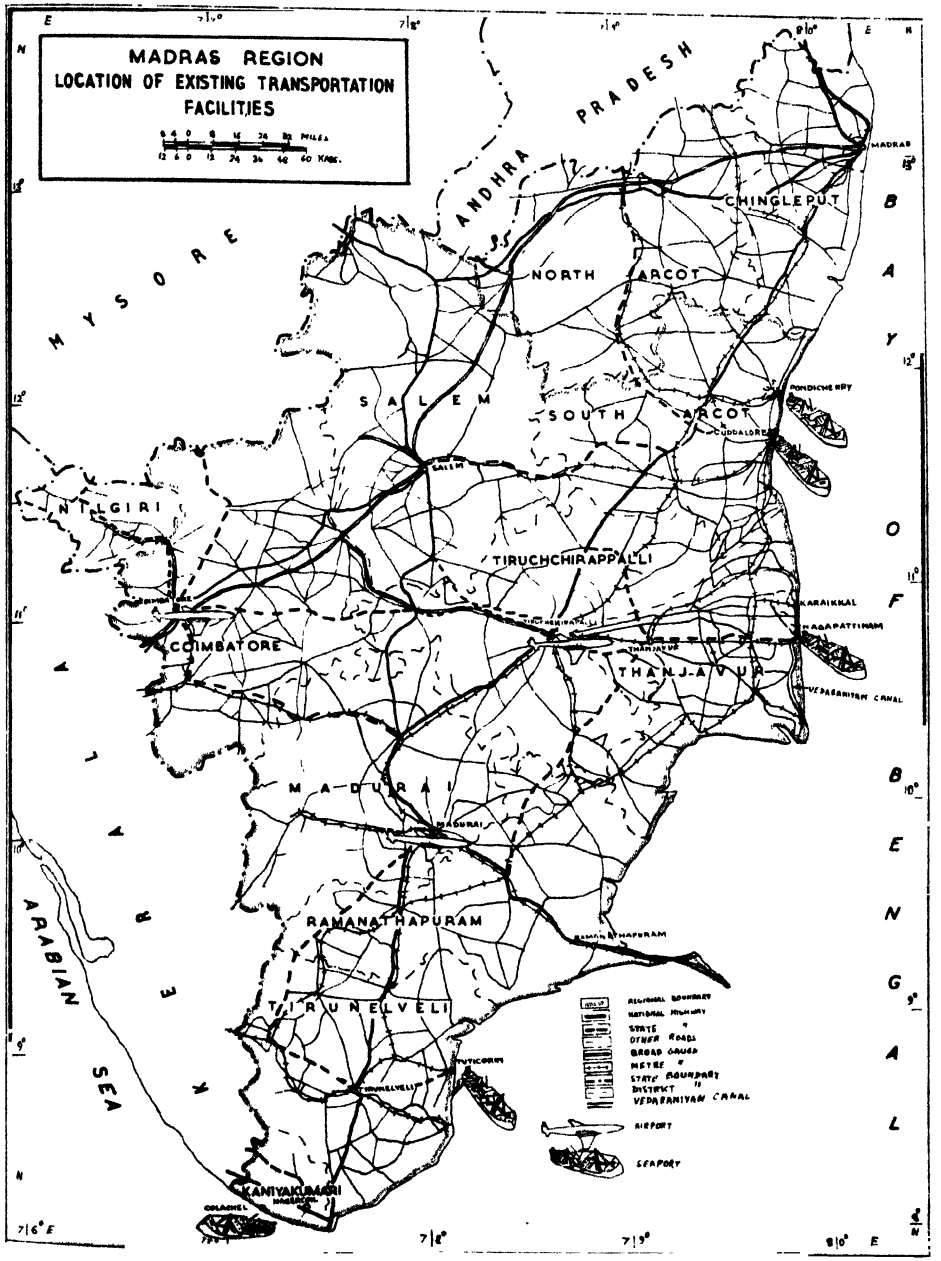
Railways

2.41 As earlier stated, the route kilometres of railway in the region are 2,942. Even though one of the nine districts in the region, namely, Kanyakumari District, is not served by rail at all, the railway route kilometres per 100 sq. kilometres of area in the region as a whole (2.77) are substantially higher than in the country (1.84). Judged by the route kilometres per million

1 The prospects are that this capacity will be raised to 20,000 tonnes per year.

2 The road kilometres given exclude those for Pondicherry the figures for which are 469 kilometres, of which 236 kilometres are surfaced and 233 unsurfaced.

MAP 1


MADRAS REGION
LOCATION OF EXISTING TRANSPORTATION FACILITIES
MILES
KMS.
ANDHRA PRADESH
MYSORE
NORTH ARCOT
CHINGLEPUT
MADRAS
SALEM
SOUTH ARCOT
CUDDALORE
PONDICHERRY
NILGIRI
TIRUCHCHIRAPPALLI
KARAIKKAL
NAGAPATTINAM
COIMBATORE
THANJAVUR
VEDARANIYAM CANAL
MADURAI
RAMANATHAPURAM
TIRUNELVELI
TUTICORIN
KANIYAKUMARI
ARABIAN SEA
BAY OF BENGAL
REGIONAL BOUNDARY
NATIONAL HIGHWAY
STATE "
OTHER ROADS
BROAD GAUGE "
METRE "
STATE BOUNDARY
DISTRICT "
VEDARANIYAM CANAL
AIRPORT
SEAPORT

of population, the region (1.1) is not quite as well served as the entire country is (1.3).

2.42 The average density of passenger traffic per route kilometre per day in the region, 2,810 is not very much less than the average for India, 3,405.[1] There are, however, many individual sections with very poor traffic density, e.g., Madurai-Bodinayakkanur section with density 294, in the metre gauge, and Mettur Dam-Salem section in the broad gauge with density 595.

2.43 The average railway goods traffic density in the region is substantially less than in the rest of the country. In 1962-63 in terms of net tonne kilometres per route kilometre per day it was 2,214, less than half of the average (4,861) for the country as a whole. The traffic density over the metre gauge sections of the region varied from 34 tonne kilometres per route kilometre per day on the Mayuram-Travguchar section to 4,174 on the Madurai-Virudhunagar section. On the broad gauge, the variation was between 289 tonne kms per route km per day on the Salem-Mettur Dam section and 7,899 on the Jalarpet-Erode section.

Problems of the Railway

2.44 The main problem of the railway has not been its capacity over the region as such, but its capacity over the 'north-east' and 'north-west' lines, via Waltair, via Vijayawada and via Raichur. Over these sections and through these junction points has to pass the traffic from north to south, destined not only to the region under study but also to many other areas on the Southern Railway in the States of Mysore, Kerala and Andhra Pradesh. The traffic offering and waiting to move over these routes has long been in excess of the capacity available. The railway administration is well seized of the problem and have either completed or have planned a number of line capacity works, which when completed by the end of the Third Plan period, will augment considerably the intake of loads at the three inter-change points.

2.45 There is no current deficiency of line capacity; Southern Railway, as others in the country, has had, however, to face within the region certain transitory and sometimes recurrent problems which it has met by imposing restrictions in bookings, quotas for wagon supply, etc.

2.46 The trend of the railway passenger traffic in the region has been strikingly different from that elsewhere on the Southern Railway and on the Indian Railways as a whole. While during the Second Plan period there were increases of 9 per cent and 17 per cent respectively over the Southern Railway and on the Indian Railways, the railway passenger traffic in the region during the same period remained practically stationary. The railway has had to face

1 The densities mentioned are in respect of non-suburban traffic.

severe competition from the well organised bus services, including long distance express bus services.

2.47 The financial results of the working of the railway lines in the region cannot be separately worked out as the available compiled statistics do not lend themselves to such an attempt. However, as the region under study is largely served by the metre gauge lines, it may be assumed that the results of the working of the entire metre gauge lines of the Southern Railway would fairly reflect the results in respect of the region also. The Southern Railway metre gauge system has been working at a loss. There has been an increase in its operating ratio from 105.6 to 115.4 during the decade 1952-53 to 1962-63, principally due to increases in the prices of fuel and in staff costs, not compensated by corresponding increases in traffic volume or in freight rates and fares. Maintenance of uneconomic train services, and operation of flag stations, halts and certain branch lines, which are not adequately remunerative, have also contributed to the uneconomic working.

The Road System

2.48 The total length of roads in the region is, as already stated, 34,817 kms[1] of which 24,760 kms were surfaced and 10,057 kms unsurfaced. Generally stated, the road plans in vogue so long have been expression of physical planning ideas rather than of applied economic plans. The planning ideas which have held the field are summed up in two formulae known as 'The Star and Grid' formulae of the Nagpur Plan for the period 1943-61, and the Bombay Plan of the Chief Engineers for the period 1961-81. These formulae take account of the area and population and its distribution. They envisage certain standards of accessibility by way of maximum distances between any village and *(a)* any road, and *(b)* a metalled road. The standards prescribed differ according to whether the area is more developed or relatively less developed. These formulae indicate how many kilometres of roads of each category there should be in an area. On the average the two formulae target for the provision of 16 kilometres of roads per 100 square kilometres and 32 kilometres of roads per 100 square kilometres, respectively, over the country as a whole. The road mileage desired was not correlated, directly, to traffic density as such. The emphasis was on accessibility. Judged by the criteria of the Bombay Road Plan for 1961-81, the length of the roads in the region under study is already equal to the 1981 target and much in excess of the current all-India average. The ratio of surfaced road mileage to the unsurfaced is also nearly thrice the all-India figure. In relation to population as well, the region is

1 As on March 31, 1961.

relatively better served than the country, the kilometres of roads per million of population being 13.3 as against the all-India average of 11.5.

2.49 The average density of traffic over roads of different categories in the regional road network in 1960-61, in terms of gross tonne kilometres per route kilometre per day, shows a wide range of transition from a mean density of 4,213 on the national highways to a mean density of 896 on other district roads. The average figure for the road network as a whole in the region was 1,932.[1]

2.50 The traffic densities on road sections can also be expressed in terms of "passenger car units"[2] per route kilometre per day. In the region, in 1963-64, the traffic density on national highways in these units varied from 30,484 to 494, the average being 6,569. In the case of State highways, the range of density varied from 38,334 to 92, the average being 6,246. The corresponding figures for major district roads were 59, 186, 133 and 3,952 and for other district and village roads, for which Census figures are available, 12,841, 77 and 2,232.

Problems of the Road System

2.51 The problems pertaining to the road system of the region relate to section capacity, alignment and accessibility.

2.52 The problems relating to road capacity are dealt with in detail in Chapter 6 in the section entitled 'Concept of Road Capacity'.

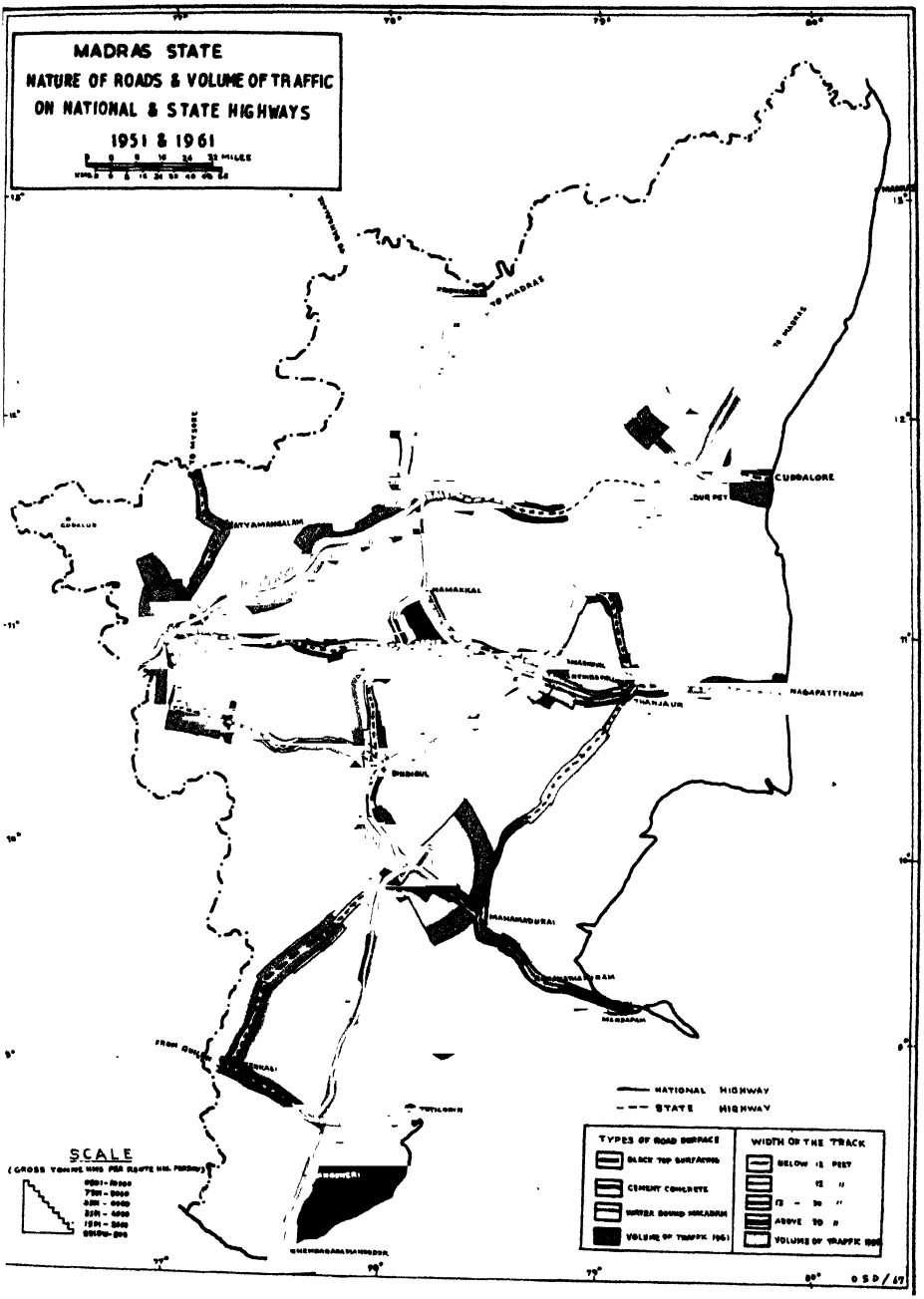
2.53 Studies of the growth of traffic density between 1950-51 and 1960-61 show that the total density on the roads (motor vehicles and carts taken together), has more than doubled (the annual rate of growth being 8%). This increase in density is due almost entirely to the increase in traffic by motor vehicles, the share of traffic by carts having been more or less stationary in absolute terms. The density of motor vehicles has more than trebled, the annual rate of increase being 12.6 per cent.

2.54 Another point to note is that both the prevailing density in absolute terms as also the rate of growth of traffic density are in the descending order: national highways, State highways, major district roads and other district roads. This means that the roads with heavy traffic densities now are also

1 This figure applies only to the aggregate of the sections for which the P. W. D. Census was taken. This covers fully the national highways, most sections of the State highways and major district roads but very little length of other categories of roads. Corresponding figures for the country as a whole are not available. In Map 2 the type of roads and the utilisation of road capacity over the national highways and State highways in 1951 and 1961 are pictorially depicted. Map 3 is a similar map in respect of major district roads and other district roads in Coimbatore District.

2 In fact "passenger car units" are increasingly coming into use for the measurement of traffic density and for comparison of capacity of individual road sections. The basis is given in Chapter 6 and Table 59.

MAP 2


MADRAS STATE
NATURE OF ROADS & VOLUME OF TRAFFIC
ON NATIONAL & STATE HIGHWAYS
1951 & 1961
MILES
TO MADRAS
TO MADRAS
TO MYSORE
CUDDALORE
PORT NOVO
SATYAMANGALAM
MAYAVARAM
NAGAPATTINAM
TANJAUR
TRICHINOPOLY
MADURAI
RAMNAD
TUTICORIN
KANYAKUMARI
NATIONAL HIGHWAY
STATE HIGHWAY
SCALE
TYPES OF ROAD SURFACE
BLACK TOP SURFACING
CEMENT CONCRETE
WATER BOUND MACADAM
VOLUME OF TRAFFIC 1961
WIDTH OF THE TRACK
BELOW 12 FEET
12 "
12 - 20 "
ABOVE 20 "
VOLUME OF TRAFFIC
O S D / 67

those with a high potential for further growth, and leaves no room for doubt that the problem of augmenting sectional capacities of roads in the region to meet the future demand is pressing, even in this area which is very much in advance of the Bombay Plan targets.

2.55 Concerning road alignment, it is found that it is rather tortuous and circumambulatory in a district like Thanjavur, where, due to the high cost of land, straightening out of alignments would now be a costly process. But this is an important problem in the context of the need to speed up road traffic in the future so that the road system could handle considerably larger volumes of traffic.

2.56 While the road communications in the region, on the average, do not fall short of the norms for accessibility prescribed in the Bombay Plan, they do so in certain hilly and forest areas. Deficiency exists, to some extent, in the Ramanathapuram District and also in some other interior parts of other districts of the region.

Road Transport

2.57 The road transport industry of the region commands[1] 10,454 commercial vehicles of which 3,895 are 'stage carriages' (buses) and 6,559 'public carrier' vehicles. The number of commercial vehicles per million of population and the density of vehicles per road kilometre in 1961, in the region as compared with the State and the country as a whole are set down in Table 14. The vehicle density in the region is markedly poorer than in the rest of the State as also in the rest of the country.

Bus Services

2.58 More than 75 per cent of the stage carriages in the region operate on intra-district and intra-State routes, linking the countryside with important centres of economic or administrative activity; the balance ply on inter-State routes. The estimated utilisation of the buses in terms of passenger kilometres is 22.54[2] million per day or about 8,277 million per year.

2.59 A feature of the carriage of passengers by buses in the region is the operation of long distance express bus services by the State Government. These services have been developing at a fast rate since 1959. They were run on 24 routes in 1963-64 with an aggregate route kilometres of 7,872. The traffic registered in 1963-64 was 174.15 million passenger kms.

2.60 There are local "town bus services" operating in 23 towns in the region,

1 In 1963.

2 This figure excludes those pertaining to the "town bus services".

MAP 3


COIMBATORE DISTRICT
TYPE OF ROAD & VOLUME OF TRAFFIC 1951 & 1961
(Roads other than national highway and State highway)
RAMAPURAM
HASSANUR
CHELLAMPALAYAM
MAPETTAI
ANDIYUR
SATYAMANGALAM
PULLIYAMPATTAI
SULUR
MADAMPATTI
VELLAKKOVIL
POLI
AMBARAMPALAYAM
TIRUMOORTHI
KUMARILINGAM
NATIONAL HIGHWAY
STATE HIGHWAY
TYPE OF ROAD SURFACE
WIDTH OF THE TRACK

with a total population of 2.52 million; 406 buses are engaged in these services and about 194 million passengers are carried per year. Measured in terms of passenger kilometres, the performance registered is 674.08 million passenger kilometres per year.

2.61 Goods transport by lorries is much better organised in the region than what obtains in the rest of the country. About 50 per cent of the vehicles are run by organised agencies, the carriage of goods in specialised vehicles, running to a time schedule, being a unique feature of an increasing number of organised operators.

2.62 In 1962-63 the goods traffic carried by 'public carrier' vehicles came to 1,563 million tonne kilometres, of which 432 million were accounted for by traffic in collection and distribution services.

2.63 Besides this, the 'private carrier' vehicles, numbering 1,485, carried 349 million tonne kilometres of traffic including 17 million tonne kilometres in collection and distribution services.

Problems of Road Transport Industry

2.64 The main problems of the road transport industry in the region are generally those faced by it elsewhere in the country. They stem from the level of taxation, the licensing procedures and policies adopted, and the difficulties it has in getting spare parts and financial accommodation at reasonable rates of interest. While the larger transport units are better organized in the region than elsewhere, the practice of the individual operators joining up into 'unions' —a practice prevailing in other parts of the country[1]—is rather uncommon. The larger organised units have complained of difficulty in obtaining an adequate number of fully trained drivers.

Bullock Carts

2.65 The bullock cart, as elsewhere in the country, provides essentially collection and distribution services for goods. This traffic, in 1962-63, is estimated to have been about 10.4 per cent of the total goods traffic of the region in terms of tonne kilometres. In the collection and distribution services, however, the role of the bullock cart is much more significant, and its proportion is over 50 per cent.

2.66 The density of bullock cart traffic over roads of different categories has remained more or less stationary during the last decade. As against this, the number of cycles and motor vehicles coming on the roads is fast increasing, both in the countryside and in the towns.

1 Particularly in Northern India.

Inland Waterways

2.67 The only navigable waterway in the region is the Vedaranniyam Canal, 57 kms long, which connects the large salt manufacturing centre of Vedaranniyam with the port of Nagapattinam.[1] As the canal now is, it serves only a limited purpose, namely, facilitating the movement of such articles as salt, fuel, rice, straw, etc., available within a narrow strip along either bank and requiring transport over its short length. Such movements in the recent past have aggregated to less than 10,000 tonnes per year and there has been no problem in meeting the demand for this transportation.

Ports

2.68 The region is served by the intermediate port of Tuticorin and the minor ports of Pondicherry, Cuddalore and Nagapattinam. None of these ports has deep-sea berths capable of handling ocean-going vessels alongside. They are all roadsteads handling the cargo between ship and shore by the use of lighters, the distance varying at different ports from 3 to 8 kms.

2.69 All the ports are provided with adequate covered godowns and stacking areas for their present traffic, but none is equipped for handling heavy lifts.

2.70 The ports and port towns are all rail linked and served by good roads.

2.71 The traffic handled by the four ports has risen from about 8.16 lakh tonnes in 1955-56 to 14.96 lakh tonnes in 1963-64, i.e., an increase of 75.7 per cent in eight years. The main increase in traffic has been at Tuticorin, which is presently handling about a million tonnes, and at Cuddalore handling about half a million tonnes.

Problems of the Ports

2.72 In the case of the ports, the main problems relate to the choice of the ports for provision of additional capacity to meet the expected future traffic and the extent to which capacity should be provided. Besides, there are certain subsidiary problems relating to supply of lighters, of drinking water, shore-labour, etc.

Airports

2.73 The regional airports at Tiruchirapalli, Madurai and Coimbatore have all light traffic. The airports at Madurai and Tiruchirapalli, handled in the year 1962-63, 19 and 10 passengers respectively per day and a cargo

1 Map 1.

traffic of 726 and 24 kgs, respectively, per day, while that at Coimbatore handled 39 passengers and about 679 kgs of cargo per day.

2.74 The existing air services adequately cater to the current demand and an increase in the frequency of the services will have to await a substantial increase in the traffic volume.

Place of Transport in the Regional Economy

2.75 Before concluding this chapter it would be interesting to give some measure of the importance of transport in itself in the regional economy and of the relative importance of its main forms, namely, the road and the rail services. Earnings are the only measure common to all; and although the estimations of aggregate earnings that have been made here are necessarily not very precise, they are certainly accurate enough to indicate the comparative orders of magnitude.

2.76 Aggregate transport expenditure by transport users in the region in 1963 was Rs. 59.1 crores or 6.0 per cent of the regional income.

2.77 The estimated expenditure[1] on the main modes of transport is shown in Table 15.

2.78 The relatively dominant position of road transport in this region, whether for goods or passenger traffic, is at once clear from the figures in Table 15. Of the total expenditure on transport incurred by all transport users in the region, 72.2 per cent was on road transport as against only 26.9 per cent on rail.

1 The expenditure referred to here is that of all transport users other than the users of bullock carts and of transport on own account, e.g. 'private carrier' vehicles and 'private cars' and it is equivalent to the earnings of the transportation agencies in the region.

Chapter 3

Economic Projections for Transport Planning, 1966-76

Introduction

IT WOULD BE clear from Chapter 1 dealing with aims and methodology, that a regional transportation study has necessarily to be based on a regional economic study. For this reason, before the analysis and projections of regional transportation are taken up, the probable behaviour of certain economic and demographic variables in the time horizon of our study, i.e., between 1966-67 and 1975-76 has to be gone into.[1] These variables are of importance to the ultimate appraisal of transportation needs and requirements in the region and they are examined in detail as given below.

(i) Population in the region and in its districts.

(ii) Production of different commodities.

(iii) Changes in the regional income and its distribution among the population and among the districts.

(iv) The demand for different commodities and its geographical distribution in the region, based on *(i)*, *(ii)*, and *(iii)* above.

Projections of Population

Population in the Region in 1960-61

3.2 The population of the region stood at 26.57[2] million in 1960-61, being about 79 per cent of the Madras State's population of 33.69 million. The rate of growth of population in the region during 1951-61 was 1.04 per cent per annum, which is slightly less than in the State as a whole of 1.13 per cent.

Projections on to 1970-71

3.3 Districtwise projections of population in the region are obtained by

1 Separately for the two periods within the time-horizon, namely, 1966-67 to 1970-71, and 1971-72 to 1975-76 (i.e., the Fourth and Fifth Plan periods).

2 Including Pondicherry.

first dividing the population of the State in 1951 into 'rural' and 'urban' and the urban again according to 'town-sizes'. The rates of growth for the rural areas and for each 'town-size' for the urban areas are averaged over the State as a whole. These averaged rates of growth for each 'town-size' are then applied to the 'town-size' groups in each district, and by this process, a new set of population figures for every 'town-size' group in each district for 1961 is derived, different from the actuals for the district in that year. The total population thus derived for each 'town-size' in a district is then scaled up or down at a uniform percentage, so that their aggregate for the district conforms to the district's actual population in 1961. When this is done certain new rates of population growth for each 'town-size' in the district are obtained, and these rates are applied to the actual 1961 figures for the particular 'town-size' in the district, to arrive at the population in 1970-71. The final figures are given in Table 16.

3.4 The anticipated increase in the population of the Madras State during 1961-71 is 4.86 million, i.e., an increase of 14.4 per cent during the decade,[1] which is higher than the corresponding increase during 1951-61 (11.85%); yet it would appear to be a realistic rate of increase if the corresponding figures are examined over a longer period, say, from 1921.

3.5 The regional population in 1971, summed up from the districtwise projections, is 29.6 million, i.e., an increase of 2.98 million or of 11.2 per cent during the decade 1961-71. The slightly lower rate of increase in the region compared with the State as a whole is the result of anticipated migrations and the drift of people towards the cities outside the region.

Projections on to 1976

3.6 The projected population of the region in 1976 is 31.8 million as against 41.2 million for the State. These projections are on the assumption that *(a)* the annual rates of growth in the region and in the State during 1971-76 would be the same as during 1961-71, and *(b)* the State's population would be distributed among the different districts in 1976 according to the percentage distribution that obtained in 1971, subject to an allowance being made for inter-district migrations (vide Table 16).

Projections of Production of Agricultural Commodities

3.7 Projections of production in 1971 of a number of food crops, including rice and of a number of commercial crops, which together are likely to take

1 Equivalent to an annual rate of increase of 1.35 per cent.

about 90 per cent of the cropped area are made for the entire State.[1] The anticipated extension of irrigated area in the State and the districts during the Fourth Plan was ascertained from the Government of Madras. It is assumed that paddy and sugarcane will be grown on irrigated lands. The additional area that will come under paddy is determined on the basis of the 'irrigation elasticity of area under paddy' during the last decade in the Madras State; the irrigated acreage under sugarcane is worked out according to the requirements of sugar factories, existing and licensed, to expand or to be newly set up. Sugarcane for gur has been worked out on the assumption that supply will be maintained in each district at the present level or will decline according to the availability of irrigated area for cane for gur production, after setting apart what has been estimated to be brought under paddy cultivation and under sugarcane to meet the additional anticipated capacities of sugar units. The balance, if any, of the expected gross irrigated area is distributed among other crops according to the present pattern. Fertilizer consumption, assumed to be doubled during the Fourth Plan, is allotted to the different crops in proportion to the product of the expected irrigated area under each crop and its appropriate dosage. The increases in production of the different crops have been estimated taking account in each case of *(a)* the increase in irrigated and unirrigated area, *(b)* the increase in fertilizer inputs (including green manure in the case of rice), and *(c)* improved efficiency in the use of fertilizers. The effect of other input factors and of changing agricultural practices and attitudes have also been considered in finalising the magnitude of the different crop outputs by 1971.

3.8 This is so far as projections up to 1971 are concerned. Projections of agricultural output in 1976 are made on the assumption that the yields per acre between 1971 and 1976 would go up at the same rate as during 1961-71, and that the increase in output of each crop would be distributed among the districts in the same pattern as in 1971. No account is taken of any further expansion of cultivated area or of any substantial additional irrigation, as this may be problematic in the State unless inter-State schemes such as diversion of Kerala waters to irrigate tracts in Ramanathapuram district come through.

3.9 Regional projections of production of ten agricultural commodities in the years 1970-71 and 1975-76 thus worked out are given in Table 17.

Projections of Industrial Outputs

3.10 For projecting the industrial output in 1971 and the output of the

1 In the case of Pondicherry, projections of production of different agricultural crops up to 1976 as contained in the Council's Report of the *Techno-Economic Survey of Pondicherry* have been adopted and are given in Table 17.

raw materials required, the first step taken was to list the industrial units, expanding or newly to be set up during the Fourth Plan period, with particulars of location, capacity, and existing and potential sources of raw materials. The sources for these data are *(a)* the licences issued or proposed to be issued to the various industries in the region, which would expand or commence production in the Fourth Plan, and *(b)* the Council's "Industrial Programmes for the Fourth Plan for Madras State" (July 1964).[1] The requirements of raw materials and of coal and other fuels have been worked out on the basis of information from existing units and known input-output coefficients.

3.11 Industrial production in 1975-76 is estimated in some cases on the assumption that the rates of growth between 1966-67 and 1970-71 will be maintained during the period 1971-72 to 1975-76, and in some others on the assumption that the regional production will maintain in 1975-76[2] the same relation to the expected all-India production as in 1970-71. These increases in production have been allowed only where the regional resources appeared to permit them, and when this was not the case, imports were envisaged from outside the region.

3.12 While the foregoing is a statement of the broad approach, the methods adopted for projection of production of the principal industries and of their raw material requirements have necessarily somewhat varied in regard to details from one industry to another. A few instances of the methods adopted are given here to clarify the approach in this regard. In the case of sugar the projections are based on *(a)* information of the crushing capacities of the proposed new and the expanding and existing units in the Fourth and Fifth Plans, and *(b)* the assumption that the number of crushing days will increase from 180 to 200 during the Fourth Plan and further to 225 in the Fifth Plan. In the case of cotton textiles, further production is estimated on the basis of *(a)* the average production of the looms working during the three years 1960 to 1962, *(b)* the anticipated increase in the number of looms in each district during 1965-66 to 1970-71 as worked out in the Council's Industrial Programmes for the State, and *(c)* an increase in the number of looms by 50 per cent during the Fifth Plan, this being the rate anticipated for all-India by the Planning Commission. Similar assumptions are made regarding the growth in the number of spindles and the production of cotton yarn. To cite yet another example, cement production is related to the sanctioned expansion of the

1 This programme, prepared for the Madras Govt., has been since accepted by it as the basis of the State's Plan in the industrial sector. The requirements of the proposed steel plant at Salem and the related developments in Neyveli have also been taken into account.

2 Expected by the Perspective Planning Division vide their Paper, *Notes on Perspective of Development, 1960-61 to 1975-76*, April 1964.

existing units and the licensed production of new units to be commissioned during the Fourth Plan. Besides, the expansion of the Dalmiapuram factory is assumed in accordance with the NCAER's recommendation to the State Government. For the Fifth Plan the cement production is worked out on the basis of *(a)* estimates of India's demand for cement during 1975-76, and *(b)* the relative share of the production of cement works in each State in the country to the total cement production anticipated in 1970-71.

3.13 The projected production figures for the several industries considered in detail are furnished in Table 18.

3.14 Along with projections of industrial output, projections have been made of the regional output of the concerned industrial raw materials, such as limestone, gypsum, bauxite, etc. While doing so, the quantities likely to be exported outside the region—as distinct from the requirements of the regional industrial units alone—have also been estimated and then added to the regional requirements to obtain the regional production. It may be stated here that the quantities of exports of different commodities from the region to other parts of the country or to foreign countries (whether raw materials or others), are estimated in different ways for different commodities. In the case of commodities like rice, sugar and cement, what is expected to be surplus to the region's requirements is assumed to be exported. In certain other instances such as iron ore and salt, the future exports are based on information from official sources such as the Minerals and Metals Trading Corporation, the Salt Commissioner, etc. For items such as magnesite, the exports are related to the demands of industries outside the region, such as the steel plants and the trends in the exports to foreign countries. In certain other cases, such as gypsum, the exports are assumed to go up at the same rate as the regional consumption. In assigning the areas to which the regional exports are expected to go, the past patterns, the expected changes in future intakes based on industrial targets outside the region, foreign export trends and similar factors,[1] to the extent known, are taken into account. The production figures predicted for industrial raw materials are given in detail in Table 19.

Estimated Changes in Regional Income and Income Distribution in 1970-71 and 1975-76

Computation of Regional[2] and District Incomes

3.15 The Madras Government's estimates of State income and of per

1 In the case of exports of consumer goods the anticipated per capita consumption in the country was a dominant factor.

2 The projections of regional income are presented for the region excluding Pondicherry in the paragraphs 3.15 to 3.21.

capita income in the State, during the period 1955-56 to 1960-61, indicate rates of growth of 2.6 per cent and 1.4 per cent per annum respectively. The preliminary estimates of the NCAER[1], however, are somewhat more optimistic and place the respective rates of growth at 3.9 per cent and 2.8 per cent per annum.

3.16 To estimate the State and regional incomes in 1970-71, the approach adopted here is, first, to evaluate the incomes that will be generated by the Council's programme for industrial investment in the State during the Fourth Plan[2] and by the agricultural outputs anticipated on the basis of the output model set up as explained in paragraph 3.7. Then the State income in the tertiary sector is estimated on the basis of past relations between it and the incomes in the industrial and agricultural sectors. The method adopted is such as would give not only the State and regional incomes but also their districtwise breakdown[3]

3.17 The estimation of district incomes in 1975-76 is based broadly on the same procedure as for 1970-71. The agricultural outputs in 1975-76 are obtained on certain assumptions, as stated in paragraph 3.8. The net value added by the industrial sector (including expansion of industries, wherever the State's raw material and other resources appeared to permit it) is assumed to be in line with the regional increase in the Fourth Plan period in some cases and, in the others, with the expected rates of increase for all-India as envisaged by the Perspective Planning Division of the Planning Commission. From these two sectoral incomes, and assuming that the income in the tertiary sector will be in the same proportion as in 1970-71, the aggregate regional and district incomes and the State income are computed. The estimates thus made are shown in Tables 20 and 21.

Growth in Regional and in Per Capita Real Incomes

3.18 The regional income is expected to go up from Rs. 886 crores in 1960-61, to Rs. 1,146 crores in 1965-66, Rs. 1,544 crores in 1970-71, and Rs. 2,085 crores in 1975-76. The rates of growth would thus be 5.3 per cent per annum during the Third Plan, 6.1 per cent per annum during the Fourth Plan and 6.2 per cent during the Fifth Plan. The corresponding figures for Madras State are 5.2 per cent, 6.5 per cent and 7.1 per cent. The sectoral rates of growth in the region are expected to be 4.9 per cent per annum in agriculture and 10.3 per cent per annum in industry during the Fourth Plan. The corresponding

1 Based on more recent data.

2 *Industrial Programmes for the Fourth Plan for Madras State,* NCAER, Delhi.

3 All computations of income are in terms of 1960-61 prices.

rates during the Fifth Plan are estimated to be 2.9 per cent and 10.0 per cent. The comparative figures for the State are 4.3 per cent and 11.5 per cent during the Fourth Plan and 3.0 per cent and 9.5 per cent during the Fifth Plan (vide Tables 20, 23 and 24).

3.19 It may be noted that the sectoral percentage contribution to the regional income from agriculture will decline steadily from 46.13 per cent to 43.21 per cent during the period 1960-61 to 1970-71, while that from industry will go up steadily from 16.6 per cent to 23.5 per cent. A further decline to 37.0 per cent in the contribution of agriculture to the regional income during the Fifth Plan is expected, whereas the contribution from the industrial sector may register a gain of 28.0 per cent. All this, however, is only the natural consequence of the faster rates of growth of industrial production than of agricultural production that are envisaged (vide Table 25).

3.20 Real income per head is expected to rise in the region from Rs. 338 in 1960-61 to Rs. 412 in 1965-66, Rs. 522 in 1970-71, and Rs. 665 in 1975-76. The rates of growth in real income per head will be 4.85 per cent per annum during the Fourth Plan and 4.9 per cent per annum during the Fifth Plan (vide Tables 22 and 23).

Changes in Income Distribution

3.21 While estimating consumption, besides considering the effect of changes in the aggregate incomes in the region and its districts, account has also to be taken of changes in income distribution among individuals. This has to be done as consumption is affected not only by the aggregate income in an area but also by the nature of its distribution. The effects of income changes have been taken into account not only for estimating the demand for consumer goods but the demand for travel (vide Chapter 4). In working out income distribution, assumptions have been made that *(a)* the income distribution is lognormal, and *(b)* the coefficient of variation, reckoned for 1961, remains constant during the time horizon of the present study.

Estimates of Demand for Consumer Goods and Goods of Other Categories[1]

Demand for Consumer Goods

3.22 Estimates of the demand for consumer goods such as rice, other cereals, grams and pulses, salt, sugar, kerosene and cloth have been prepared

1 Other than raw materials mentioned in Table 19.

for 1965-66, 1970-71 and 1975-76. From income groups at different levels of personal income in 1965-66, 1970-71 and 1975-76, worked out as explained in paragraph 3.21, expenditure groups corresponding to NSS classification have been derived assuming certain relations between income and expenditure at different levels of income. On the basis of the NSS data (16th round) regarding expenditure on different consumer goods, consumption of each of these commodities is calculated for each district and for the region as a whole. The method adopted allows by itself for substitution between consumer goods by one another in so far as it results from changes in the levels of income, e.g., of "other cereals" by rice as income rises. The estimates of consumption so made have been compared with alternative estimates made on the basis of norms or trends in per capita consumption, and where the latter seemed more realistic, they have been preferred, e.g., in the case of salt. The estimates of consumption are set out in Table 26.

Demand for Goods of Other Categories

3.23 Estimates of demand for fuels, i.e., coal, lignite, petroleum products and firewood, for intermediate goods such as iron and steel and yarn, and for certain agricultural raw materials such as cotton and oilseeds are obtained by a variety of methods. To illustrate the broad pattern of approach, brief particulars of these are given here, however, in respect of some of the commodities.

3.24 The railway's demands for coal taken into account are as estimated by the railway, after making due allowance for the extent of dieselisation that is expected by the years 1970-71 and 1975-76. The coal requirements in the case of each industry are based on its coal input coefficient and the projected level of industrial production, making due allowance for possible switch over to furnace oil and the substitution of bagasse by coal or other fuel. The requirements of coal for power generation are related to the power schemes of the State in the Fourth and Fifth Plans.

3.25 The demand for petroleum products in the region and its districts is estimated separately for each product. The rates of growth of demand during 1962-63 to 1975-76 are based upon the sales experience of the oil companies in the region and their estimates of the growth prospects of these demands. The possibility of substitution of coal by furnace oil has been allowed for. The demands are projected first for Madras State. Then regional and districtwise breakdowns of demand are obtained by relating the demand of each product to the expected increase in the type of consumers for it, for example, the anticipated increase in the number of light vehicles in the case of motor spirit, the anticipated increase in the number of heavy vehicles in the case of diesel

oil, the anticipated increase in the number of pumping sets and tractors in the case of light diesel oil, etc. The demand for furnace oil is related to that in specific industries such as cement, paper, etc. In all these cases the anticipated consumption is checked with the results of the Council's special studies in its "Demand for Energy in Southern India" (1962).[1]

3.26 The demand for cement is first estimated by four different methods. The most satisfactory one is found to be that which assumes the demand to be an exponential function of the form Y_t is equal to ab^t, where Y_t is the consumption of cement is the year t and the constants a and b are determined from data of cement consumption in the State during 1950-60. The projections on this basis is accepted. Then the projected demand for cement for the State is allocated to each district in proportion to its estimated steel requirements.

3.27 In the case of steel, the Council's estimates of its demand for the various end-uses in Madras State in 1955-56 and 1970-71, as given in its publication "Reappraisal of Steel Demand",[2] is the starting point for working out the demand in the region and its districts. These latter are related to *(a)* sanctioned capacities in the industrial sector in each district in 1963, *(b)* the requirements of agriculture based on the relative proportions of the cultivated area in each district in the latest year (1960-61) for which such figures were available, *(c)* railway requirements apportioned on the basis of route kilometres of railway in each district, *(d)* the requirements of social services assumed to be proportional to the population of each district, *(e)* the requirements of irrigation as indicated by the anticipated irrigated area in different districts, and *(f)* the requirements of power, transport and communications, assumed to bear the same proportion to the total demand for steel as in 1962-63. The estimates of districtwise industrial demand for steel in the region in 1970-71 are also checked against steel requirements for the industrial investment programme for the Madras State prepared by the Council for the Fourth Plan and accepted by the Government of Madras. The regional demand for steel in 1975-76 is estimated on the assumption that the rate of growth of demand for steel in the different districts during 1971-76 will be the same as during 1961-71.[3] The demand for pig iron is calculated in an analagous manner.

3.28 The methods used for estimating the demand for industrial raw materials[4] can be illustrated by a few examples. The demand for sugarcane by the sugar industry is calculated by working out the requirements of the units

1 *Op. cit.*, pp. 69 and 82.

2 Published in September, 1963.

3 As there was lack of detailed information regarding sectoral demands in 1975-76 this method had to be resorted to.

4 Other than those listed in Table 19.

that are to expand or to be newly set up during our time horizon; the balance of our projected production of sugarcane (as determined from the output model) is assumed to go into gur production. In the case of cotton, the demand is equated to the expected intake of the spindlage in the region during our time horizon and the average all-India consumption of cotton per spindle during the last four years in spinning and composite mills. In calculating the demand for cotton no allowance has been made for the possible blending of polynosic fibres with cotton fibre which may reduce the demand for cotton. The demand for salt has been estimated for human consumption, based on per capita norms, and for industrial consumption, by relating it to the expected intake of specific industrial consumers such as manufacturers of caustic soda, etc.

3.29 The results of our estimates of demand for "goods of other categories", based on the above methods, are set out in Table 27.

3.30 The various features of the regional economy as they may shape themselves in 1970-71 and 1975-76 have been presented in the preceding paragraphs. These are the necessary basis for transportation projections. In the next two chapters an analysis is made of the present demand for transportation in the region in respect of passengers and goods and predictions are made of what these demands may be expected to be in the years 1970-71 and 1975-76.

Chapter 4

Passenger Traffic

The Existing Situation, the Trends and the Projections

Introduction

THE RELATIVE IMPORTANCE of passenger transport in the region compared with goods transport can be judged in two ways. First, 48 per cent of all transport expenditure by users of transport is on passenger journeys. Second, the utilisation of transport capacity by passenger traffic on the railways and on the roads is quite high. For every ten goods trains run by the railways, 29 passenger trains are run in the region, and the buses contribute 28 per cent to the mean traffic density on the road network.

4.2 In this chapter we describe some aspects of the present passenger traffic in the region by all means of transport taken together as well as by each mode. We indicate also the trends in the past. We then go on to project what the traffic is likely to be in 1970-71 and 1975-76 by trains and by buses and over each of the principal sections of rail and road.[1]

4.3 While presenting the factual position we have used invariably "passenger kilometres" as the appropriate statistical unit in preference to the "number of journeys". This is for the reason that passenger kilometres are a truer measure of transportation performance and any picture presented in terms of the number of journeys will all the time have to be modified by the appropriate average lead for the traffic in question.

The Aggregate Traffic

4.4 The figures of density of passenger traffic over different sections of the

1 The facts and the analysis in this chapter are limited to those elements of passenger traffic as will help to know the traffic level and pattern in 1970-71 and 1975-76.

railway in 1962-63 were obtained from the railway administration, but for purposes of studying the traffic variations as between the various districts and by lead groups we have had to compile the figures of passenger bookings at each of the individual stations to destinations lying within the various mileage zones. In the case of buses, the traffic density figures were compiled by our out-door staff after a study of the bus services provided over each of the roads, the average seating capacity of the buses used, the mileage performed per day and the occupation ratio.

4.5 The traffic density picture thus obtained has been depicted in "flow maps". In Map 4, the relative densities of traffic over all the sections of the railways and on all the roads close to and parallel to the railway lines are depicted. In Map 5 is shown, as an example, the density of traffic over the other roads in the Coimbatore District.

4.6 The inter-city passenger kilometres[1] in the year 1962-63 by all modes in the region were 11,745 million made up as shown in Table 28. In addition the urban and suburban bus traffic totalled to 674 million passenger kilometres.

4.7 The relative percentages of passenger traffic carried by the railways and the buses in the region, 24.4 and 71.5, as brought out in Table 28, are significant. They indicate how much the region depends on the buses for passenger transport. This picture, however, is for the region as a whole, taking together both competitive and non-competitive routes.

4.8 Of the railway route mileage in the region 94 per cent has roads parallel to and within a short distance of itself. Further, except for two minor sections of these roads,[2] buses ply on all these 'competitive routes' as we have labelled them.

Traffic Over the Competitive Routes

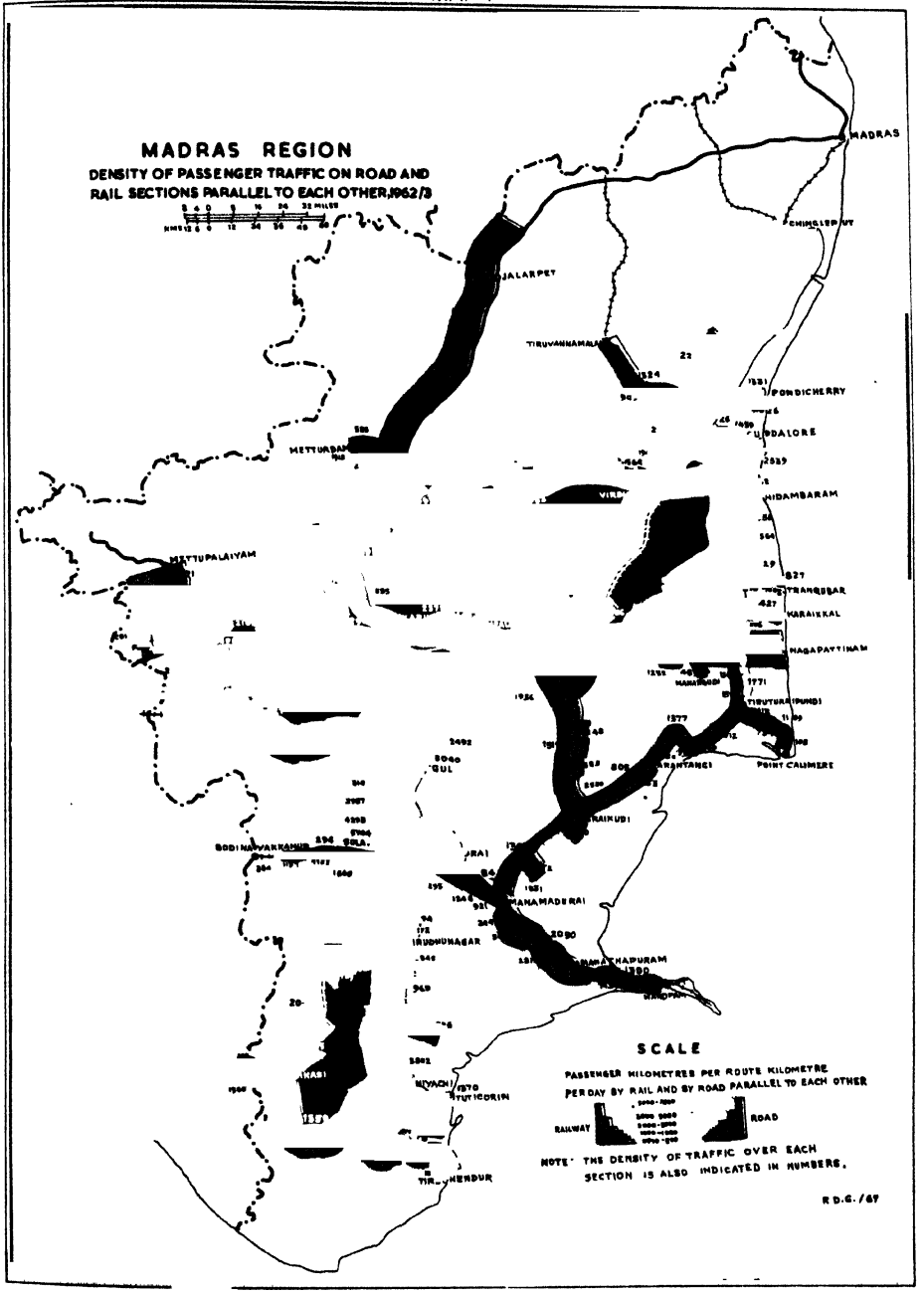
4.9 Of the aggregate traffic by trains and buses in the region as a whole, (that is 11,091.6 million passenger kilometres)[3] 5,010.2 million passenger kilometres are on competitive routes and 6,081.4 million passenger kilometres on non-competitive routes. Of the traffic on the competitive routes, the buses carry 2,160.1 million passenger kilometres and the trains 2,850.1 million passenger kilometres. Thus the traffic on the competitive routes is divided between buses and trains in the ratio of 43.1 per cent to 56.9 per cent. In using these figures pertaining to competitive routes, one has to bear in mind the

1 By inter-city traffic is meant all traffic other than urban and suburban.

2 Kagankarai-Salem, Karaikkudi-Savaganga.

3 Excluding long distance express bus traffic.

MAP 4


MADRAS REGION
DENSITY OF PASSENGER TRAFFIC ON ROAD AND RAIL SECTIONS PARALLEL TO EACH OTHER, 1962/3
MADRAS
JALARPET
TIRUVANNAMALAI
PONDICHERRY
CUDDALORE
METTURDAM
VIRU
CHIDAMBARAM
METTUPALAIYAM
TRANQUEBAR
KARAIKKAL
NAGAPATTINAM
TIRUTURAIPUNDI
POINT CALIMERE
MANAMADURAI
RAMANATHAPURAM
SCALE
PASSENGER KILOMETRES PER ROUTE KILOMETRE PER DAY BY RAIL AND BY ROAD PARALLEL TO EACH OTHER
RAILWAY
ROAD
NOTE: THE DENSITY OF TRAFFIC OVER EACH SECTION IS ALSO INDICATED IN NUMBERS.
R.D.G./67

distinction between "traffic over competitive routes" and "competitive traffic" as such. This is for the reason that all traffic over competitive routes is not competitive traffic. Some of it is long distance rail traffic for which there is no competition and some of it either originates or terminates in areas served by one and only one of the two modes of transport. It may be recalled here that for the competitive and the non-competitive routes taken together, the relative proportions are 71.5 per cent by buses and 24.4 per cent by rail, as earlier stated.

4.10 Statistics are not available to make an accurate assessment of the competitive traffic which is what one would really like to know. However, the proportion of through "non-competitive" traffic to the truly "competitive" traffic on certain competitive routes has been obtained separately by a special study of twelve representative sections of road and rail, competitive with each other. In default of anything more accurate these proportions were applied to the aggregate traffic, moving over the competitive routes by both modes over the entire region. Thus we reckoned that the competitive road and rail traffic, including that by long distance express buses (174.5 m. kms), is 1,803.3 million passenger kilometres by buses and 736.9 million passenger kilometres by rail. In other words, in terms of passenger kilometres 71.0 per cent of the competitive traffic takes to bus and 29.0 per cent to rail (Table 29). This is an important result and it should be added that there is no reason to suppose that the routes chosen for the special enquiries were in any way biased.

Further Disaggregation of Traffic

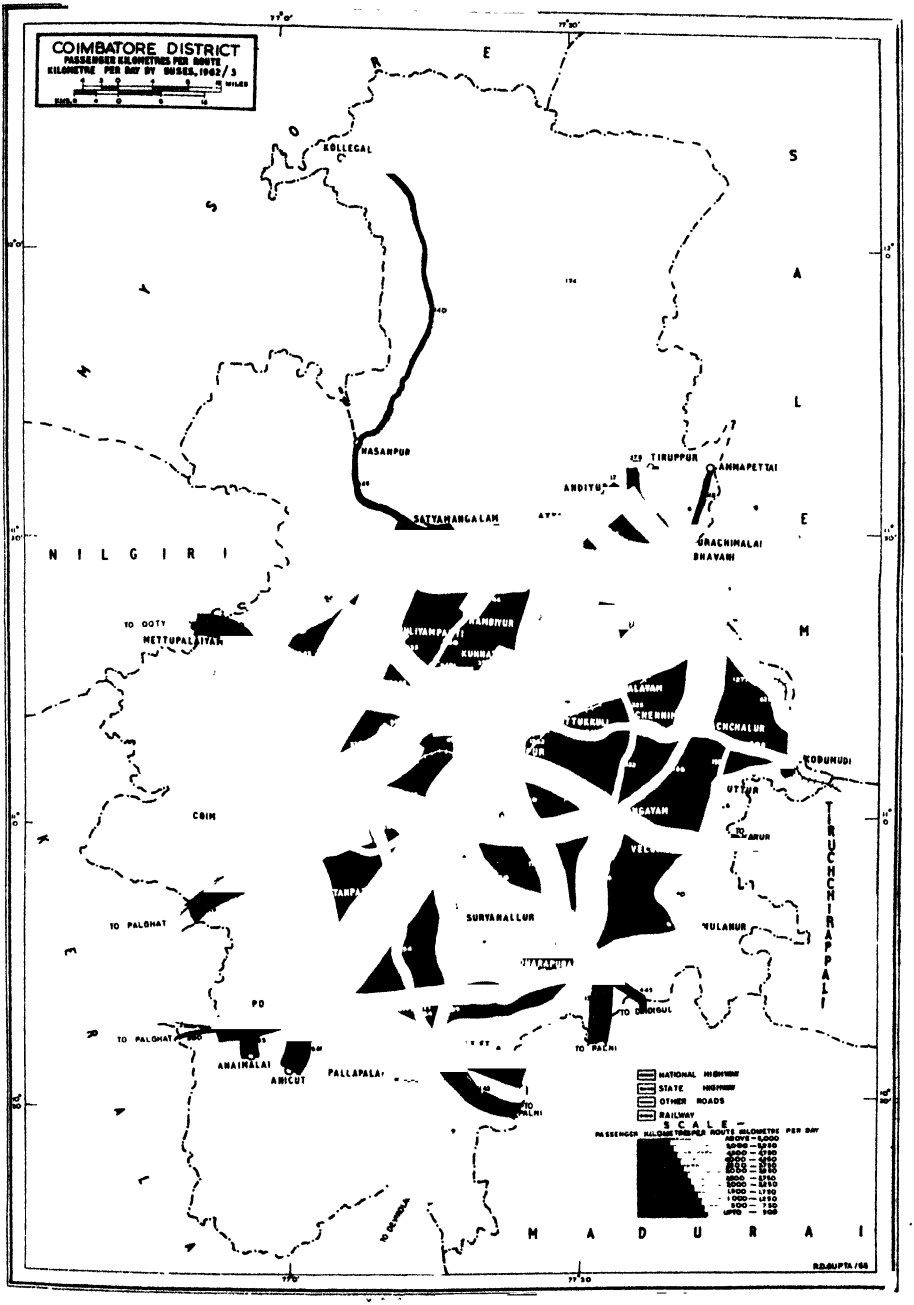
4.11 So far we have disaggregated the traffic primarily according to modes and, secondly, according to competitive and non-competitive categories. To get a deeper insight into the present situation in respect of passenger traffic we continue the disaggregation further.

4.12 Three kinds of further disaggregation are attempted. First, we look at the comparative picture of traffic in each mode according to lead groups. Next, we juxtapose the traffic by each mode on the main routes and on the branch line sections. Finally, we study the relative traffic figures not as an aggregate for the region as a whole, but as they figure out for each of its districts. The resultant figures are studied with the objective of obtaining guidance for the forecasting of the aggregate traffic in the future and its division between the buses and the trains.

Traffic According to Lead Groups

4.13 The breakdown of traffic according to lead groups has proved important and useful.

MAP 5


COIMBATORE DISTRICT
PASSENGER KILOMETRES PER ROUTE KILOMETRE PER DAY BY BUSES, 1962/3
KOLLEGAL
TIRUPPUR
ANNAPETTAI
ANDIYUR
SATYAMANGALAM
GOBICHINALAI
BHAVANI
NILGIRI
TO OOTY
METTUPALAYAM
KUNNA
CHENNIM
ENCHALUR
KODUMUDI
UTTUR
COIM
TO PALGHAT
SURYANALLUR
VULANUR
TIRUCHIRAPPALI
TO DINDIGUL
TO PALNI
ANAIMALAI
ANICUT
PALLAPALAI
NATIONAL HIGHWAY
STATE HIGHWAY
OTHER ROADS
RAILWAY
SCALE
MADURAI
R.D.GUPTA/66

4.14 Broadly, we have divided the traffic by each mode according to the lead "within 80 kms", and "over 80 kms". In the case of the railways a further division of the lead, "over 800 kms", has been made. In the absence of detailed figures of bus traffic in the different mileage groups, we have had to make certain field studies and to content ourselves with these broad distance divisions.

4.15 The position in regard to the division of traffic by leads is as follows. In 1962-63 the inter-city passenger journeys by rail and by buses in the region accounted for 11,266.1 million passenger kms. Of these, 76.8 per cent passenger kms pertained to journeys with a lead of less than 80 kms, and 23.2 per cent to those over 80 kms. Of the traffic within 80 kms, the relative shares of the buses and the railways were 87.2 per cent and 12.8 per cent respectively, while in the traffic of over 80 kms lead the relative shares were 32.8 per cent and 67.2 per cent respectively.

4.16 Disaggregation into lead groups of the traffic on the competitive routes alone or of the competitive traffic on the competitive routes for the region as a whole has not been possible.

4.17 The trends in the traffic by rail in the different lead groups are very significant. The passenger kms of journeys within 80 kms between 1956-57 and 1962-63 dropped from 48.9 per cent to 38.7 per cent of the total railway passenger kms. The absolute rate of decline in passenger kms in this lead group averaged 3.7 per cent per annum. In contrast, passenger kms in the lead groups of 81–800 kms and over 800 kms increased by about 3.1 and 6 per cent per annum respectively, so that it is very clear that the railways have had to depend on passengers travelling over 80 kms in order to sustain and improve their passenger earnings.

4.18 Information is not available to present an equally reliable comparative picture of the trend in the traffic by buses in different lead groups. Even the assessment that has been made of the changes between 1956 and 1963 in the passenger kms of bus journeys on competitive and non-competitive routes in the aggregate, without any regard to lead groups, had to be made on the assumption that the growth in bus passenger kilometres is at the same rate as the increase in corresponding seat kilometres. The information about the traffic by lead groups gathered by our special studies relate only to the year 1962-63. The trend in bus traffic over lead groups can, therefore, only be inferred from the trend in the railway traffic.

Division of Traffic Over the Mainline Sections and Over the Branch Lines

4.19 We must now refer to the flow maps of passenger traffic mentioned in paragraph 4.5. Map 4 shows passenger flows by bus and train on the compe-

titive routes. This map shows the fact that the railway passenger traffic density relative to the density on the adjoining parallel roads is substantially higher on the mainline sections than on the branch lines. It is generally between 200 and 250 per cent of the parallel bus passenger density on the main M. G. routes from Villupuram to Virudhunagar (via the main and chord lines), and on the main B.G. routes from Salem to Coimbatore. The bus passenger density, on the other hand, is relatively higher on routes parallel to the branch lines, as can be seen from the map over the Tirunelveli-Tenkasi, Manamadurai-Mandapam, Salem-Chinnasalem and Madurai-Bodinayakkanur sections.

4.20 The railway mainline sections cater to a high proportion of traffic not comparable with bus journeys which inflates their passenger kilometre density, namely, long distance through journeys, and first, second and third class mail journeys. In contrast, the higher proportion of bus traffic on routes parallel to the branch lines is due to the nature of the travel which is short distance. Also, the number of trains run on the branch lines, such as the Madurai-Bodinayakkanur branch, is extremely limited, so that the buses take the field and gather a relatively larger share of the traffic offerings.[1]

Disaggregation of Traffic in Terms of Districts

4.21 As the next step the regional traffic is analysed in terms of districts, separately for buses and trains. It is further broken down into traffic of over 80 kms lead and traffic of below 80 kms lead. Also, the figures for each district are worked out per capita to eliminate the effect of the variations in district population. The results are set out in Table 30.

4.22 These figures for each district are next set down alongside the basic figures of the length of metalled roads, length of railway line, area, population and per capita income. Also, certain derived statistical figures such as bus passenger kilometres as a percentage of total bus and rail passenger kilometres, metalled roads per 100 sq. kms of area, etc., are worked out and put in juxtaposition, as in Table 31.

4.23 With the data presented in Table 31, a multi-variate analysis of the aggregate traffic as well as of the bus traffic of each district of the region was attempted, using the variables such as *(a)* the ratio of metalled road mileage to the aggregate rail and metalled road mileage of each district, *(b)* the district's rural population, *(c)* the district income (or alternatively the per capita income of the district), and *(d)* density of population, etc. It was expected that the

1 There is definite evidence from field studies to show that the relative frequency of buses and trains as a factor influencing traffic division is a close second to differences in relative fares. Unsuitable train timings further tilt the scales of division in favour of the buses.

analysis would provide significant explanation of the variations in the aggregate traffic and in the bus traffic of each district; also that the analysis would help to form predicting equations for projecting the bus traffic of each district. However, it was found that the coefficients of the variables obtained from the analysis did not fit in well when tested against the available data for 1962-63, so that we have had to fall back on simpler methods of projection pending more extensive enquiries.

The Relative Rates of Growth of Bus and Rail Traffic

4.24 The rates of growth of bus and of rail traffic and of their total, in each district and the region as a whole between the years 1956-57 and 1962-63, are presented in Table 32.

4.25 The growing significance of bus travel is strikingly shown up by the relative rates of growth of bus and rail traffics. Taken together, the growth rate, from 1956-57 to 1962-63, was 6.9 per cent compound. The rail passenger traffic increased only by 0.2 per cent per annum compound in sharp contrast with the rapid growth of bus traffic at 10.2 per cent compound. What is even more important, the rate of growth of bus traffic on the competitive routes, 10.0 per cent, was hardly less striking than on the non-competitive routes, 10.8 per cent.

4.26 The rates of growth given in the preceding paragraph in fact tend to understate the growth of the competition rail is now receiving from buses, as one finds the growth of bus traffic relative to rail is steadily accelerating in more recent years.

Passengers' Choice of Mode of Transport and the Division of Traffic Between Buses and Trains

4.27 The question remains as to what the various factors are that influence a passenger in his choice of the mode of transport (where he has a choice), and what relative weight a passenger gives to each of the factors.

4.28 The factors which influence a passenger in his choice between the railways and the buses are:

(i) The relative fares;

(ii) the relative distances between his residence and the nearest bus-stand and railway station as also the similar relative distances at the destination;

(iii) the relative travel times;

(iv) the relative frequencies of the services and the convenience of the actual timings; and

(v) other aspects of convenience, principally the presence or absence of overcrowding.

4.29 An attempt was made (we believe for the first time in this country), to assess quantitatively to what extent each of these factors influences a prospective passenger in his choice of the mode of transport. With the help of the Railway Board and the Southern Railway, field studies were carried out over four selected sections, to observe and record quantitatively each of these factors as also the resulting division of traffic between the railway and the buses.

4.30 The tabulation and analysis of the field data have disclosed that:

(i) in the 1 to 10 kms range of distance, the railway has had a higher share of the traffic (53.3% of the total) compared with the buses, due mainly to the railway fares being from 10 Paise up to 25 Paise as against the fare of 31 Paise charged by the buses; and

(ii) in the other distance zones covered by the study the division as given in Table 33, shows varying preponderance by the buses.

4.31 Apart from this, the detailed statistical analysis of the division of traffic as a function of the various variables listed as determining consumer preferences has disclosed correctly the nature of the effect of each factor on the division—but we have insufficient confidence in the exact value of the coefficients to make predictions using them. Certain morals can, however, be drawn from them which are important for policy. The choice of mode of transport is very sensitive to fare differentials. Next in order of importance is the relative frequency of services. More field studies covering a larger number of sections and of greater length than attempted here will, we expect, lead to an even more fruitful analysis of the kind discussed above.

4.32 Having described the present position and the past trends in passenger traffic, we now pass on to projections of the traffic to the years 1970-71 and 1975-76, and its allocation as between the two principal modes of transport and the several sections thereof.

Projections of Aggregate Traffic in 1970-71 and 1975-76

4.33 An obvious method which lies ready at hand for projections of aggregate passenger traffic in the region is to use the past rates of growth.

4.34 The basic statistics for attempting projections of past trends are those furnished in Table 32 and those referred to in para 4.17. But it will be noted from our observations in paragraph 4.18 that while we have a clear and reliable picture of the rate of growth of rail traffic in the region in terms of passenger

kilometres in the aggregate, by lead groups and by districts, the corresponding picture about bus traffic is far less reliable.

4.35 The assessment of the aggregate "seat kilometres" by buses in the year 1962-63 and its division by districts is based on available figures, which are reliable, of the number of registered buses in operation on each route, their seating capacity and their daily mileage. But in the conversion of the "seat kilometres" into "passenger kilometres" and in the division of the passenger kilometres into those pertaining to journeys over 80 kilometres and under 80 kilometres, we are on less firm ground. We have had to rely on *(a)* the occupation ratios worked out by our field staff who took them to be the ratios between potential maximum earnings from bus services on selected routes to their actual takings during a sample period, and *(b)* occupation ratios derived for each district from the returns of gross earnings from operators (covering 54% of the vehicles) by dividing into the earnings the average fare per bus passenger kilometre, multiplied by the seat kilometres. The underlying principle of both these methods of calculating the occupation ratios are the same, but the sources of the data are different. The calculations made in these alternative ways are found to be quite near to each other. The division of traffic into lead groups is based on direct observations of the field staff. The bus traffic figures for 1956-57—another set of key figures for the projections—are much less reliable, as the only firm figures available for 1956-57 are the total number of buses registered in each district. The average daily mileage per bus, the average seating capacity, the "occupation ratio" and the division of traffic "over 80 kilometres" and "under 80 kilometres" have all had to be worked out making certain assumptions. And these assumptions, while they are the best that could be made in the prevailing paucity of data, are not above doubt and may mask some important variations that may have occurred.

4.36 Accepting these figures as the most plausible available, there are several ways in which the past trends can be projected.

4.37 Firstly, we can project the aggregate traffic of both the modes at the past rate of growth. Secondly, we can project the traffic by each mode separately at its own separate rate of growth during the period. A better procedure would be to divide the aggregate traffic into short distance (i.e., less than 80 kms) and long distance (i.e., more than 80 kms) lead groups and to project the traffic separately for each lead group. These projections can be made either in the aggregate for both modes or separately for each mode. A further variant would be to project the traffic for each mode separately for the parallel or competitive routes and the non-competitive routes.

4.38 The results of projecting by each of these alternative methods are shown in Table 34.

4.39 Another method of projection of passenger traffic tried was to use the National Sample Survey data regarding expenditure on conveyance by bus and by rail separately for the several expenditure groups in the year 1957-58. The expenditures on bus and train travel were first converted into passenger kilometres per head per month. (The average fare per kilometre by bus or train is known.) The total passenger kilometres travelled by a person in each expenditure group was derived by adding the corresponding figures of rail and bus travel for that expenditure group. Initially it was assumed that the passenger kilometres travelled by a person in each expenditure group would remain the same in 1970-71 and 1975-76 as in 1957-58. On this basis, from projections of income and expenditure in the region in 1970-71 and 1975-76 and of their distribution among the population, the passenger kilometres of travel in 1970-71 and 1975-76 were derived. The estimates so arrived at, gave us figures of 9,764 million passenger kilometres in 1971 and 12,428 million passenger kilometres in 1976.

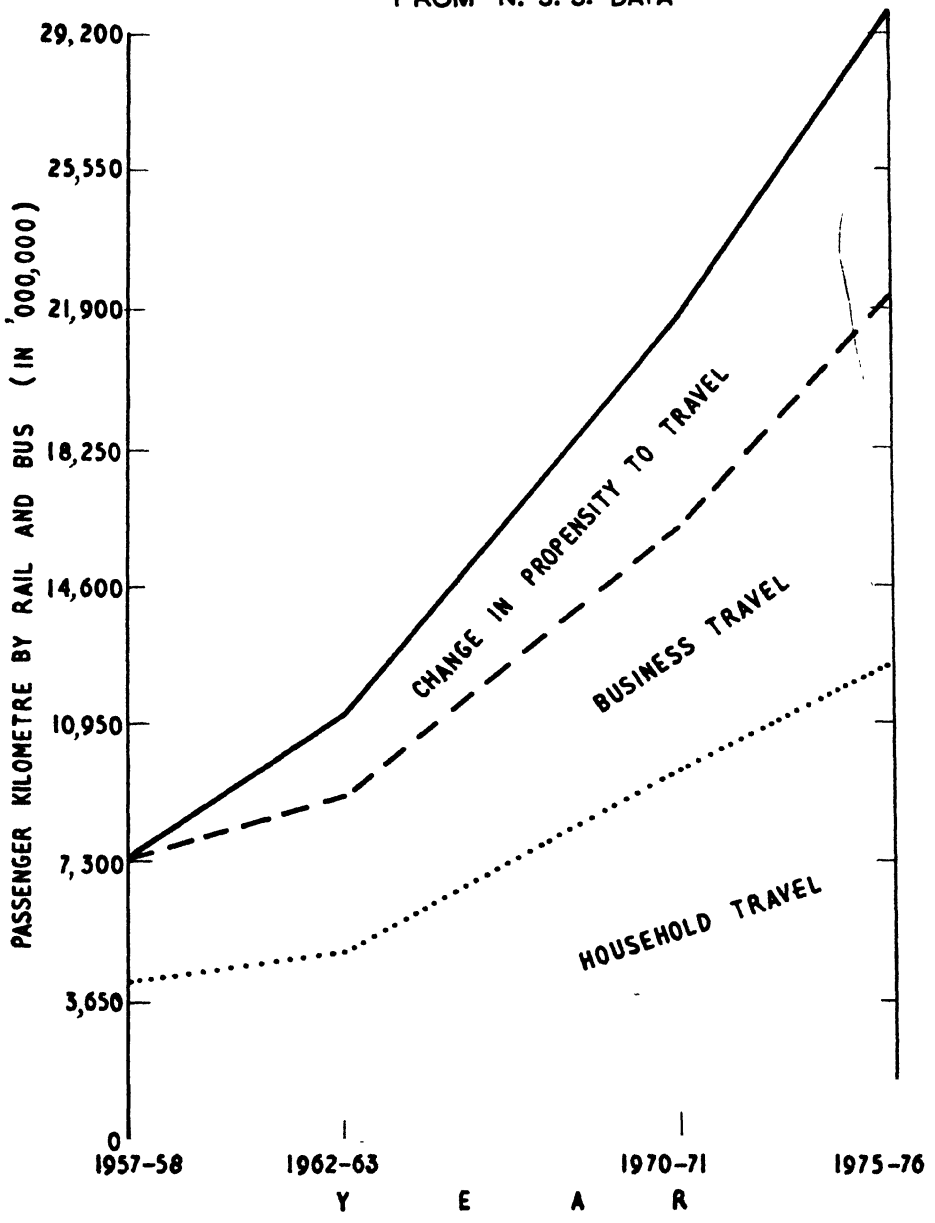
4.40 When the same method was used for obtaining estimates of traffic for 1957-58 and 1962-63, and the results checked against the actual traffic figures for those years (which were either available or estimated by alternative methods), the projections based on N.S.S. data were found to be falling short of the actual traffic in these years. Many reasons can be cited for this. An important one is that the N.S.S. data naturally do not report business travel. The difference could also be due to the manner of sampling and to under-reporting. We make the assumption that the difference between the actuals and the N.S.S. figures in 1957-58 was due to such factors and that with the exception of business travel the operation of the other factors could be assumed constant over our period. In default of better knowledge, we made the not unreasonable further assumption that business travel would grow proportionately with business income (defined as regional income minus agricultural income). On this postulate, business income was predicted to account for 6,497 million passenger kms of travel in 1970-71 and 9,735 million passenger kms in 1975-76.

4.41 Even after this allowance for business travel was made, it was found that in 1962-63 the actual traffic still exceeded the revised estimate. This indicated that there must have been at least one other factor not so far allowed for and which resulted in increased traffic. We chose to call this change over time in the propensity to travel even within the same income group. The rate of growth of traffic attributable to change in propensity was measured on this assumption for the period between 1957-58 and 1962-63, and the same absolute rate was assumed to hold good during the time horizon of our study.

4.42 In this way, we arrived at the projected estimate of 21,681 million

Chart 1

PASSENGER TRAFFIC PROJECTIONS 1971 AND 1976
FROM N. S. S. DATA



passenger kilometres in 1970-71, i.e., an increase of 92.4 per cent over 1962-63, and of 29,667 million passenger kilometres in 1975-76, i.e., an increase of 163.3 per cent over 1962-63.[1]

4.43 The results of the projections, including the three individual components—household travel, business travel and changes in propensity to travel—are depicted in Chart 1.

4.44 The results of the projections obtained from the N.S.S. data can be compared with the several other projections referred to in paragraph 4.37 and set out in Table 34. To enable this to be done the results of the projections from the N.S.S. data have also been included in that table. It will be seen that the results of the several projections are in fair agreement with each other for 1970-71, but for 1975-76 they are not quite so close. It is Projection 1 and Projection 3(a) of Table 34 which are somewhat near the results of the projections for 1975-76 from the N.S.S. data.

4.45 Caution is necessary in the use of the several figures of traffic estimate that are furnished in Table 34. Past trends merely projected over time do not allow for the more rapid increases in per capita income we are expecting in the future. Also the change in the propensity to travel cannot be assumed to operate indefinitely. There are limits to the expenditure of time either on domestic travel or on business travel. The propensity changes must keep within the bounds set by this limiting factor.

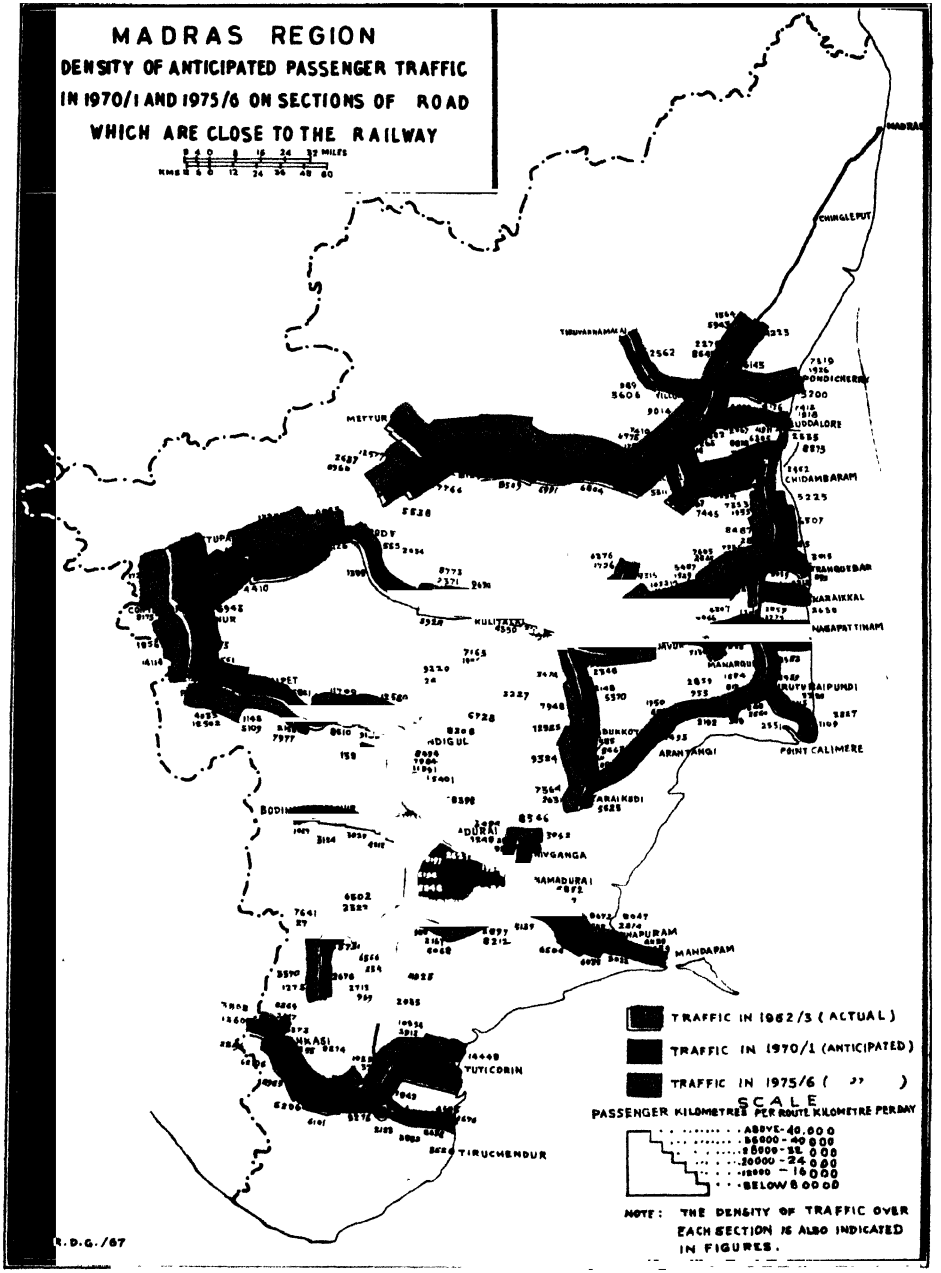
4.46 Having studied all the figures in Table 34 and having due regard to the inherent limitations of these figures, we have thought it best to adopt the figures of projections obtained from the N.S.S. data as a reasonable basis for planning for the future. These are the figures which we have analysed by modes of transport and by individual sections in the paragraphs that follow and also these are the figures we have used in Chapter 6 while working out the future requirements of rail and road transportation capacity for passenger traffic.

Districtwise Breakdown of Projected Traffic

4.47 Having projected the aggregate passenger traffic on to the years 1970-71 and 1975-76, our next task was to break it down by districts. As stated in paragraph 4.23, we attempted a number of sophisticated statistical methods and endeavoured to form equations to give the relationship between per capita travel on the one hand and the factors which influence travel on the other, such as the availability of rail and road per unit area, per capita income and the population density. Our attempts, however, did not yield fruitful results, due

1 Equivalent to an annual rate of 8.5 per cent compound in the period 1962-63 to 1970-71 and 7.7 per cent compound in the period 1962-63 to 1975-76.

MAP 6


MADRAS REGION
DENSITY OF ANTICIPATED PASSENGER TRAFFIC IN 1970/1 AND 1975/6 ON SECTIONS OF ROAD WHICH ARE CLOSE TO THE RAILWAY
MILES
KMS
MADRAS
CHINGLEPUT
PONDICHERRY
CUDDALORE
CHIDAMBARAM
MAYAVARAM
TRANQUEBAR
KARAIKKAL
NAGAPATTINAM
POINT CALIMERE
ARANTANGI
ARAIKUDI
SIVGANGA
MANAMADURAI
MANDAPAM
TUTICORIN
TIRUCHENDUR
TRAFFIC IN 1962/3 (ACTUAL)
TRAFFIC IN 1970/1 (ANTICIPATED)
TRAFFIC IN 1975/6 (")
SCALE
PASSENGER KILOMETRES PER ROUTE KILOMETRE PER DAY
ABOVE-40,000
40000 - 32,000
32000 - 24,000
24000 - 16,000
BELOW 8,000
NOTE: THE DENSITY OF TRAFFIC OVER EACH SECTION IS ALSO INDICATED IN FIGURES.
R.D.G./67

perhaps to there being in operation several other important factors influencing travel such as the variations in the social and cultural habits in the districts, etc. We were perforce constrained to predict the break-down by less sophisticated methods. The method chosen was to attribute to each district what we thought was a reasonable rate of growth, with our knowledge of the expected rate of growth of per capita travel and of per capita income for the region as a whole and of the differing rates of increase in per capita income expected in each district.

4.48 In Table 35 are set down the figures of anticipated passenger traffic by districts in the years 1970-71 and 1975-76.

Anticipated Passenger Traffic by Bus in the Districts

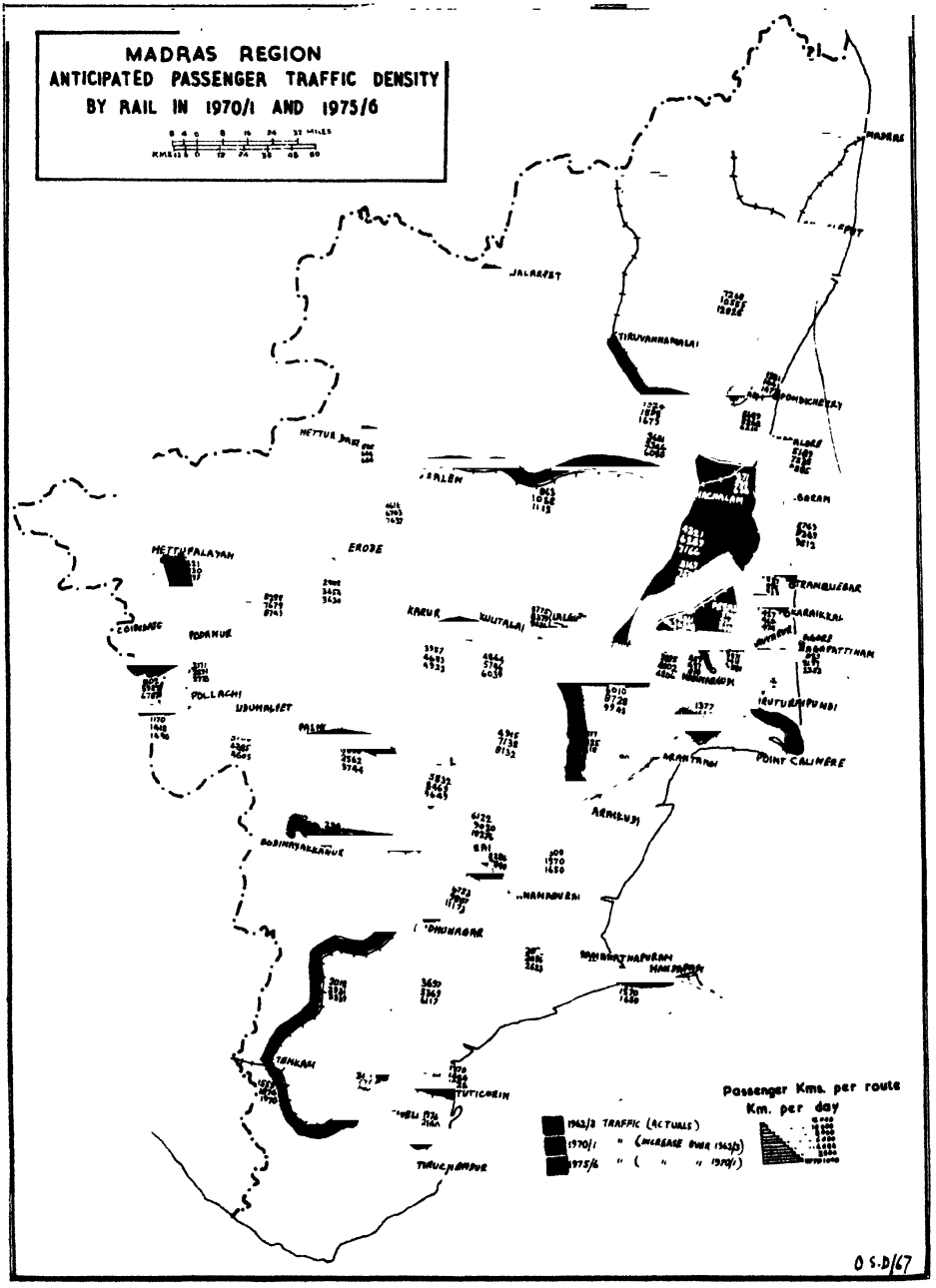
4.49 In our attempts to allocate to the buses their portion of the anticipated aggregate traffic in each district (by rail and by bus), our endeavour to apply sophisticated statistical methods again proved futile. So far as non-competitive routes are concerned, we thought it not unreasonable to assume rates of increase for each district at 20 per cent higher than the rate adopted for the aggregate traffic in the district. This is for the reason that the aggregate traffic is made up of not only bus traffic but also rail traffic which will unquestionably grow at a slower rate. Further, new non-competitive routes are likely to be opened up with the increase there will be in the metalled road mileage. As for bus traffic on competitive routes, in the past its rate of growth has been nearly the same as that over the non-competitive routes (10.0% for competitive routes and 10.8% for non-competitive routes). Therefore, for the competitive routes in each district also, for the period 1962-63 to 1970-71, the same basis of 20 per cent over the anticipated rate of increase in the aggregate traffic in the district has been adopted. For the period 1970-71 to 1975-76 a lower percentage of 15 instead of 20, was, however, adopted as in course of time the division of traffic on the competitive routes between the railways and the buses should stabilise itself.

4.50 In Table 36 are presented our estimates of bus passenger traffic in each district in 1970-71 and 1975-76.

Anticipated Rail Passenger Traffic in the Districts

4.51 The traffic by rail in each district was easily arrived at, being the difference between the anticipated aggregate traffic and the anticipated traffic by buses. Reference has been made in paragraph 4.17 to the decline in the period from 1956-57 to 1962-63 of the rail short distance traffic at 3.7 per cent

MAP 7


MADRAS REGION
ANTICIPATED PASSENGER TRAFFIC DENSITY
BY RAIL IN 1970/1 AND 1975/6
KMS
MILES
MADRAS
JALARPET
TIRUVANNAMALAI
PONDICHERRY
METTUR DAM
ERODE
METTUPALAYAM
COIMBATORE
PODANUR
POLLACHI
UDUMALPET
PALNI
KARUR
KULITALAI
TRICHINOPOLY
TANJORE
KUMBAKONAM
NEYVELI
MANNARGUDI
PORTO NOVO
CHIDAMBARAM
MAYAVARAM
TIRUTURAIPUNDI
POINT CALIMERE
KARAIKKAL
TRANQUEBAR
MADURAI
TUTICORIN
TIRUCHENDUR
1963/3 TRAFFIC (ACTUALS)
1970/1 " (INCREASE OVER 1963/3)
1975/6 " (" " 1970/1)
Passenger Kms. per route Km. per day
O.S.D/67

per annum and an increase of long distance traffic at 3.2 per cent per annum. We have assumed that in the future up to 1975-76 the rail short distance traffic will stabilise at the present level, and that the entire increase in rail traffic will be in its long lead traffic. In other words the anticipated increase will be distributed over the railway main line sections.

4.52 The anticipated traffic by rail in each district is given in Table 37.

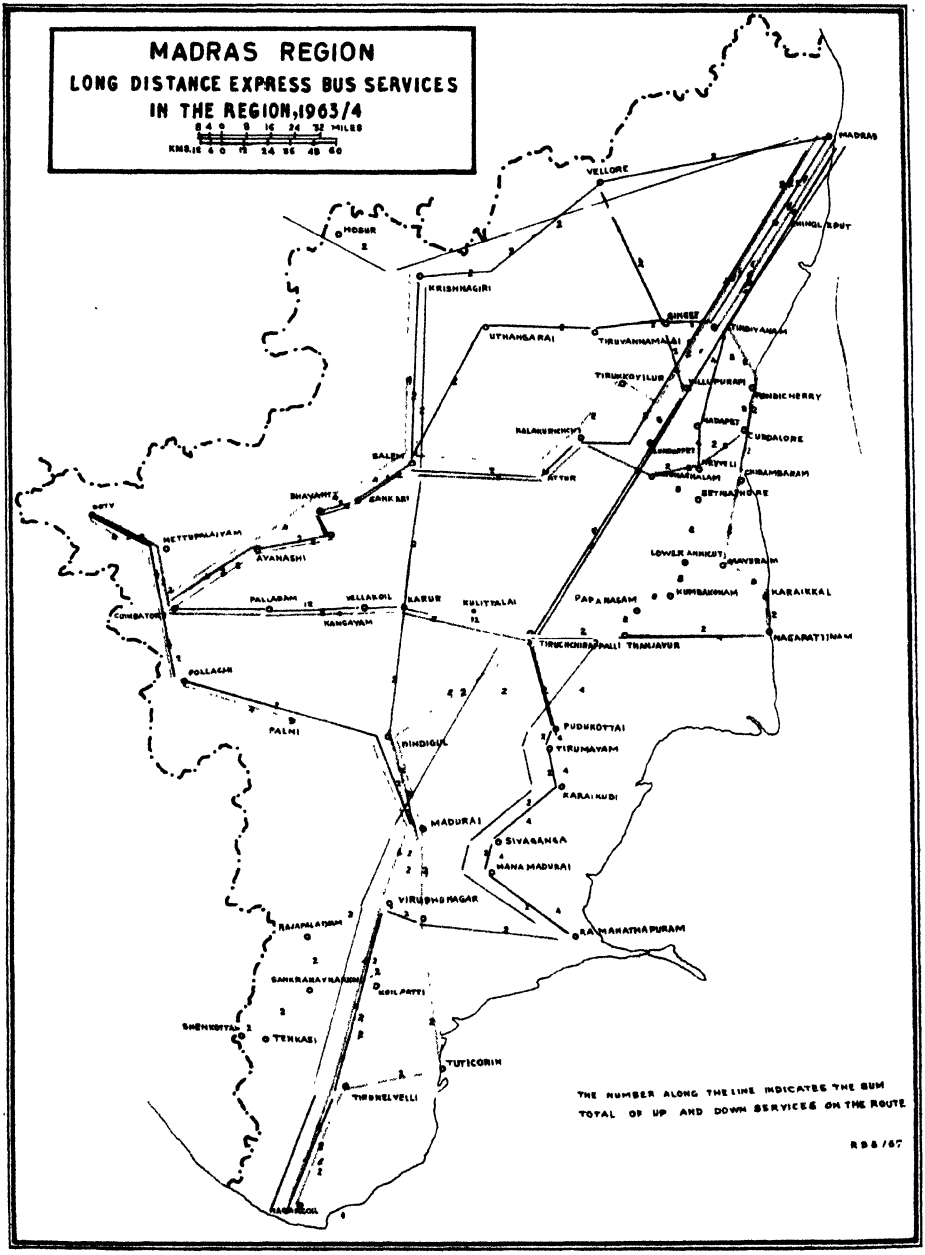
4.53 In Maps 6 and 7 are depicted the anticipated passenger traffic by road and by rail respectively in 1970-71 and 1975-76. In the case of the bus traffic the flow has been depicted only over the sections which are close to the railway road. The railway flow map includes also the cross traffic, i.e., the traffic passing through the region. We will revert again to these maps in Chapter 6, when we consider the additional capacity by rail and by road that will have to be provided.

Points of Importance

4.54 To impart appropriate emphasis before proceeding further, we set down below some of the basic facts emerging from the preceding paragraphs:

1. The buses and the trains are the principal modes of passenger transport in the region and their relative shares in the traffic in 1962-63 were 71.5 per cent and 24.4 per cent. The buses are in fact the dominant mode of passenger transport.
2. In this region there are roads close and parallel to 94 per cent of the railway track, so that competition between the railway and the road services is very intense. On the competitive routes alone, the relative shares of the buses and the trains in the traffic are 43.1 per cent and 56.9 per cent.
3. The aggregate rate of increase of passenger traffic in the region between 1956-57 and 1962-63 was 6.9 per cent. The rate of increase by buses was 10.2 per cent and that by trains was only 0.2 per cent.
4. Between 1956-57 and 1962-63 the railway traffic with leads of less than 80 kms declined by 3.7 per cent per year. It is the railway traffic with leads over 80 kms that increased at 3.2 per cent per year and helped to sustain the rail traffic.
5. The anticipated aggregate traffic by rail and by buses taken together will in the years 1970-71 and 1975-76 be respectively 1.9 times and 2.6 times of that in 1962-63.
6. In 1970-71 and 1975-76, the bus traffic as a whole is expected to be 216 per cent and 308 per cent respectively of the traffic in 1962-63. This is a fair measure of the additional vehicles and road capacity

MAP 8


MADRAS REGION
LONG DISTANCE EXPRESS BUS SERVICES
IN THE REGION, 1963/4
MILES
KMS.
MADRAS
VELLORE
MADURAI
KRISHNAGIRI
UTHANGARAI
TIRUVANNAMALAI
TIRUKKOYILUR
VILLUPURAM
PONDICHERRY
CUDALORE
CHIDAMBARAM
SALEM
METTUPALAIYAM
AVANASHI
COIMBATORE
PALLADAM
VELLAKOIL
KARUR
KULITTALAI
TIRUCHIRAPPALLI
THANJAVUR
KARAIKKAL
PAPANASAM
KUMBAKONAM
POLLACHI
PALNI
DINDIGUL
PUDUKOTTAI
TIRUMAYAM
KARAIKUDI
SIVAGANGA
MANAMADURAI
VIRUDHUNAGAR
RAJAPALAYAM
RAMANATHAPURAM
SANKARANAYANAR KOIL
SHENKOTTAI
TENKASI
TUTICORIN
TIRUNELVELI
THE NUMBER ALONG THE LINE INDICATES THE SUM TOTAL OF UP AND DOWN SERVICES ON THE ROUTE
RSS/67

that will be needed. Due note must be taken of the fact that in the years 1970-71 and 1975-76 the bus traffic density will be nearly twice and thrice respectively of what it was in 1962-63.

7. The anticipated annual rate of growth of rail traffic is 'nil' so far as short distance traffic (i.e., traffic below 80 kms) is concerned. The long distance traffic in 1970-71 and 1975-76 is expected to be roughly 1.57 times and 1.76 times of that in 1962-63. The increase will largely occur over the main line sections. This again is a rough measure of the additional capacity that will be needed on the railway to deal with passenger traffic.

Three Topics of Special Interest

4.55 There are three other topics of interest in the passenger transport of the region, on which we have not touched till now and which must be dealt with to complete the picture. They are:

(i) the long distance express bus services run by the State Government;
(ii) inter-city passenger travel by other modes such as cars, taxis and by air; and
(iii) the town bus services operated in the different towns of the region.

Long Distance Bus Services

4.56 The long distance express bus services are important, if for no other reason than that they are an 'up and coming' development likely to challenge and further erode into railway passenger transport. As we have remarked earlier, the rail traffic within 80 kms has shown serious decline, and, for the maintenance or increase of their traffic, the railways have had to depend on the longer journeys of over 80 kms. The long distance bus services, modest as they are at present, will divert, in the not distant future, substantial portions of the traffic from the railways over the long distance routes as well if they continue to grow as fast as they have done since 1959-60.

4.57 The express bus services on long, State-wide routes were started by the Government of Madras in 1959-60 and are run departmentally. The number of express buses in operation increased from 2 in 1959-60 to 72 by 1963-64,[1] and the number of routes went up from 1 to 24. The route kilometres operated grew from 360 to 7,872 during the period. The passenger kilometres catered to by these buses (on originating traffic), are estimated at 174.45 million per annum, which represents 1.55 per cent of the total inter-city passenger kilometres by bus and rail in the region.

1 These services are depicted in Map 8.

4.58 The express buses carried 9.24 million passenger kilometres of traffic with a length of travel of under 80 kms, and 165.21 million passenger kilometres on lengths of travel of over 80 kms. The traffic catered to by them is thus essentially relatively long lead traffic. The average length of journey by express buses is about 121 kms compared with 21 kms for all buses, 53 kms for all railway journeys, 39.8 kms for third class ordinary and 170 kms for third class mail. It is appropriate, therefore, to say that the long distance express bus services are truly competitive with third class mail journeys and will become even more so.

4.59 It is significant that of the passenger-kilometres performed in journeys of over 80 kms by road and rail together, the express buses even now account for 7.1 per cent, and that compared only with the category of third class mail traffic by railway, the passenger-kilometres recorded by express buses are 20.9 per cent. Where the railways have lost relatively more long distance traffic is *(i)* where the train service is relatively slower as over the metre gauge and where the journey involves transhipment at an intermediate junction, and *(ii)* where the long distance fast trains run mostly during the night and there is no adequate fast train service during the day time.

4.60 A point which deserves to be noted is that the express bus fares generally exceed not merely the ordinary railway third class fares but also the third class mail fares. Often they are in excess by about 20 per cent of the mail fares.

Certain Policy Implications of the Running of Long Distance Buses

4.61 In certain ways the features of consumer preference pertaining to the long distance buses are quite distinct from those pertaining to the buses normally running over shorter routes. Extension of operation of long distance buses has certain distinct and important policy implications.

Air Travel

4.62 Besides travel by bus or train, passenger journeys are made by air, private cars, and by taxis. These are briefly discussed below.

4.63 Travel by air is to some extent an alternative to rail first class journeys. Of 1,07,000 rail journeys by first class, the number of rail journeys from airport towns or towns in their hinterland was 28,600. The number of comparable air journeys was 14,159 in 1962-63, i.e., 49.5 per cent of the first class rail journeys from the airport towns and the towns in their feeder area. But in absolute terms, the number of air journeys averaged to only about 39 per day.

Journeys by Private Cars and Taxis

4.64 Inter-city journeys by private cars and taxis may be placed in the same category as first class rail journeys. The former numbered 4.9 million in 1963. So they were 45 times as numerous as the first class rail journeys.

4.65 In the inter-city travel private cars and taxis catered to 472.2 million passenger kilometres, that is nearly 13 times the passenger kilometres of first class rail travel (37 million passenger kms). The figure is, however, only 4 per cent of the aggregate inter-city passenger traffic in all classes and by all modes of transport.

Town Bus Services Catering to Urban and Suburban Passenger Traffic

4.66 In the foregoing paragraphs we have dealt with the inter-city passenger traffic. The urban and suburban traffic which is carried by buses, taxis and private cars, within towns or cities in the region, are a distinct category of traffic which is discussed below.

4.67 There are 23 towns in the region which command town bus services, generally operating within town limits. These towns together contain a population of 2.569 million. The town size varies from that with a population 27,000 to 4,25,000, the average population per town being 1,07,374.

4.68 In these towns, 406 town buses were in operation in 1962-63. This is as against the total of 3,895 buses registered in the region for all services. The number of passengers carried per annum was 194 million. The passenger kilometres performed were 674 million, roughly 8 per cent of the passenger kilometres by buses in inter-city journeys. Each inhabitant in these towns, on an average, made 75 journeys per year in these buses, with an average lead of 3.5 kilometres.

4.69 Though the town bus services generally operate within town limits, in some places the journeys catered to by them are also suburban in nature, e.g., Tiruvadamarudur-Kumbakonam-Swamimalai, via Kumbakonam railway station (19 kms) and Tanjore-Melatur, via Patti Agraharam and Thittai, (19 kms).

4.70 The railways, in the region, generally do not perform comparable services except at Tiruchirapalli, where passengers are carried between various parts of the town such as Tiruchirapalli Fort, Tiruchirapalli Town and Tiruchirapalli Junction by shuttle trains specially meant for such traffic.

Chapter 5

Goods Traffic

Present Pattern, Trends and Projections

Scope of the Chapter

IN THIS CHAPTER we deal with the present (1962-63) flows of goods traffic, in the aggregate and individually for the more important commodities, by each mode of transport. The past levels of movement are also given to the extent possible and the trends in the traffic are commented upon. We then go on to project the aggregate goods traffic onto the years 1970-71 and 1975-76. Finally, we deal with the question of the division of the projected traffic between road and rail. On the assumption that there will be no basic change in the pattern of the present division of traffic we give an estimate of what the traffic density will be over the several sections of the railways and the roads. As in Chapter 4, dealing with passenger traffic, we confine our factual statements and discussions to what is necessary to estimate the volume of goods traffic and its pattern in 1970-71 and 1975-76, by each mode of transport and over the several sections. Much additional information of interest pertaining to goods transport form part of the data collected.

Sources of the Railway Data

5.2 The data about the goods traffic on the railways, such as the places of origin, destination and tonnages moved between pairs of points, were obtained for each individual commodity for 1962-63 from the coded information available with the Southern Railway.[1] This information is available for every item of traffic of a commodity which earns not less than Rs. 100 a month as freight between each particular pair of stations. The flow maps for the aggregate traffic by rail, as also for the traffic in some of the principal commodities, to which we shall presently refer, are based on these "point to point" figures.

1 The data extracted covers over 90 per cent of the region's rail goods traffic. The parcel traffic of the region and the cross traffic are not included.

Information about sectional traffic densities, including cross traffic,[1] was obtained from the railway's operating statistics, and that about the aggregate traffic in individual commodities in 1956-57 and 1962-63, for the purpose of judging the trends in traffic by commodities, from their goods revenue statistics.

Sources of Road Traffic Data

5.3 In the case of goods traffic by road, the assessment and depiction of the flows in the aggregate and for individual important commodities, even as it prevails at present, has been much more difficult. Three different methods were adopted. Yet none of them yielded—nor by their very nature could they yield—a complete picture. A fair picture was pieced up together from the sum total of information thus gathered.

5.4 One method adopted was to collect data from road operators, regarding the tonnage and the composition of the traffic carried by them, by the issue of a questionnaire. Our study covered operators who owned and operated 18.3 per cent of the public carrier's lorries in the region. Generally the information furnished by the operators was not quite reliable. The second method used was to organise an "origin-destination study" on two consecutive days around 18 focal points in the region, covering all types of goods carriers by road. The information so obtained was coded, punched and tabulated. This source was specially useful on account of the data provided of the traffic in individual commodities by lead groups, the average leads involved and the load factor of the lorries. The third method was to contact the wholesale traders at the principal markets throughout the region and to elicit figures of dispatches and arrivals of important agricultural commodities at the towns during the year. The information given by them was also cross-checked with the District Marketing Officers. This method was particularly useful for assessing the flow of agricultural commodities.

5.5 As has been indicated earlier, the results of these three methods were brought together so as to provide a mutual cross-check.[2] By this process a composite picture of the aggregate flow and of the flows of important individual commodities was obtained for the year 1962-63.

5.6 While from these three sources of data a reasonably reliable picture of the flows of traffic in 1962-63 was obtained, the obtaining of similar informa-

1 That is traffic which both originates and terminates outside the region.

2 By combining the average load factor of a lorry in the region (calculated from the origin-destination data), with the gross tonne kilometres of lorry traffic obtained from PWD Census an estimate of aggregate lorry traffic in net tonne kilometres was made and found to confirm our other estimates.

tion for 1956-57 was found to be very much less satisfactory. The available basic information pertained to the number of trucks registered in the region and the gross traffic density by road as revealed by the triennial P.W.D. Census. These two items of information enabled us to estimate, very roughly, only the aggregate volume of the traffic in that year. We could not work out the composition of the traffic or any of the other features, such as the average lead, load factor, etc.

5.7 The "origin-destination" study yielded also information regarding goods traffic by private carriers' lorries.

5.8 The traffic carried by bullock-carts was also assessed by three different methods. From the published results of the triennial P.W.D. Census of road traffic were obtained the density of traffic by bullock-carts in the region as a whole and over individual sections and also the trends in the traffic density. A special study made by our outdoor staff, at selected market towns and rural areas, furnished useful information as to the normal leads and the nature of the services rendered by the carts. The data obtained during the "origin-destination" study yielded figures of average lead and the load factor. And the latter figures proved useful for converting the "gross tonne" figures of the P.W.D. Census into "net tonne" figures.

Volume and Pattern of Road and Rail Traffic in 1962-63

5.9 In Table 38 are given the figures of traffic carried by the different modes of transport in 1962-63 in terms of "tonnes" and "tonne kilometres".

5.10 In terms of tonnes, in 1962-63 the railways moved 5.84 million as against 16.09 million moved by public carriers' vehicles, 1.67 million by private carriers' vehicles and 25 million by bullock-carts. But this picture in terms of tonnes is likely to prove misleading, as it does not take account of the substantial differences in the average lead by each of these modes of transport. In terms of tonne kms, railway traffic recorded roughly 2,378 million as compared with 1,563 million by public carriers' vehicles, 349 million by private carriers' vehicles, and 500 million by bullock-carts. The railways accounted for 49.7 per cent of the goods traffic in the region in terms of 'tonne kilometres', as against 39.9 per cent by public and private carriers' vehicles together, and 10.4 per cent by bullock-carts.

Traffic in "Distribution", and in "Medium and Long Distance Transportation" Services

5.11 This account of the performance of the different modes of transport

gains in usefulness if one distinguishes between what may be termed "Collection and Distribution Services" and "Medium and Long Distance Transportation Services". The former expression has been used here as covering the transportation generally within a distance of 40 kilometres (25 miles), in retail collection and distribution and also from the fields and villages to the nearest *mandies*[1] and the latter as covering the rest of the transportation services. Apart from the broad difference in the nature of these services, the usefulness of this division arises also from the fact that generally in one case the competition is between the bullock-carts and lorries while in the other it is between the lorry and the railways.

5.12 The entire bullock-cart traffic comes by its very nature under Collection and Distribution Services. The traffic that is carried by the public carriers' vehicles and the private carriers' vehicles is partly in Collection and Distribution Services and partly in Medium and Long Distance Transportation Services. The railway services are entirely of Medium and Long Distance Transportation Services. In Tables 39 and 40 are given the relative volumes of traffic by each of these modes of transport in Collection and Distribution Services and in Medium and Long Distance Transportation Services respectively in the year 1962-63.

5.13 It will be observed from Tables 39 and 40 that the aggregate goods transportation of 4,790 million tonne kms was divided between the Collection and Distribution Services and the Medium and Long Distance Transportation Services in the ratio 19.8 : 80.2.

5.14 In the aggregate of the Collection and Distribution Services, the relative shares of the bullock-carts and the motor vehicles (both private carriers and public carriers taken together) were 52.7 per cent and 47.3 per cent respectively.

5.15 The total traffic under Medium and Long Distance Transportation Services was shared by the railway on the one hand and the public and private carriers' motor vehicles on the other in the ratio 61.9 per cent to 38.1 per cent. These two are significant figures, as they give a measure of the real extent of competition between the railways and the mechanised road vehicles as it now prevails.

5.16 The picture of the division of traffic in the major commodities in the year 1962-63, between the railways and the lorries when transported over different leads is given in Table 41.

Flow Maps of Road and Rail Traffic

5.17 In Map 9 is shown the aggregate flow of goods traffic by rail in 1962-63.

1 *Mandies*, i.e., market towns.

The traffic depicted pertains to that originating or terminating within the region and therefore excludes the cross traffic which just goes through. Flow maps have also been prepared for important individual commodities, and that for rice and paddy is given as specimen in Map 10.[1] Similarly flow maps have also been prepared for movements by lorries. That in respect of rice and paddy is reproduced as a specimen vide Map 11.[2]

5.18 These maps, showing the flows of individual commodities by rail and by road, have been helpful giving the trend of the present flows of traffic for comparison with the future flows once the projections of the traffic in those commodities have been made and have been allocated between road and rail. They were not used however, as the basis for comparing the transport needs as at present with the available transport capacity. This was for two reasons. Firstly, these flow maps do not include cross traffic. Secondly, so far as the aggregate traffic by sections is concerned, we have far more reliable data of aggregate "freight tonne kilometres per route kilometre per day" by railway in their goods operating statistics, and of "gross tonne kilometres per road kilometre per day" on the roads from the triennial P.W.D. Census data.

Past Trends in the Division of Traffic

5.19 Having dealt with the level of the aggregate traffic in 1962-63 and its division between the different modes of transport, we now pass on to a study of the trends in this division since 1956-57, both in the aggregate and by important commodity groups. As has been indicated earlier, the data available for this study are very limited so far as road transportation is concerned even in regard to the aggregate traffic carried. When one attempts to break the aggregates into figures pertaining to individual important commodities, the necessary data simply do not exist. One is therefore left to infer the variations in the commodity composition of road traffic from the reasonably clear account available of the variations in rail traffic.

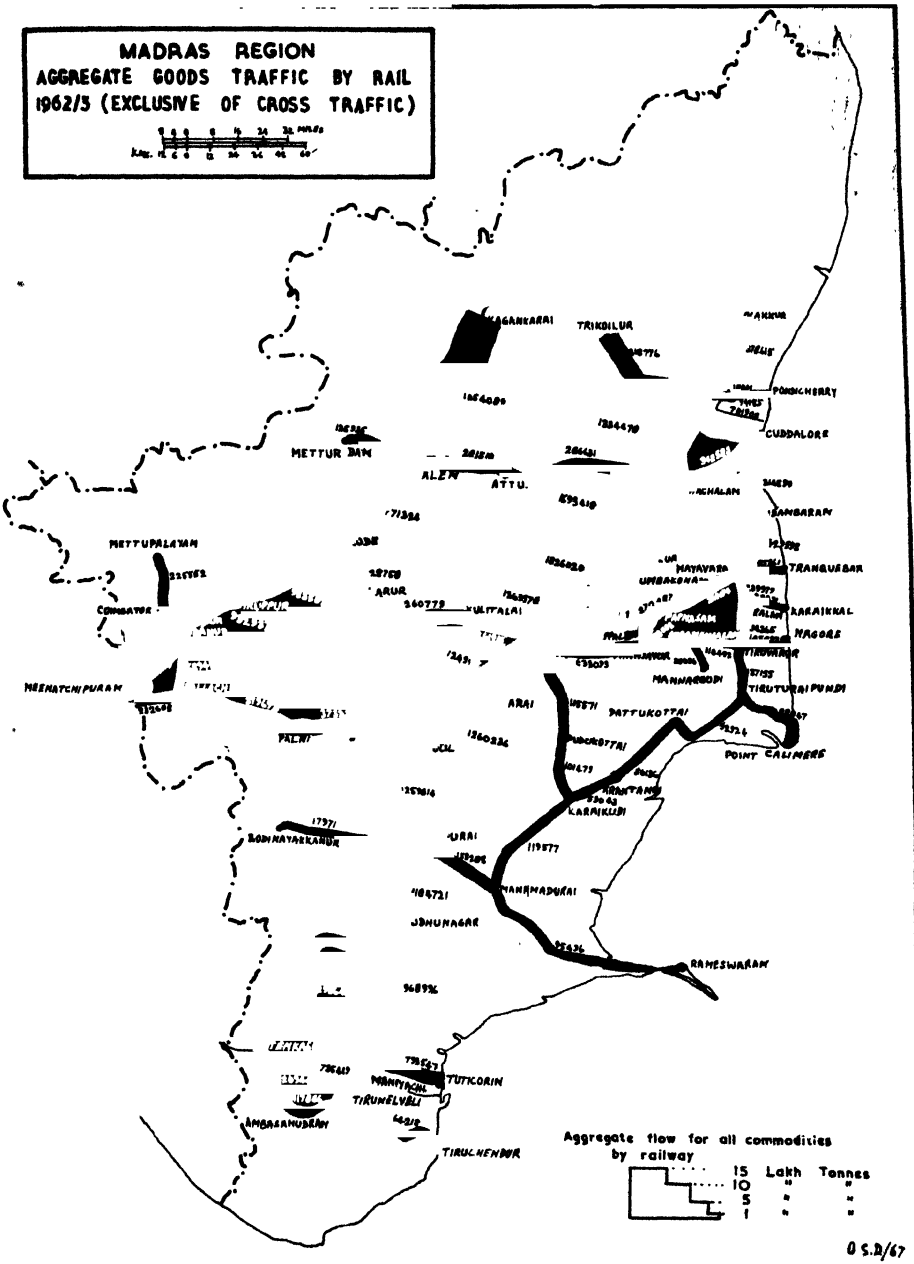
5.20 The rate of growth of goods traffic by railway in the region is given in Table 42. During the period 1956-57 to 1962-63, the originating goods traffic of the railways increased by 2.1 per cent and the terminating traffic by 4.9 per cent per annum compound. In terms of tonne kms, the originating and terminating traffic together increased by 6.9 per cent per annum compound.

5.21 For an estimate of the aggregate transportation service performed

1 Those drawn in respect of other commodities, namely, sugarcane, oilseeds, cotton, limestone, salt, firewood, fruits and vegetables and the residual traffic in other commodities, have not been reproduced.

2 Those pertaining for cotton, firewood and fruits and vegetables have not been reproduced.

MAP 9


MADRAS REGION
AGGREGATE GOODS TRAFFIC BY RAIL
1962/3 (EXCLUSIVE OF CROSS TRAFFIC)
Kms.
Aggregate flow for all commodities by railway
15 Lakh Tonnes
10 " "
5 " "
1 " "
O S.D/67
METTUR DAM
METTUPALAYAM
COIMBATORE
PALNI
POLLACHI
ARUR
KULITTALAI
ALEN
ATTU.
TRICHUR
PONDICHERRY
CUDDALORE
TRANQUEBAR
KARAIKKAL
NAGORE
TIRUVARUR
MANNARGUDI
TIRUTURAIPUNDI
PATTUKOTTAI
POINT CALIMERE
ARAI
KARAIKUDI
MADURAI
RAMESWARAM
TUTICORIN
TIRUNELVELI
TIRUCHENDUR

by the lorries in 1956-57 and subsequently, from which the trends as between that year and 1962-63 may be seen, the only firm figures available are the number of lorries registered in the region each year. These figures, for the years 1956, 1961 and 1962, are given in Table 43.

5.22 The figures given in Table 43 pertaining to variations in lorry traffic do not reflect the increase in the average capacity of the lorries. Enquiries reveal that between 1951 and 1963 there has been a steady increase in the average capacity of the lorries. If allowance is made for this factor as also for the increase that has been occurring in the average mileage run by a lorry each year the relative compounded annual rate of increase in goods traffic in the region by lorries between the years 1956-57 and 1962-63, works out to about[1] 16.6 per cent. This is a significant figure and must be seen alongside the corresponding rate of growth of tonne kilometres of aggregate goods traffic by railway, i.e., 6.9 per cent (vide paragraph 5.20).

Differing Trends in the Railway Traffic in High Rated and Low Rated Commodities

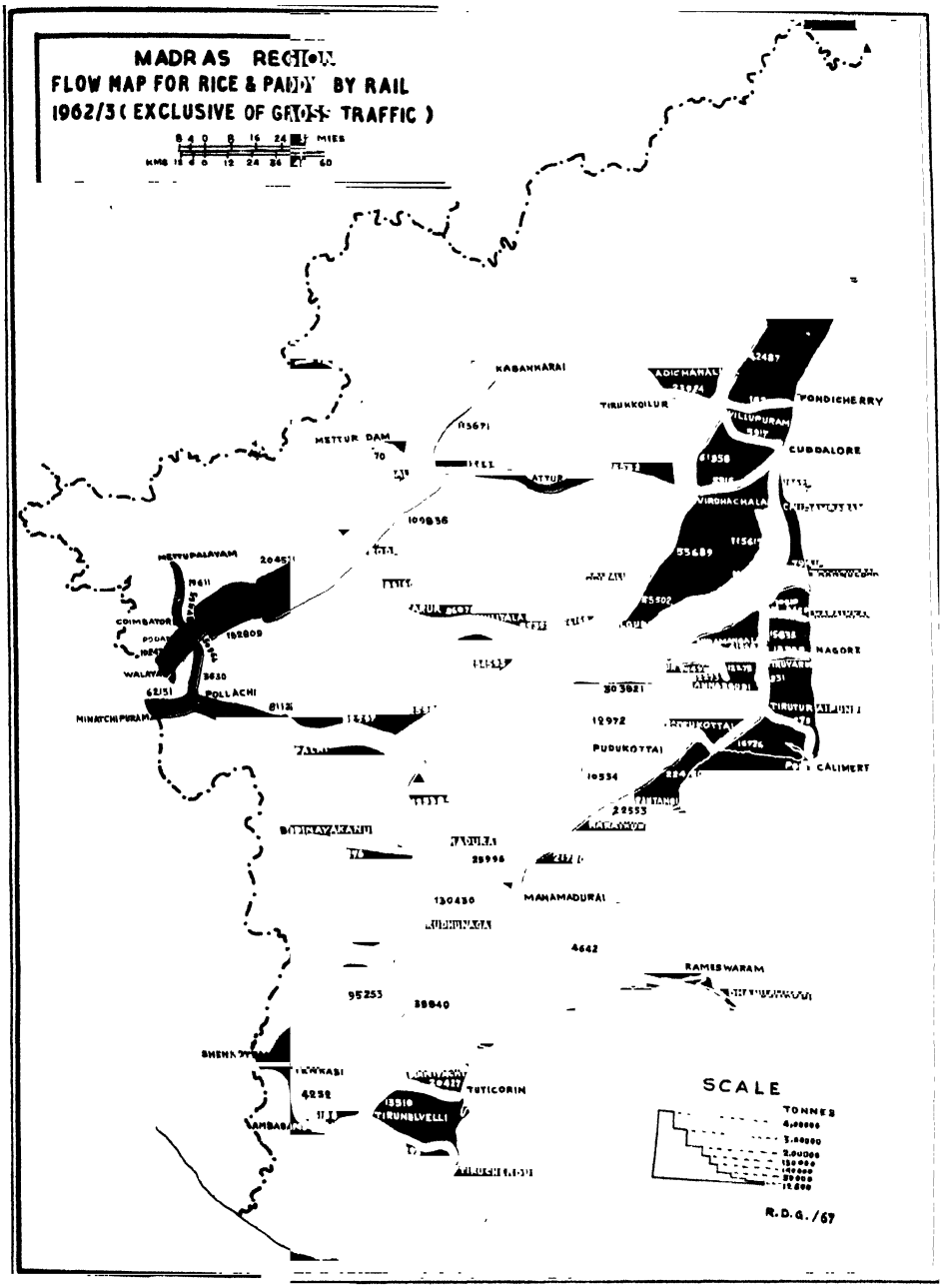
5.23 In Table 44 the total tonnage of outward and inward traffic by rail at the stations in the region during the years 1952-53 and 1962-63 is given for each of the important commodities. So as to bring out clearly the implications of these figures, the commodities have been arranged in the ascending order of their freight rate classifications. Those up to and inclusive of class 65.B have been treated as "low rated" commodities, and those of 70.B and above as "high rated" commodities. Sub-totals have been given for each of these two groups.

5.24 A study of the figures in Table 44 is very revealing. There has been a drop in the railway traffic in the case of every one of the "high rated" commodities, the weighted average of the drop being as high as 51 per cent in the ten-year period under consideration. In sharp contrast are the figures for low rated commodities with an increase of 39 per cent in the aggregate. This is, however, the net result of increases in some and decreases in others. It is commodities such as coal, manures, ores, cement, mineral oils, and iron and steel which have shown substantial increases, and these are the commodities which have helped to sustain and improve the railway traffic.

5.25 Between 1952 and 1963, the industrial and agricultural outputs in

1 In the absence of any other guide, for the purpose of working out this figure the average annual performance of 1,10,000 net ton miles per lorry per year in 1957 as given in paragraph 5.16 of *Some Aspects of Goods Transport by Road in Delhi Region* (NCAER, 1958), has been taken as applicable to the region now under study as well.

MAP 10


MADRAS REGION
FLOW MAP FOR RICE & PADDY BY RAIL
1962/3 (EXCLUSIVE OF GROSS TRAFFIC)
KABANHARAI
METTUR DAM
ATTUR
TIRUKKOILUR
ADICHANAL
PONDICHERRY
VILLUPURAM
CUDDALORE
VIRDHACHALA
NAGORE
COIMBATORE
POLLACHI
MINAKCHIPURAM
PUDUKOTTAI
CALIMERE
MANAMADURAI
RAMESWARAM
TUTICORIN
TIRUNELVELI
SCALE
TONNES
R.D.G./67

the region and the regional exports and imports have gone up considerably. Further, there have been changes in the location of industries, Neyveli, Mettur, Coimbatore and Tiruchirapalli showing advances in industrial employment, output and the resultant trade and commerce. The number and size of the towns have also increased. All these have played their part in changing the pattern of rail movements. But even after every allowance is made for factors such as these, there can be little doubt that the impressive fall in the high rated traffic in the railways in the region, especially in a period of economic expansion, is attributable to the competitive diversion of traffic to the road services.

5.26 The rate of growth of bullock-cart traffic has been assessed from the results of the triennial P.W.D. Census and is furnished in Table 45.

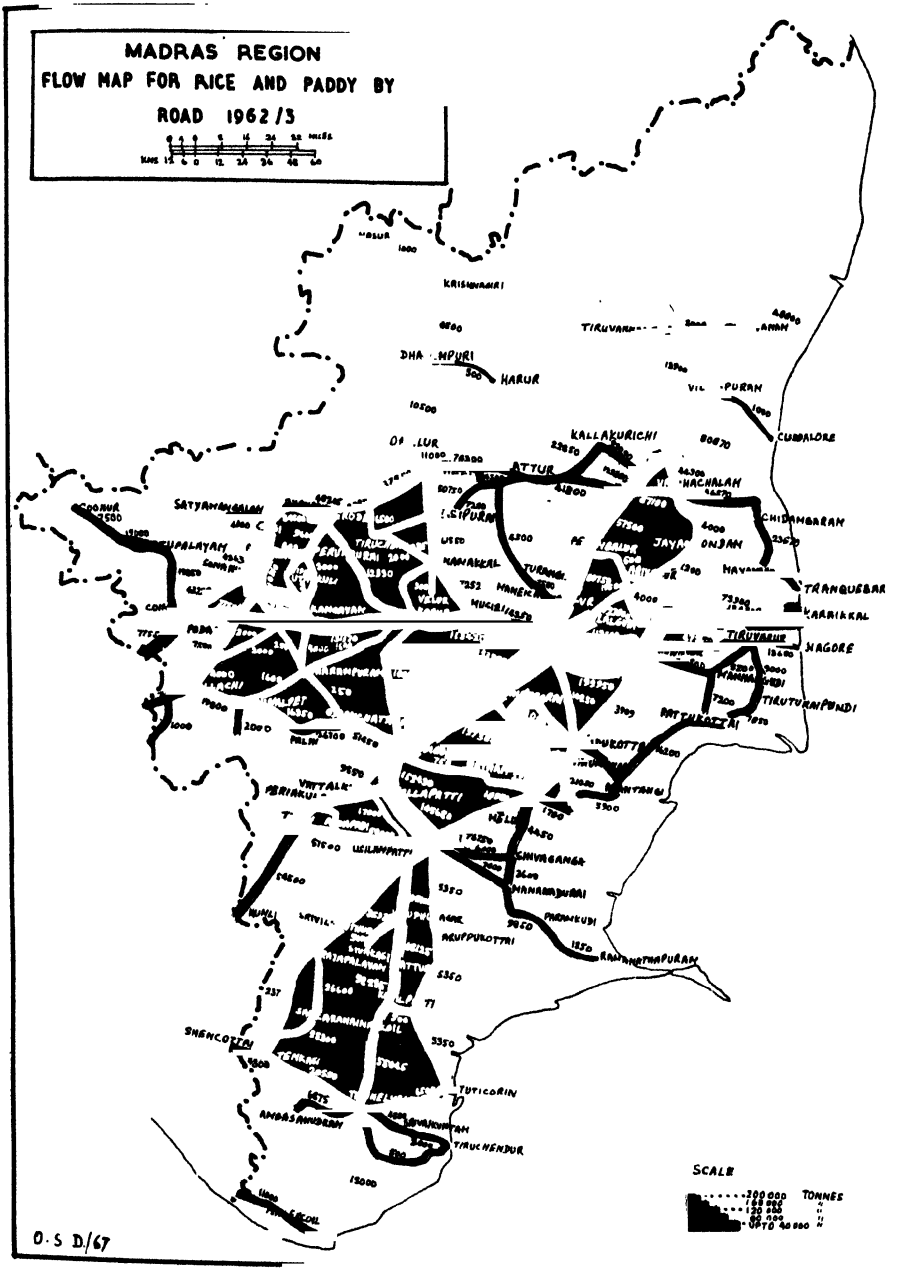
5.27 The volume of traffic carried by bullock-carts has been more or less steady during the past many years. Field enquiries indicate that the carts are engaged almost entirely in Collection and Distribution Services as defined in paragraph 5.11 and as distinct from Medium and Long Distance Transportation Services. There has been no basic change in the nature of commodities carried by them, nor is any basic change envisaged in the future.

Aggregate Goods[1] Traffic in Various Commodities in 1970-71 and 1975-76

5.28 So far we have presented the picture of goods traffic in the aggregate at present, its rate of growth in the past, its division between the main modes, and the changes in its pattern and composition over time. While in the case of passenger traffic the past trends formed the very basis for predicting the level and pattern of traffic in the future, so far as goods traffic is concerned past trends and rates of growth, either in the aggregate or of individual commodities, are by themselves not very helpful in projecting either the aggregate traffic or the traffic in the particular commodities. These are determined by anticipated industrial and agricultural developments individually and specifically placed in time and location and by the levels of their intake of raw materials and fuels and their output of finished goods. The past pattern of division and flow of goods traffic by road and rail dealt with so far in this chapter are useful, however, for another purpose. Since patterns of flows and division are not expected to change capriciously, they provide the first approximate basis for future divisions and flows between the two principal modes of transport, as quite distinct from the volume or level of traffic either collec-

1 Aggregate by road and by rail together.

MAP 11


MADRAS REGION
FLOW MAP FOR RICE AND PADDY BY
ROAD 1962/3
KRISHNAGIRI
HARUR
KALLAKURICHI
ATTUR
CUDDALORE
TRANQUEBAR
KARAIKAL
NAGORE
TIRUVARUR
TIRUTURAIPUNDI
TUTICORIN
SCALE
TONNES
O.S D/67

tively or for individual important commodities.

5.29 In Chapter 3 we have presented the methods and results of projections of production and consumption of individual commodities.[1] Out of these figures the aggregate estimate of future traffic has been made. By bringing together the results of the projections of production and consumption of each commodity, the areas of surpluses and deficits are identified. We know the points which have a surplus and to what extent and also the points which have to import and in what quantities. Making the assumption that the flows from the areas of surplus to those of deficit should be such as to minimise the tonne kilometres of transportation, one can infer the quantum and pattern of desire for movement in the aggregate, i.e., whether by road or by rail. For each commodity for which the transportation demand is thus projected the desire for movement is tabulated between pairs of points. Sometimes these 'points' are districts, sometimes 'taluks' and sometimes individual towns. For a select number of commodities the anticipated desires for movement have been depicted in "Desire Maps". An example of a desire map is reproduced as Map 12 illustrating the case of cement.[2]

5.30 The commoditywise estimates of goods traffic in the region thus derived are set out in Table 46.

5.31 The aggregates given in this table represent volumes of traffic which will have to be allocated between the different modes of transport, mainly road and rail and their various sections. It is only when this allocation is made, as is done in the next section, will it be possible to give estimates of (itemwise and aggregate) tonne kilometres of traffic by rail and by road separately, and thus complete the picture of the transportation tasks which the region will have to face during the Fourth and Fifth Plan periods respectively.

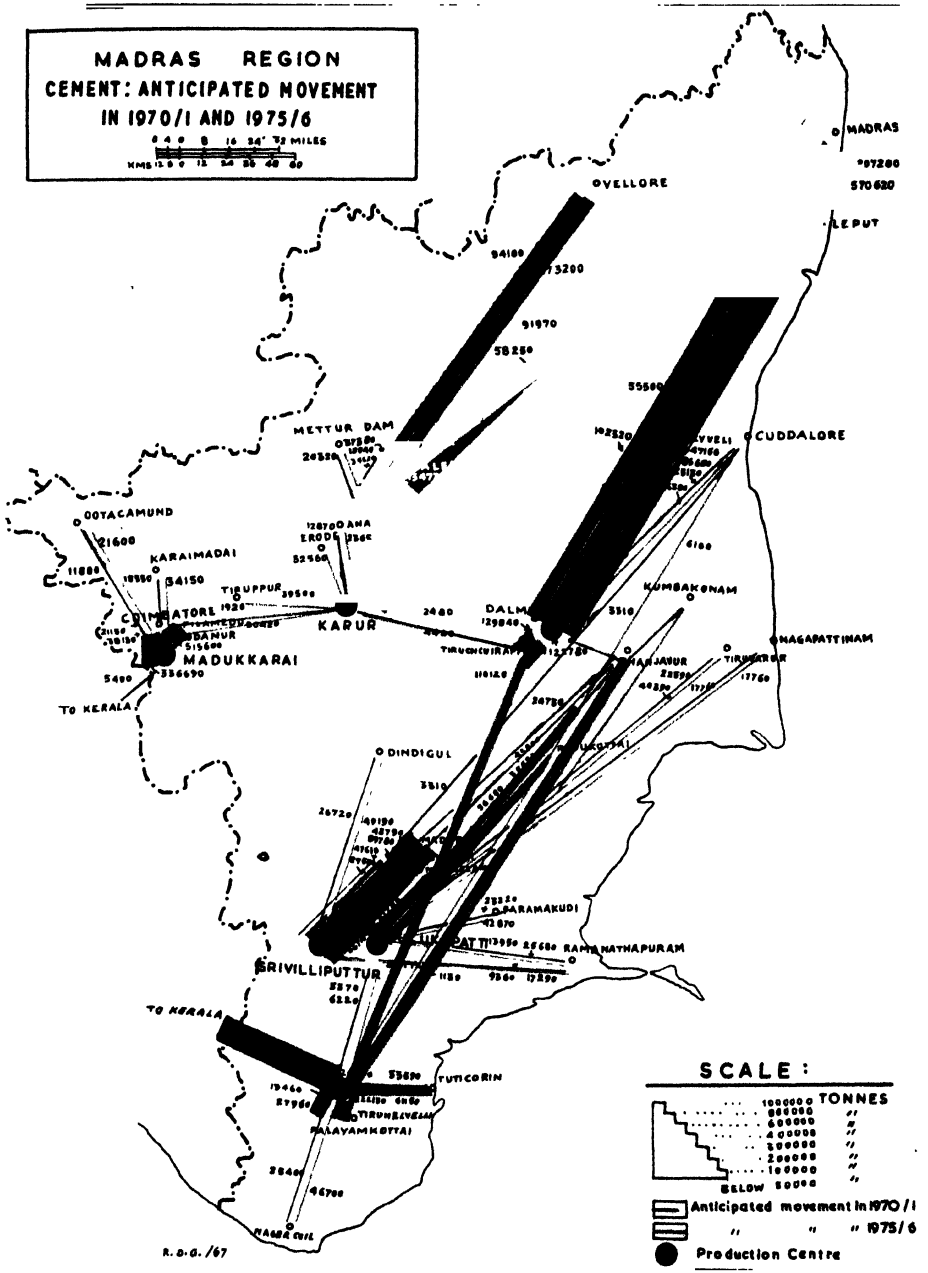
Basis of Allocation of Future Commodity Traffics Between the Main Modes and Their Different Sections

5.32 After thus obtaining a picture of future desire for transportation for a large number of individual commodities, which constitute 82 per cent of the anticipated transportation demand of the region, as has been stated, the next step is allocation of this traffic between the two main modes of transport, namely, the railway and road services, and over their specific sections. To do this we adopted the present pattern of traffic division in respect of each com-

1 Vide Tables 17, 18, 19, 24 and 25.

2 The other commodities for which desire maps have been prepared are coal, petroleum products, limestone, gypsum, magnesite, bauxite, iron ore, salt, fertilizers and sugar, but these maps have not been reproduced in this Report.

MAP 12


MADRAS REGION
CEMENT: ANTICIPATED MOVEMENT
IN 1970/1 AND 1975/6
MILES
KMS
MADRAS
VELLORE
CUDDALORE
METTUR DAM
OOTACAMUND
KARAIMADAI
ERODE
TIRUPPUR
COIMBATORE
KARUR
DALMIAPURAM
KUMBAKONAM
NAGAPATTINAM
MADUKKARAI
TO KERALA
DINDIGUL
PARAMAKUDI
RAMANATHAPURAM
SRIVILLIPUTTUR
TUTICORIN
TO KERALA
SCALE :
TONNES
BELOW
Anticipated movement in 1970/1
" " " 1975/6
Production Centre
R.D.G./67

modity and over the different ranges of haul by road and rail separately as given in Table 41.

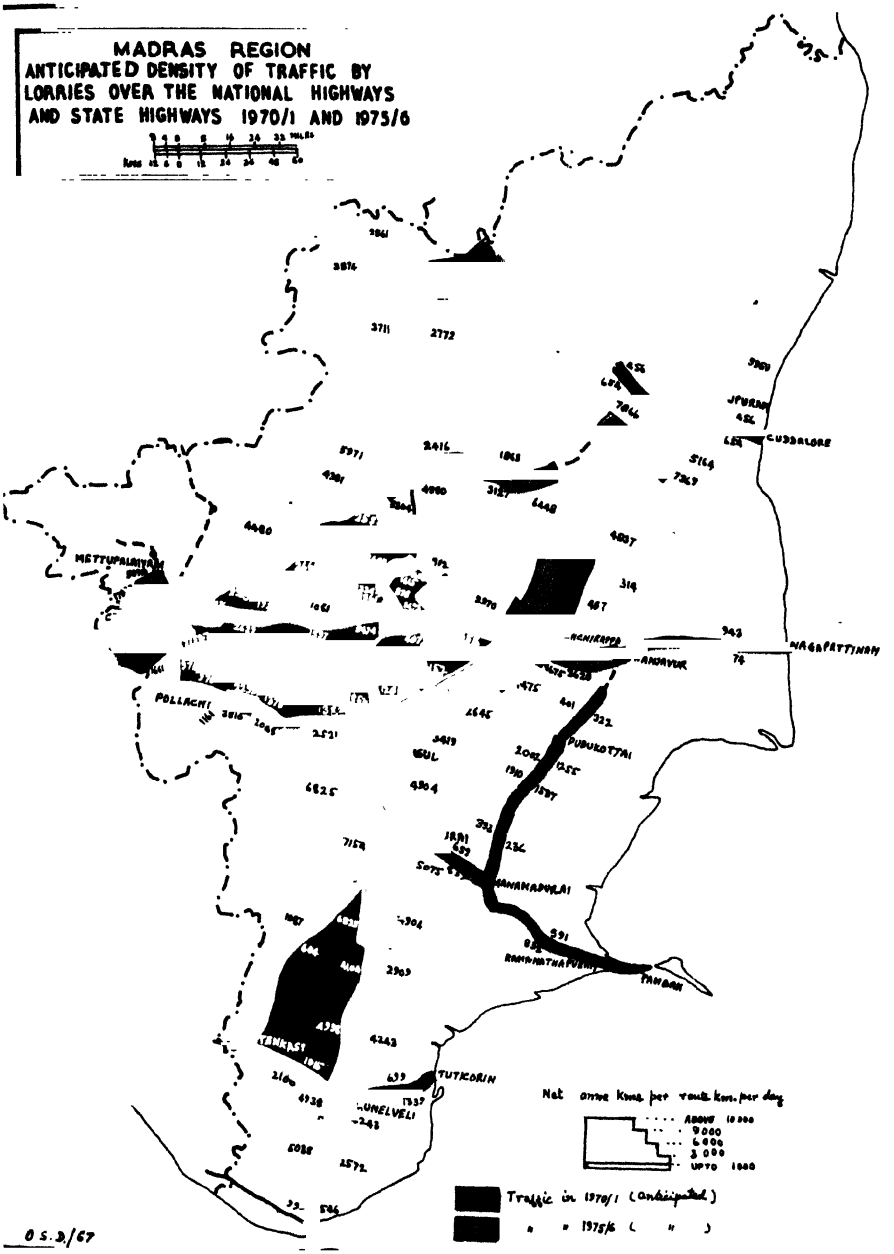
5.33 The commodities for which we had predicted the production, consumption and flows (in the aggregate by the several means of transport), for 1970-71 and 1975-76, can be divided into two groups, namely, *(i)* those for which the full data are available, and *(ii)* those for which the increased consumption alone could be predicted but not the individual sources from which the increased movements will occur. The commodities coming under the first group are coal, salt, cement, manures and fertilizers, iron and steel, rice and paddy, sugar, petroleum products, iron ore, limestone, magnesite, bauxite, gypsum and sugarcane. Those under the second group are firewood, building materials, timber, pulses and other cereals, fruits and vegetables, oilseeds, raw cotton and cotton cloth.

5.34 In the case of the commodities coming under the first group (for all of which the future aggregate desire for movement by all the modes of transport taken together has been predicted with full information as to "from and to points", the present mileage divisions as between the railway and the road services for the particular commodity—as brought out in Table 41 have been applied for each anticipated desire for movement. Thus between what points and in what quantities each of these commodities will move by rail and by road is predicted and the composite trend shown for each commodity. The procedure enables not only the quantity of traffic and the mode of transport to be predicted, but also the specific sections of road or rail that will be traversed.

5.35 In the case of the commodities coming under the second group, for which we had a picture of the increase in future consumption but not of the specific sources of supply and the quantities that will be drawn from each source, the simple expedient adopted is to inflate the present flows by rail and road respectively in the ratio of the existing consumption to the anticipated consumption. This process also enables not only the aggregate quantities to be moved by each means of transport to be predicted but also the specific sections of road or rail over which the movements will take place.

5.36 The commodities not coming under either of the above mentioned groups are clubbed together as "all other commodities". In their case our knowledge as to their traffic characteristics is confined to roughly assessed aggregate quantity in tonnes. This traffic is first divided as between the railway and roads in the same proportion as its division at present. The further distribution over individual sections of rail and road is made on certain broad assumptions. In the case of the railway it is made in the proportion of the desnity of the other known traffics. In the case of the road system it is on the basis that the desnity of this traffic on the more important roads will generally

MAP 13


MADRAS REGION
ANTICIPATED DENSITY OF TRAFFIC BY LORRIES OVER THE NATIONAL HIGHWAYS AND STATE HIGHWAYS 1970/1 AND 1975/6
Miles
Kms
METTUPALAYAM
POLLACHI
PUDUKOTTAI
RAMANATHAPURAM
TUTICORIN
TIRUNELVELI
CUDDALORE
NAGAPATTINAM
ANDAVUR
Net annual kms. per vehicle km. per day
ABOVE 10 000
9 000
6 000
3 000
UPTO 1000
Traffic in 1970/1 (Anticipated)
" " 1975/6 (")
O.S.3/67

be higher than that over the less important roads.

5.37 The results of allocation of traffic are given in Tables 47 and 48.

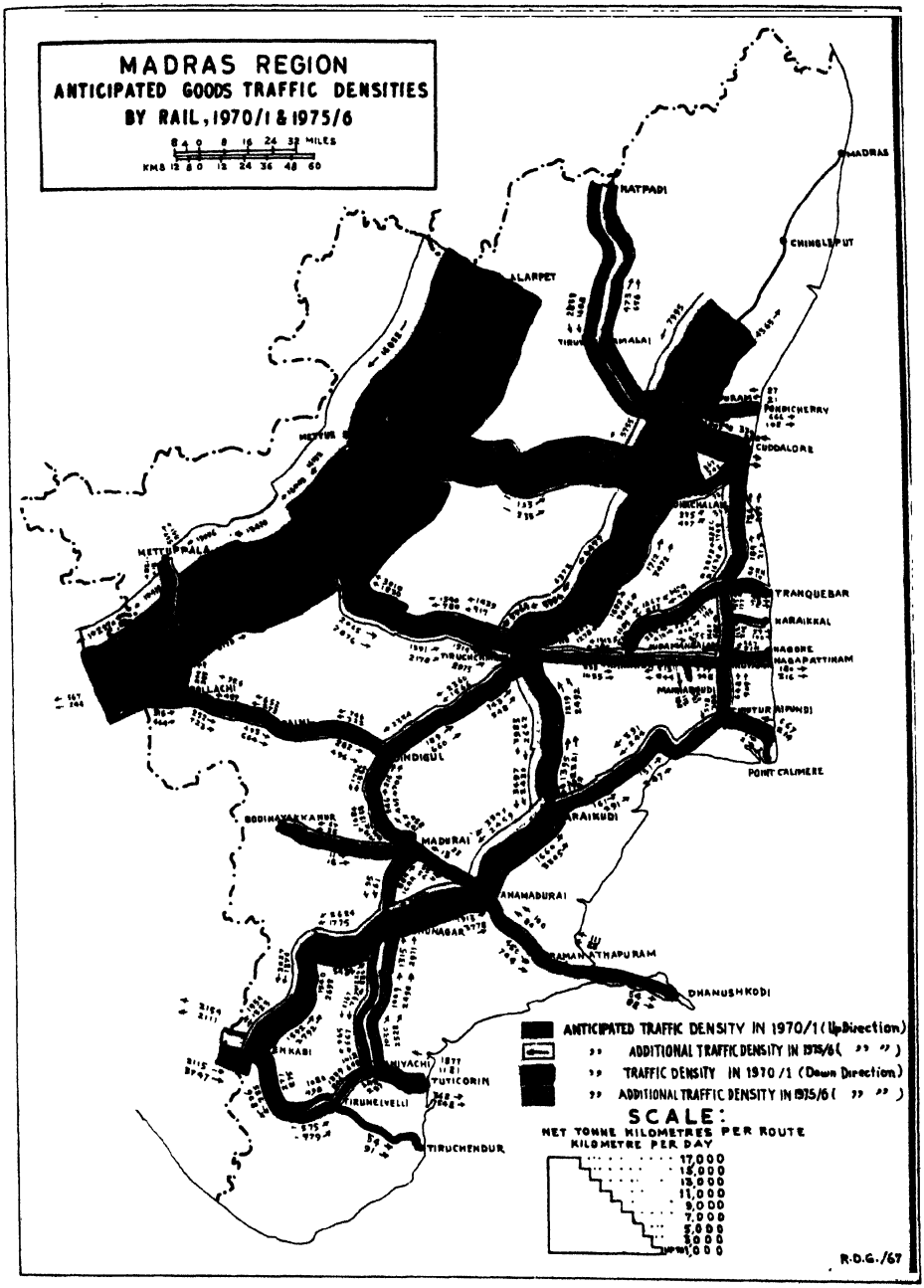
5.38 The discussion so far has been about what have been defined as Medium and Long Distance Transportation Services in paragraph 5.11. Increased quantities requiring this category of transportation will also necessitate a more or less corresponding increase in Collection and Distribution Services. In Table 39 a picture is given of the aggregate Collection and Delivery Services performed in 1962-63 and what the shares therein are of the bullock-carts and the lorries. Also, in paragraph 5.27 we have commented on the fact that in the past the aggregate movements by bullock-carts have more or less remained stationary. For projecting the aggregate demand for Collection and Delivery Services in the future we have assumed that it will go up in the same proportion as the increases in tonnage needing Medium and Long Distance Transportation. One commodity needing a substantial volume of Collection Services is sugarcane moving to the sugar mills. These movements we have distributed between the lorries and the bullock-carts in the ratio of the present division and also distributed them among the several roads in the vicinity of the sugar factories based on the demand for sugarcane for crushing by each factory. Regarding the balance under Collection and Distribution Services we have assumed *(i)* that there will be an increase of 20 per cent between now and 1970-71 and a further increase of 10 per cent between then and 1975-76 in the aggregate services performed by the bullock-carts,[1] *(ii)* that the balance of these services will have to be performed by the lorries, and *(iii)* that the distribution of these movements as between the several sections of roads will generally be to the same broad pattern as at present. One-fourth of this traffic is attributed to the more important roads and one-fourth to the less important roads. The balance half is attributed to the vicinity of the larger towns in the ratio of the known total lorry traffic around these towns.

5.39 Similarly, in the case of the traffic by railway, the sectional traffic densities anticipated inclusive of cross traffic, are depicted pictorially in Map 14.

5.40 Following the procedures outlined in the previous paragraphs 5.32 to 5.39, there results a picture for 1970-71 and 1975-76 respectively of *(a)* the division of traffic between road and rail in the aggregate, *(b)* division of the total volume of medium and long distance transportation as between the two modes of transport, and *(c)* division of the traffic in Collection and Distribution Services between the lorries and the bullock-carts. This picture is presented

1 These increases of 2.5 per cent and 2.0 per cent per year have been assumed on the basis that an adequate number of motor vehicles may not be available to cater to all the increase under Collection and Distribution Services.

MAP 14


MADRAS REGION
ANTICIPATED GOODS TRAFFIC DENSITIES
BY RAIL, 1970/1 & 1975/6
MILES
KMS
MADRAS
NATPADI
CHINGLEPUT
ARPET
PONDICHERRY
CUDDALORE
TRANQUEBAR
KARAIKKAL
NAGORE
NAGAPATTINAM
POINT CALIMERE
MADURAI
RAMANATHAPURAM
DHANUSHKODI
TUTICORIN
TIRUCHENDUR
ANTICIPATED TRAFFIC DENSITY IN 1970/1 (Up Direction)
ADDITIONAL TRAFFIC DENSITY IN 1975/6 (" ")
TRAFFIC DENSITY IN 1970/1 (Down Direction)
ADDITIONAL TRAFFIC DENSITY IN 1975/6 (" ")
SCALE:
NET TONNE KILOMETRES PER ROUTE KILOMETRE PER DAY
17,000
15,000
13,000
11,000
9,000
7,000
5,000
3,000
1,000
R.D.G./67

in Table 49, 50 and 51, which may be compared with the present position as depicted in Tables 38, 39 and 40. Whereas in Table 51 the figures have implicit in them the divisional pattern as at present, those in Table 50 allow for replacement of bullock-carts by lorries in the carriage of much additional distributive traffic.



Chapter 6

Present Capacities of Rail and Road Sections and their Comparison with Anticipated Traffic Densities

Scope of the Chapter

CORRECT CONCEPTS of capacity of rail and road sections are pivotal to the problem of determining the scale and location of future investments. One has to go into the concepts of capacity separately for rail and for road, as these concepts vary significantly as between the two modes. Also, as is explained further on, there is now no traditionally accepted concept of road capacity.

6.2 In this chapter, after explaining the concepts of rail and road capacity and the units adopted for their measurement, the capacities expected to be available on 31-3-66 are measured against the anticipated densities of traffic in the years 1970-71 and 1975-76 by each mode and over each section. Thus the potential bottlenecks of the future are located and the extent of additional capacity needed is also predicted. These two types of identification, apart from revealing the sections over which congestion is predicted, also disclose the sections where surplus capacity in both or one of the modes is plainly indicated during the time-horizon of our study, an aspect relevant to the question of the future location of industries.

Concepts of Railway Capacity

6.3 It is traditional to measure the capacity over individual sections of the railway in terms of the number of trains that can be run each way daily. The rationale of this is the system of working trains on the 'line clear' system. Not more than one train can at any time be on a single line of track between any two adjacent stations. Therefore, the theoretical maximum number of trains

that can be run over the section in any one day is obtained by dividing the twenty-four hours of a day by the running time of a train between those two adjacent stations in the section situated at the longest distance apart from each other.[1] This theoretical maximum, however, is an idealised measure incapable of being achieved in day-to-day working. In practice a somewhat lower figure is accepted as the real capacity of the section. If one compares the capacity thus arrived at with the number of trains run daily over the section on the average during any given period, one obtains a picture of the extent to which the available capacity is being utilised and the quantum of surplus capacity that is available.

6.4 What has been stated is the traditional method of expressing sectional capacity on the railways. But knowledge of section capacity on this basis has to be further supplemented, as this knowledge by itself does not readily permit of an assessment, of say, what quantity of additional goods traffic can be carried over a particular section within the available capacity. In order to find out this one must know how many additional wagons can be moved per day and not merely how many additional trains. Also, any change in motive power can make a considerable difference to the number of trains required to carry the existing traffic and to the additional traffic that can be carried within the existing limits of the total number of trains that can be run daily. For practical purposes, therefore, it is necessary to know also the room available over each section in terms of the number of wagons that can be cleared in a day.

6.5 Apart from "sectional capacity" or "line capacity" referred to so far, there are also other factors which limit the volume of traffic that can be carried by a railway at any one time with the existing ground[2] facilities. These factors are the capacities of: *(i)* marshalling yards; *(ii)* goods sheds; and *(iii)* transhipment sheds. It is traditional to measure all these three components of capacity at any one place in terms of the number of wagons that can be dealt within a day.

Present Railway Traffic Density Relative to Present Capacity

Line Capacity

6.6 In Table 52 are given *(i)* the sections of railway in the region,

1 A "section" referred to here is the length between one "train forming station" and the next. It is generally between 100 and 120 miles long. In between there will be a number of stations situated at varying intervals of distance, from about 3 miles to 7 miles. Let the longest distance apart of such stations over the particular section be, say, six miles and the average running time of a train between those stations, say, 20 minutes. Then the theoretical capacity of the entire section is 24 hours divided by 20 minutes, which is equal to 72 trains both ways or 36 trains each way daily.

2 *The ground facilities* referred to are distinct from *rolling stock*.

(ii) the line capacity of each section as on 31st March, 1963, *(iii)* the extent to which the capacity was used on that date over each section, *(iv)* the line capacity expected to be available as on 31st March, 1966, *(v)* the extent to which the capacity is expected to be used then, and *(vi)* the capacity expected to be available in terms of the number of wagons each way that can be cleared.[1] It will be observed from the table that on 31-3-63 adequate line capacity was available over all sections and also that adequate capacity is expected to be available to deal with the anticipated traffic at the end of the current Plan period. But, whether this capacity will be adequate to deal with the anticipated traffic in 1970-71 and 1975-76 is the important question remitted to us, and it is examined in detail in the next section of this chapter.

6.7 As in the case of sectional line capacity, the position regarding the capacity of the larger marshalling yards is given in Table 53. The capacities as prevailing on 31-3-64 were adequate. Also, adequate capacity is expected to be made available in time by the end of current Plan period to deal with the traffic then expected.

6.8 Tables 54 and 55 give the corresponding picture of tranship shed and of goods shed capacities in the case of the larger towns. Here again adequate capacity existed on 31-3-64 and will exist by 31-3-66 to deal with the traffic then anticipated to move.

Comparison of the Available Railway Capacity with the Anticipated Traffic

6.9 In Appendices 2 and 3 are given our estimates of the anticipated passenger traffic and goods traffic in the years 1970-71 and 1975-76 over each section of the railways within the region. The volume of anticipated traffic is depicted in Maps 7 and 14. The units in which the estimates are given are 'passenger kilometres per route kilometre per day' and 'net tonne kilometres per route kilometre per day', respectively. These anticipated traffic densities have now to be converted into suitable units, then the densities of passenger traffic and of goods traffic over each section have to be integrated, and the results have to be compared with the picture of capacities expected to be available by the end of the current Plan period as given in Table 52. As earlier stated, the objective is to predict the location and extent of bottlenecks that are likely to show up by 1970-71 and 1975-76, as a necessary first step towards making recommendations on how these bottlenecks should be removed, what physical assets will need to be created and what costs are likely to be incurred.

1 The position as on 31-3-63 is also pictorially depicted in Map 15.

6.10 In the case of passengers, the anticipated sectional traffic densities in 1970-71 and 1975-76 are, as earlier stated, in terms of passenger kilometres per route kilometre per day. The generally accepted unit of measurement of section capacity in the case of the railway being 'train kilometres per route kilometres per day' in each direction, the figures or anticipated traffic density in terms of passenger kilometres per route kilometre had to be converted into these units. This was done taking due note of the fact that the increase in the railway passenger traffic in the future will be almost entirely in the relatively longer distance traffic, so that any appreciable strengthening of existing short distance trains cannot be expected to cater to anticipated additional journeys.

6.11 In the case of railway goods traffic,the figures of anticipated traffic over each section in 1970-71 and 1975-76 given in Appendix 2 are in terms of 'net tonne kilometres per route kilometre per day'. These figures are available separately for the more important commodities and for all other commodities taken together, and also separately for the direction of heavier traffic and for that of lighter traffic. By dividing the traffic density figures by the appropriate figures of average wagon load for the concerned commodity, the density figures were first converted from 'tonne kilometres' into 'wagon kilometres' per route kilometre per day. Then again, taking due note of the nature of the motive power expected to be used and the average train load expected to be achieved over each section in the direction of heavier traffic, the figures were converted into train kilometres per route kilometre per day.[1]

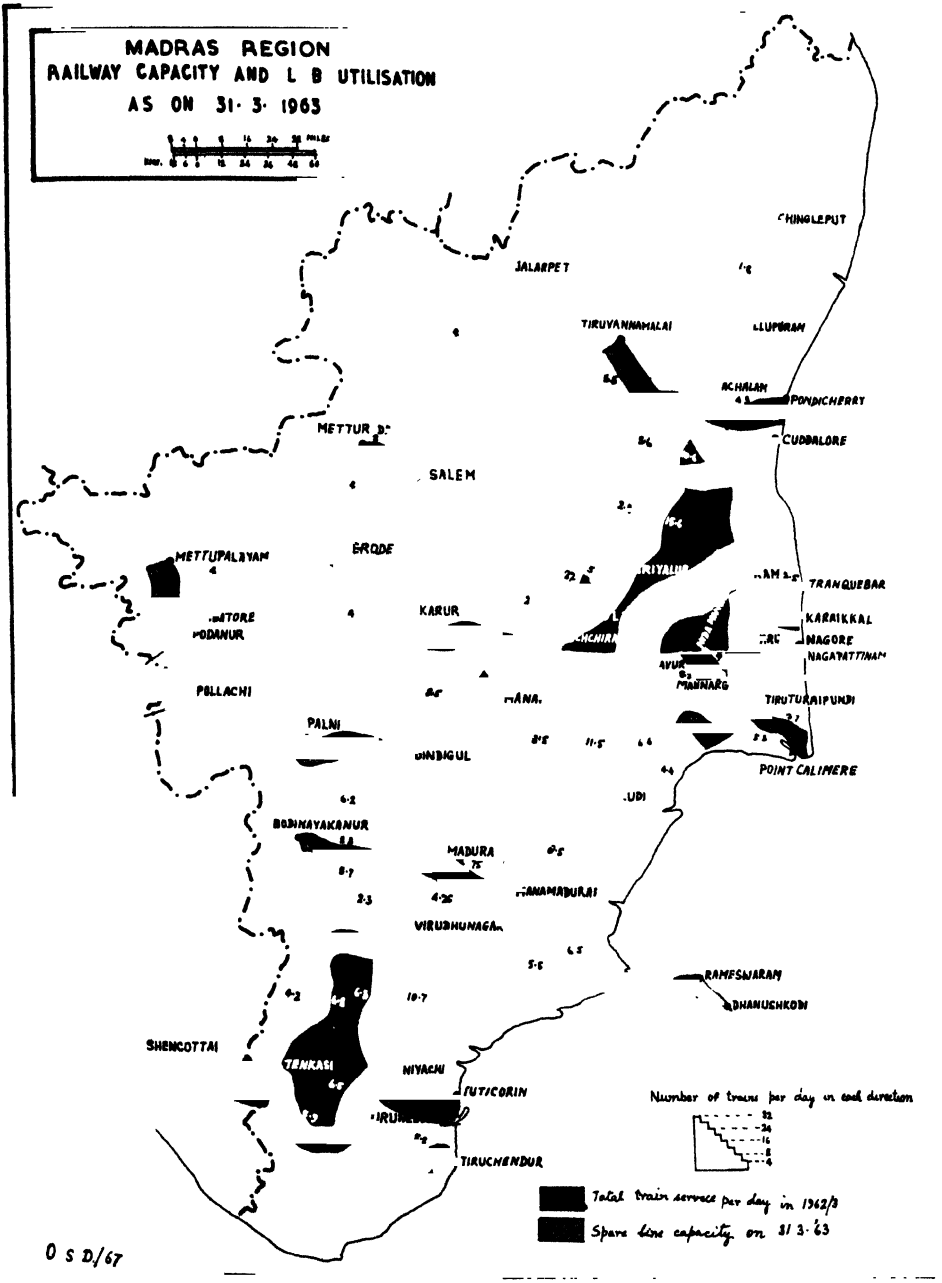
6.12 The anticipated traffic density picture for goods and passenger traffic thus worked out being in a common unit, 'train kilometres per route kilometre per day', could be added together and integrated. The resulting figures for each section were then compared with the capacity expected to be available by the end of the Third Plan period on that section, after making due allowance for the paths required for departmental trains.

6.13 This comparison is set out in Table 56. In that table we get not only a picture of the sections over which there will be spare capacity or a deficiency of capacity, but also the precise extent of the surplus available or the additional capacity that will need to be provided as the case may be.

6.14 A summary of the position anticipated, so far as it concerns the sections

1 The figures of anticipated goods traffic were arrived at on the basis of the movements being invariably from the nearest point of surplus to the point of deficit. This does not always take place in practice. Also, our projections did not take note of the secondary movements, i.e., movements from the principal wholesale markets to the secondary distributing centres. To allow for these factors, and for seasonal variations of traffic, the figures arrived at were increased by 20 per cent to give the number of goods trains per day for which capacity will be needed. A similar adjustment has been made also in the case of goods traffic by road.

MAP 15


MADRAS REGION
RAILWAY CAPACITY AND L B UTILISATION
AS ON 31· 3· 1963
CHINGLEPUT
JALARPET
TIRUVANNAMALAI
VILUPURAM
PONDICHERRY
METTUR
CUDDALORE
SALEM
ERODE
METTUPALAYAM
KARUR
TRANQUEBAR
KARAIKKAL
NAGORE
NAGAPATTINAM
PALLACHI
PALNI
DINDIGUL
TIRUTURAIPUNDI
POINT CALIMERE
MADURA
VIRUDHUNAGAR
RAMESWARAM
DHANUSHKODI
SHENCOTTAI
TENKASI
TUTICORIN
TIRUCHENDUR
Number of trains per day in each direction
Total train service per day in 1962/3
Spare line capacity on 31·3·63
O S D/67

over which additional capacity is expected to be required by 1975-76, is furnished in Table 57. The sections over which additional capacity will be needed are also shown pictorially in Map 16. The table and the map are significant. It will be observed that additional railway sectional capacity will need to be provided over practically all the metre gauge and broad gauge mainline sections within the region, and over the Tiruchirapalli-Erode broad gauge section and Tiruchirapalli-Karaikkudi metre gauge section. It will also be needed over the Vridhachalam-Salem and Neyveli-Vridhachalam sections, should the steel plant in this area materialise. Of the total railway route kilometres of 2,942 in the region, additional section capacity will be needed over 1,596[1] kilometres.

6.15 Apart from the fact that all the mainline sections in the region will need extra section capacity by 1975-76, it is also specially significant that the train service density over a number of these metre gauge sections is expected to be well over 21 each way daily, which is the generally accepted practical limit in this country for normal single line working even with electric traction. This means that by 1975-76 the concerned mainline metre gauge sections will either have to be converted into double line retaining the present gauge or converted into broad gauge. One other alternative will be to construct new short circuiting lines in either gauge which will relieve the existing mainline sections and also open up new territory, e.g., a line linking Salem with Dindigul via Karur (vide Map 18 page 83).[2] Yet another possible alternative is the introduction of Central Traffic Control (C.T.C.). Chapter 7 deals with in detail the questions of which of these alternatives is to be preferred, where and with what phasing in time.

Concept of Road Capacity

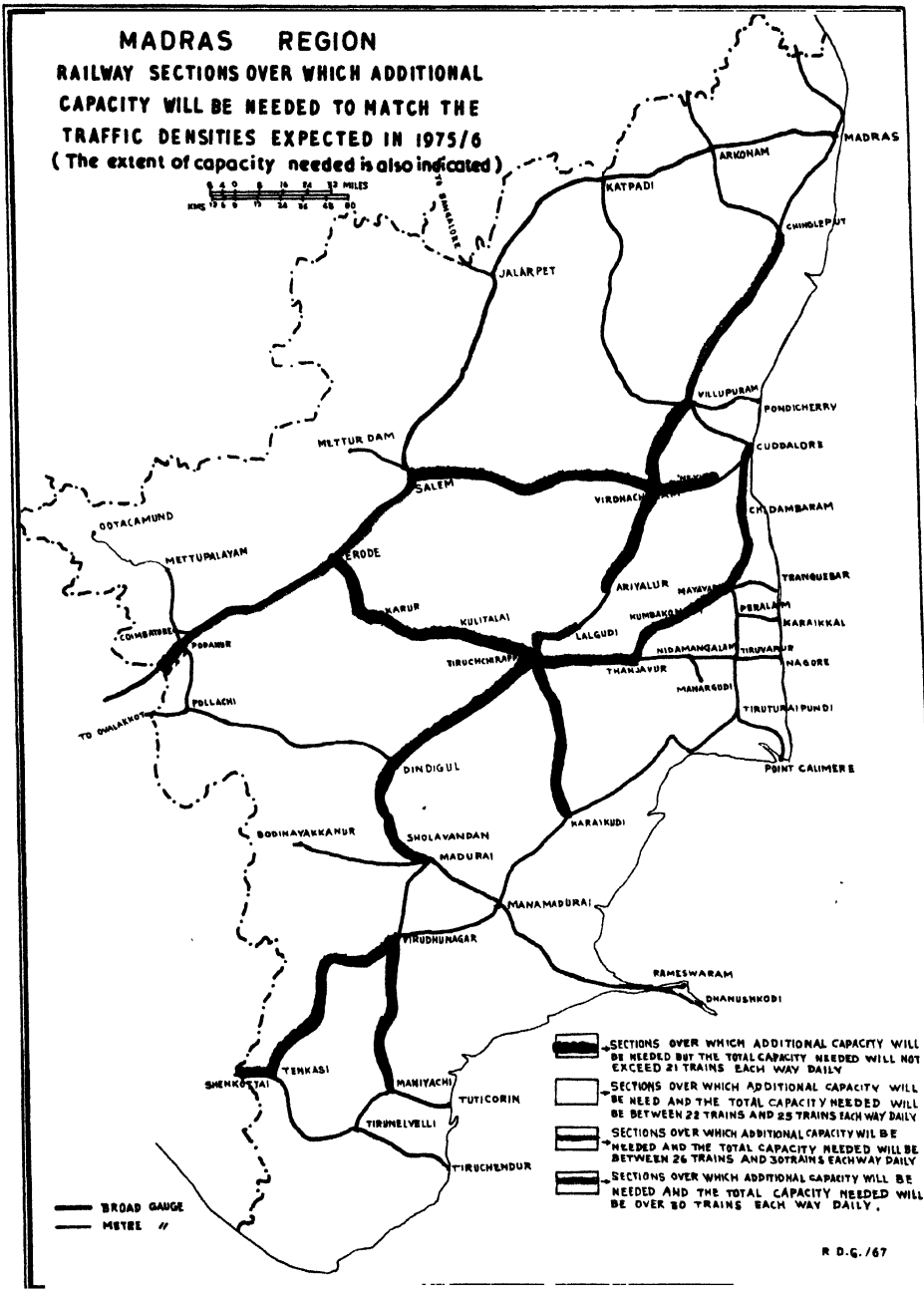
6.16 As has earlier been stated, there is at present no traditionally accepted standard for measurement of road capacity; but such a standard, in terms of a clearly defined unit, is nevertheless a necessary preliminary for determining the magnitude of investment on road construction and improvements and for locating the particular sections or areas where the investment will be needed.

6.17 In the case of a road network or any of its sections, both the measurement of capacity and projection of traffic density raise problems which are very different from those encountered in the case of the railways. The problems stem firstly from the fact that movements of goods and passengers on

1 Including also the few mainline sections over which the figures indicate marginal availability of surplus capacity.

2 Chapter 7.

MAP 16


MADRAS REGION
RAILWAY SECTIONS OVER WHICH ADDITIONAL CAPACITY WILL BE NEEDED TO MATCH THE TRAFFIC DENSITIES EXPECTED IN 1975/6
(The extent of capacity needed is also indicated)
MILES
KMS
MADRAS
ARKONAM
KATPADI
CHINGLEPUT
JALARPET
VILLUPURAM
PONDICHERRY
CUDDALORE
METTUR DAM
SALEM
VIRDHACHALAM
CHIDAMBARAM
OOTACAMUND
METTUPALAYAM
ERODE
ARIYALUR
MAYAVARAM
TRANQUEBAR
KARUR
KULITALAI
LALGUDI
KUMBAKONAM
PERALAM
KARAIKKAL
COIMBATORE
POLLACHI
TIRUCHCHIRAPALLI
NIDAMANGALAM
TIRUVARUR
THANJAVUR
NAGORE
MANARGUDI
TIRUTURAIPUNDI
TO DHARAPURAM
DINDIGUL
POINT CALIMERE
KARAIKUDI
BODINAYAKKANUR
SHOLAVANDAN
MADURAI
MANAMADURAI
VIRUDHUNAGAR
RAMESWARAM
DHANUSHKODI
TENKASI
SHENKOTTAI
MANIYACHI
TUTICORIN
TIRUNELVELLI
TIRUCHENDUR
SECTIONS OVER WHICH ADDITIONAL CAPACITY WILL BE NEEDED BUT THE TOTAL CAPACITY NEEDED WILL NOT EXCEED 21 TRAINS EACH WAY DAILY
SECTIONS OVER WHICH ADDITIONAL CAPACITY WILL BE NEED AND THE TOTAL CAPACITY NEEDED WILL BE BETWEEN 22 TRAINS AND 25 TRAINS EACH WAY DAILY
SECTIONS OVER WHICH ADDITIONAL CAPACITY WIL BE NEEDED AND THE TOTAL CAPACITY NEEDED WILL BE BETWEEN 26 TRAINS AND 30TRAINS EACH WAY DAILY
SECTIONS OVER WHICH ADDITIONAL CAPACITY WILL BE NEEDED AND THE TOTAL CAPACITY NEEDED WILL BE OVER 30 TRAINS EACH WAY DAILY.
BROAD GAUGE
METRE //
R.D.G./67

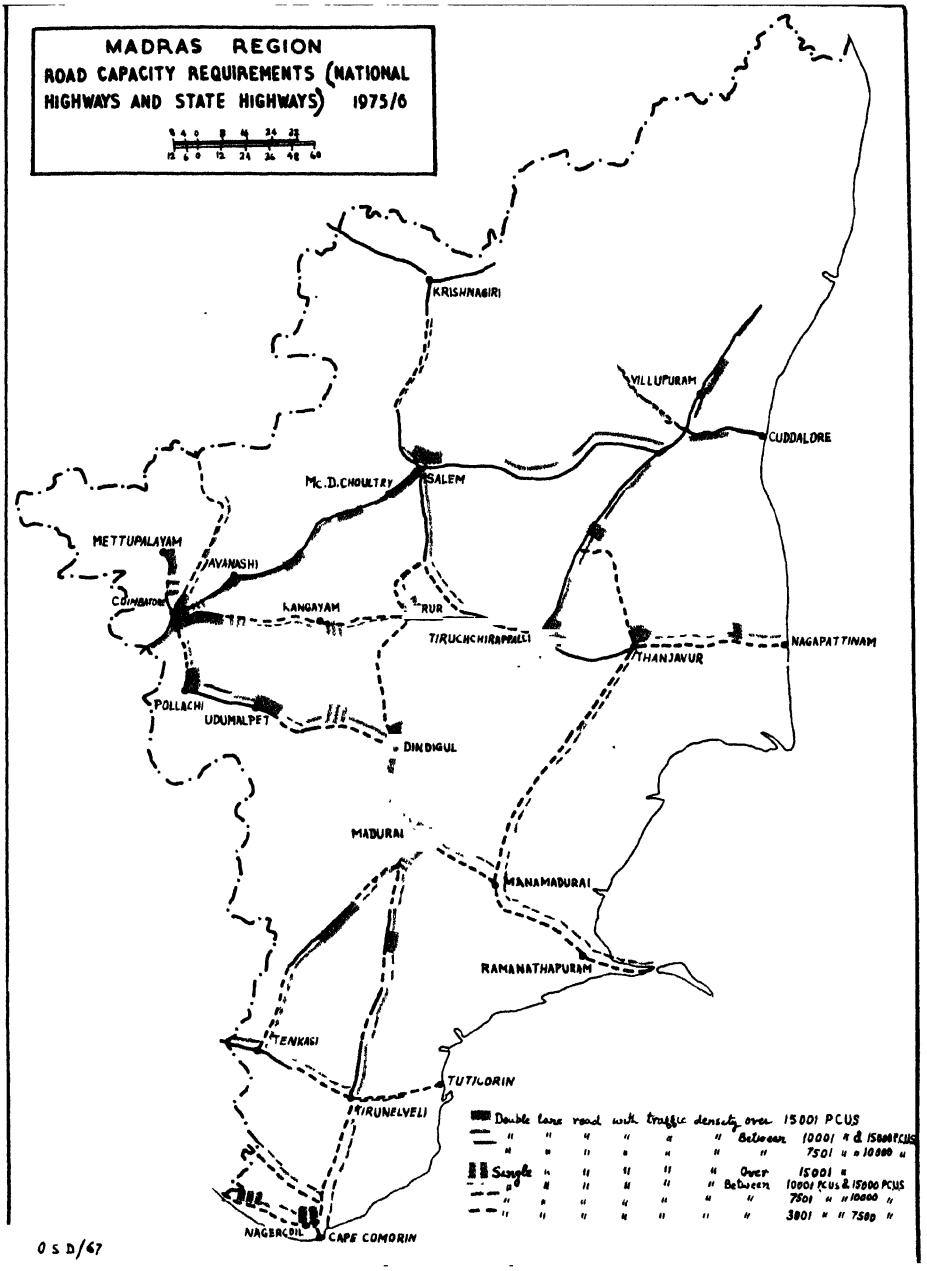
the roads is neither scheduled nor coordinated by a unified authority as rail movements are. Further, road traffic is made up of mixes of vehicles, such as bullock-carts, cycles, mechanised vehicles, etc., each with its own characteristic range of speeds and with different effects on road capacity however defined.

6.18 The capacity of any road section or network may be defined as the number of vehicles that can be cleared subject to a given minimum average speed for the mechanised vehicles, say, of 25 miles an hour. The capacity would vary with the 'mix' of the various types of vehicles that wish to pass over the road sections; as, given a road section with certain specifications regarding surface and width, the section will have different mean speeds of mechanised vehicles for different vehicle-mixes. The capacity, however, defined, has also to be expressed in terms of one single unit, say, the 'passenger car equivalent', so that different vehicle-mixes cleared over a road section or over different road sections can all be expressed in terms of the same unit. The problem of capacity is further complicated by the fact that the private car equivalent of a given type of vehicle, such as a lorry or a bus or a bullock-cart, itself varies with speed.

6.19 Engineers tend to quote what they call 'designed' or 'practical' capacities of road sections, the capacity varying according to the specifications of the road section in respect of the width of pavement, the nature of its surface, the kind of terrain over which the road section lies, the geometrics of the road section, etc. Often these figures of capacity lack realism. One such set of measures of capacity for road sections of varying widths of pavement of carriage way, but all of them with black top surfaces, furnished to us is set out in Table 58. The 'passenger car equivalents' of different types of road vehicles associated with these measures of capacity are those given in Table 59. Also, the capacities given pertain to roads in the open country as distinct from those in built-in areas and to roads without any special handicaps by way of curves or gradients.

6.20 The capacity standards given to us were first compared with the present traffic densities on the road network in the region. For this we took the P.W.D. Census Report of 1963 which gives for each road section in Madras State the average number of vehicles of each type per day during the Census weeks. We made use of the passenger car equivalents given in Table 59 and calculated the density for each section of the road and compared it with the capacity measures as given in Table 58. When this was done it was found that the traffic far exceeds the capacity as per the standards given on most sections of the road network; yet field experience shows definitely that there is quite 'free' movement of traffic on most of these sections. The inference, therefore, is, that the capacity measures given to us tend seriously to under-estimate the

MAP 17


MADRAS REGION
ROAD CAPACITY REQUIREMENTS (NATIONAL HIGHWAYS AND STATE HIGHWAYS) 1975/6
KRISHNAGIRI
VILLUPURAM
CUDDALORE
Mc.D.CHOULTRY
SALEM
METTUPALAYAM
AVANASHI
COIMBATORE
KANGAYAM
KARUR
TIRUCHCHIRAPPALLI
THANJAVUR
NAGAPATTINAM
POLLACHI
UDUMALPET
DINDIGUL
MADURAI
MANAMADURAI
RAMANATHAPURAM
TENKASI
TUTICORIN
TIRUNELVELI
NAGERCOIL
CAPE COMORIN
Double lane road with traffic density over 15001 PCUS
Between 10001 & 15000 PCUS
7501 " " 10000 "
Single " " " " Over 15001 "
" " " " Between 10001 PCUS & 15000 PCUS
" " " " " 7501 " " 10000 "
" " " " " 3801 " " 7500 "
O S D/67

true capacity of road sections, at any rate in the conditions prevailing in Madras State.[1]

6.21 In all these circumstances, there appeared to us that there was only one way of measuring road capacity satisfactorily under the conditions of traffic-mix obtaining in our country; namely, to make tests of speed on a number of sample sections, varying in terrain, width of carriageway, the nature of surface and geometrics, and vehicle-mixes, and to deduce from these experiments the effect of each of these factors on the mean speed of mechanised vehicles and hence on section capacity. But within the resources and the time available, it was not possible to undertake as many experiments as would be necessary to put the measures of road capacity on a reasonably firm foundation.

6.22 The Madras Highways Research Centre conducted, however, a few experiments for us around Madras and Pollachi. The former area had less number of slow-moving vehicles on the road sections than the latter where bullock-carts tended to predominate. The results are tabulated in Table 60. In the table are given, for each section, the figures of the width of road pavement, the nature of the area in which the road section lies, i.e., whether it is in a built-in area or in open country, the average speed obtained by the mechanised vehicles, the total traffic in passenger car units per day and the ratio of peak hour to total traffic. To express the traffic density in terms of passenger car units, the passenger car equivalents given in Table 59 were used in the absence of any demonstrably better set of equivalents.

6.23 On the basis of the data presented in Table 60 we have worked out our own provisional measures of capacity, pending more detailed experiments all over the country and the results that may come out from them. The measures of capacity thus adopted in this Report are set out in Table 61.

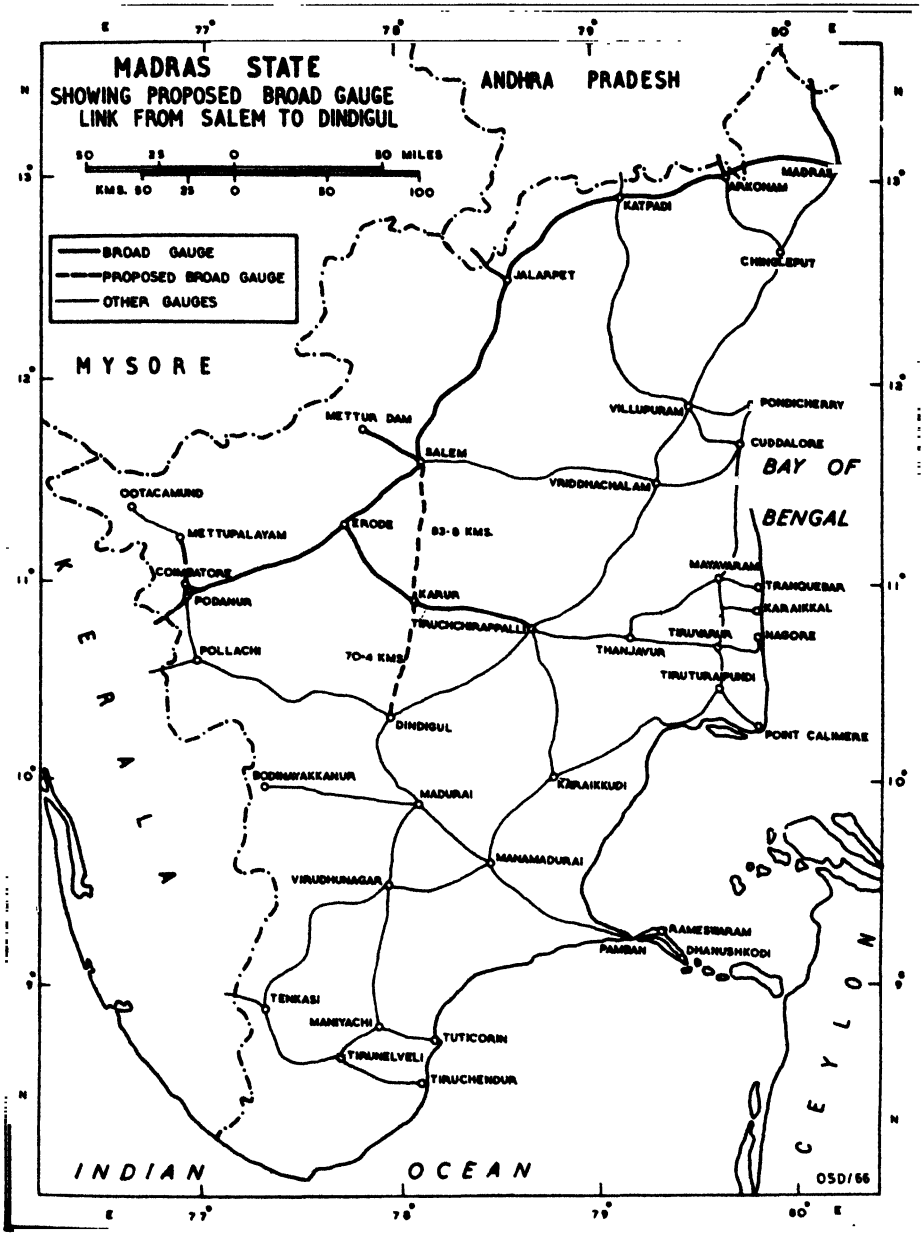
Projections of Road Traffic Density

6.24 We have earlier referred to the fact that road traffic consists not only of passenger traffic by buses and of goods traffic by lorries (dealt with largely in Chapters 4 and 5), but also of goods and passengers carried in bullock-carts, taxis, private cars, cycles, etc., which also contribute to road traffic densities. Therefore, before we compare the capacities of road sections in the region with the anticipated traffic densities in 1970-71 and 1975-76, projections have to be made of the future traffic in private cars, cycles, scooters, tractors, tractor-trailer combinations, hand-carts, etc., as well.

6.25 In Chapter 5 all the anticipated long and medium distance transporta-

1 This perhaps is only to be expected as the capacity measures given to us are admittedly not based on detailed or wide-ranging field experiments.

MAP 18


MADRAS STATE
SHOWING PROPOSED BROAD GAUGE
LINK FROM SALEM TO DINDIGUL
ANDHRA PRADESH
50 25 0 50 MILES
KMS. 50 25 0 50 100
BROAD GAUGE
PROPOSED BROAD GAUGE
OTHER GAUGES
MYSORE
KERALA
METTUR DAM
SALEM
ODTACAMUND
METTUPALAYAM
ERODE
83-8 KMS.
COIMBATORE
PODANUR
KARUR
POLLACHI
70-4 KMS
TIRUCHIRAPPALLI
DINDIGUL
MADURAI
VIRUDHUNAGAR
TENKASI
MANIYACHI
TUTICORIN
TIRUNELVELI
TIRUCHENDUR
JALARPET
KATPADI
MADRAS
AVADI
CHINGLEPUT
VILLUPURAM
PONDICHERRY
CUDDALORE
VRIDDHACHALAM
BAY OF
BENGAL
MAYAVARAM
TRANQUEBAR
KARAIKKAL
TIRUVARUR
NAGORE
THANJAVUR
TIRUTURAIPUNDI
POINT CALIMERE
KARAIKKUDI
MANAMADURAI
RAMESWARAM
PAMBAN
DHANUSHKODI
CEYLON
INDIAN OCEAN
OSD/66

tion of goods traffic allocated to the roads is assumed to be carried by lorries. It was stated therein that in the case of transportation in Collection and Distribution Services, meaning by this expression all transportation for distances less than 40 kms the traffic was catered to principally by lorries and bullock-carts. How these items of traffic were allocated to specific sections of roads was explained. The discussion, however, did not cover cross traffic, i.e., traffic passing through the region without originating or terminating therein. This traffic on the roads moves entirely by lorries.

6.26 Traffic density attributable to cross traffic was assessed in the following manner. From the origin-destination study of December 1963, the road sections on which there is cross traffic at present were identified and for each such section ratio of purely regional to cross traffic was obtained. The same ratios were applied on these cross traffic sections to anticipated traffic densities on account of long and medium distance regional transportation of goods.

6.27 The assumption that movements of goods in long and medium distance transportation would always be by the shortest route is somewhat erroneous. It is not always that a consuming market draws its supplies from the nearest point of surplus. Therefore, there will certainly be what may be called irrational movements, to a certain extent, i.e., movements which do not seek to minimise the tonne kilometres of transportation. We have also to allow for secondary movements, i.e., movements from the larger markets of first import to the smaller markets of distribution. A factor of 20 per cent was added to the traffic densities to allow for such movements.[1]

6.28 The tonnages of aggregate goods traffic by lorries anticipated over each section were first converted into figures of "number of lorries" making due allowance for the anticipated increase in the average capacity of lorries from 5.25 tonnes in 1962-63 to 6.2 tonnes in 1970-71 and 7.5 tonnes in 1975-76 and assuming a load factor of 80 per cent as at present. These figures were then converted again into 'passenger car equivalents' on the basis stated in Table 59.

6.29 In the case of passenger traffic by buses, the present bus density on each road section in a district was inflated as indicated in paragraph 4.52, making due allowance for the expected increase in the average seating capacity of buses. It was assumed for this purpose that the average seating capacity of a bus would rise from 47 in 1962-63 to 55 in 1970-71 and 60 in 1975-76 and that occupation ratio would be 80[2] per cent in both years. The bus density

1 In the case of railways also a similar allowance has been made for irrational and secondary movements.

2 This is doubtless a somewhat high figure; but it has been adopted having regard to the need to conserve the use of petroleum products and the fact that the number of new motor bus chassis available will be limited.

so arrived at was later converted into passenger car equivalents for each section.

6.30 The projections of traffic density attributable to private cars, scooters, cycles, etc., were made as follows. In the case of cycles and private cars, independent projections of the numbers of those expected to be in use in 1970-71 and 1975-76 were made by different methods,[1] and the overall percentages of increase in each of these types of vehicles by 1970-71 and 1975-76 were applied to their respective densities on each section of the road as obtaining in 1963. The number of scooters, tractors and other types of fast-moving vehicles in relation to the number of private cars being very small, in their case the same multiplication factors as for private cars were adopted. In the case of single bullock-carts, and hand-carts, no increase was assumed to occur on any road section.

6.31 In all, projections of traffic density have been done for each section of road for 13 different types of vehicles (see Table 59) and each of those projections was then converted into passenger car units. Aggregates of these projections for each section of the road gives the road sectional densities for 1970-71 and 1975-76.

Comparison of Road Traffic Density with the Capacity now Available

6.32 The figures of anticipated road traffic density over each section of the road network thus arrived at are furnished in Appendix 4 so far as the sections over which the present capacity is expected to be inadequate in 1975-76 are concerned. In juxtaposition the present capacity and the present traffic density over the sections are also given. The position is also pictorially depicted in respect of National Highways and State Highways in Map 17. The map not only indicates the sections of road over which the present capacities will be exceeded in 1975-76, but also brings out the extent to which there will be congestion. It indicates severe congestion around the larger towns like Coimbatore, Salem, Tiruchirapalli and Madurai.

1 Projections of the number of cars in the region on to 1970-71 and 1975-76 are based on two variables: (*a*) Income elasticity of demand, and (*b*) anticipated growth of and changes in the distribution of income. The present private car density on each road section was inflated by a factor of 2.39 over 1962-63 for 1970-71 and a factor of 1.64 over 1970-71 for 1975-76. Projections of the number of cycles in the region on to 1970-71 and 1975-76 were based on predictive equations formed from income and population variables, along with a trend component. The present traffic density of cycles on each road section was inflated by a factor of 2.137 over 1962-63 for 1970-71 and a factor of 1.501 over 1970-71 for 1975-76.

6.33 Taking each category of roads separately, the position is as follows:—

Category of roads	*Total length*, 1963-64 (kms)	*Length over which the present capacities will be inadequate to cater to the traffic densities expected in* 1975-76 (kms)
National highways	1,373	934
State highways	1,471	1,104
Major district roads	11,502	7,443
Other district roads	20,471	1,455

Chapter 7

Investments Needed in Railways and Roads

IN THE LAST chapter an assessment has been given of the anticipated traffic densities over each rail and each road section in 1970-71 and 1975-76. The sections over which the existing capacities will be inadequate have been isolated; indicating also for each section the extent of additional capacity that will be needed. This chapter indicates *(a)* the physical assets that need to be created over each such section to provide the required additional capacity, and *(b)* the financial investment provisions for such assets.

7.2 This process is not simple. Particularly in the case of the railways there are many alternative ways in which the desired additional capacity can be created. The various steps that can be taken and the maximum capacity that can be reached normally by each such step are given in Table 63.

7.3 In the case of existing metre gauge sections, there is also the further alternative of converting the line to broad gauge.

7.4 So far as roads are concerned, the capacity limits of single and double-lane roads given in Table 61 are reproduced below:[1]

Single lane roads	3,000 passenger car units per day
Two lane roads	7,500 " "

The manner in which these units were evolved does not make available an answer to the question as to what standards are to be adopted if the traffic density exceeds 7,500 passenger car units per day. There is also the question whether three-lane roads are at all desirable and if the jump should not be straight to four-lane roads from two-lane roads. Experts do not agree on either of these aspects, and we have neither the results of any field studies by others nor have we been able to undertake such studies ourselves.

7.5 Apart from the position about the standards of capacity that are

1 The manner in which these standards were arrived at is explained in paragraphs 6.16 to 6.23.

available for application as explained in the preceding paragraphs, there are certain broader aspects of transport planning—aspects of substantial importance—that must be kept constantly in mind.

7.6 The ground assets[1] required for increasing transportation capacity cannot and should not be designed for each Plan period just to match the traffic density then anticipated. Planning and execution have to be on a long-term basis. This position arises from the fact that the railway ground assets have a long life, so that it would be uneconomical to create an asset confining one's attention to a relatively short-term assessment of the capacity required, if well within the useful life of that asset the maximum traffic it can cater to is likely to be exceeded and if it will have to be replaced by an entirely different asset. An example to illustrate this point is that electrification of an existing metre gauge section may just adequately meet the requirements of the anticipated traffic density in 1975-76; but it will be uneconomical and unwise to embark on such electrification, if, say, by 1980-81 it cannot meet the traffic demands and if doubling or conversion to broad gauge will necessarily have to be resorted to.

7.7 Another important aspect in railway planning is that it is substantially costlier to haul a tonne of goods over the metre gauge than over the broad gauge. The relative costs for the Southern Railway in the year 1963-64 were 4.38 Paise and 3.13 Paise per tonne kilometre. From these figures it is at once obvious that in the case of a metre gauge single line, the traffic density over which is expected to reach the limit of its capacity, it would be a substantial advantage if it is converted from metre gauge to broad gauge instead of from single to double line (M.G.). Over the Chingleput-Villupuram section, for example, on the basis of the anticipated traffic there will have to be 31 trains each way daily in the year 1975-76—a number beyond the capacity of the single line whatever be the system of operation and tractive power used. Converting the line into broad gauge will not be much costlier than providing an additional metre gauge track. The same traffic volume will need no more than 19 broad gauge trains each way daily and by resorting to conversion into broad gauge there will be a saving in operating costs of nearly Rs. 17 lakhs a year.

7.8 That the ground assets in transportation are costly, endowed with long life and are such as to take a period of three to five years to create, all emphasise the need first to conceive of certain broad objectives over a wider time horizon and then to fit our immediate requirements appropriately into such a broader scheme.

7.9 South India is a peninsula with long leads from north to south and much shorter leads from east to west. Many of its major needs such as coal, iron and steel, and grams and pulses have of necessity to be transported from

1 As distinct from rolling stock assets.

North India. As the years roll on and the standard of living of our people improves there will be an ever growing increase in such movements. These will be long distance movements in substantial quantities, for which the railway is the appropriate mode of transport. It would not be incorrect to say that the north to south railway lines will be the very life lines of supply to South India. In all these circumstances, broad gauge is the obvious long-term choice for such lines in preference to metre gauge, single line or double line, on account of its ability to carry larger volumes of traffic with greater ease and at cheaper costs, i.e., without the ever recurring "quotas" and "restrictions" which a break of gauge invariably imposes.

7.10 The figures in Tables 57 and 63 as also Map 16 clearly show that most of the north to south metre gauge mainline sections in the region will be reaching the limits of their capacity before 1975-76. There is nothing to commend the doubling of these metre gauge lines for providing the additional capacity needed. Such a course will be uneconomical and will also not be in keeping with the long-term needs of the area. These lines must be converted into broad gauge and the only question for detailed consideration really is the phasing and time schedule of such conversion.

7.11 At this stage one can also study with advantage the benefits that will accrue from a new broad guage line connecting Salem with Dindigul via Karur and integrate the study with the study of the plans for conversion of the existing metre gauge mainlines into broad gauge. Map 18 may be seen in this connection. The map shows that such a line has certain *prima facie* advantages.[1] It is significant that such a line will make the broad gauge route from Arkonam to Dindigul and beyond 17 kms shorter than the existing metre gauge route via Chingleput, Vridhachalam and Tiruchirapalli. Even from Madras, the opening of such a line will make the B.G. route to Dindigul and beyond only 59 kms longer than the existing shortest M.G. route.

7.12 The following is a natural division of the mainline metre gauge sections for considering their conversion into broad gauge according to a phased programme. At the end of the list is included also the new line from Salem to Dindigul referred to in the preceding paragraph.

	Kms
1. Madras to Villupuram	159
2. Villupuram to Tiruchirapalli via Vridhachalam	178
3. Villupuram to Tiruchirapalli via Thanjavur	242
4. Tiruchirapalli to Maniyachi and thence to Tuticorin and Tirunelveli	344
5. Virudhunagar to Tenkasi	123
6. Salem to Dindigul via Karur	154

1 In fact the case for such a line has already been mooted in certain quarters.

Of these six items, item 1 will have to be taken along with either item 2 or item 3 and not by itself. Similarly, item 5 will have to be taken up with similar conversion over the Tenkasi-Trivandrum section.[1]

7.13 In summary, the phasing of the conversion has to be for the following three groups of sections:

(1) Madras to Tiruchirapalli via Vridhachalam,

(2) Madras to Tiruchirapalli via Thanjavur, and

(3) Tiruchirapalli to Maniyachi and thence to Tuticorin and Tirunelveli. And along with it has to be considered the desirability and the phasing of a new broad gauge line Salem to Dindigul, via Karur.

7.14 While deciding the phasing, it has to be kept in mind that

(i) it is particularly in the case of goods traffic that the maximum benefits accrue from the conversion from metre gauge to broad gauge; and

(ii) in the case of passenger traffic, as far as possible transhipment should not be forced on to large streams of traffic, and where it is inescapable the points of transhipment should be such that it can be done during convenient hours.

7.15 With due regard to these two points, the following two alternative phasing programmes merit detailed consideration:

First Alternative

1st Phase: Villupuram to Madurai, via Vridhachalam with a new broad gauge line from Madras to Villupuram.

2nd Phase: Madurai to Maniyachi and thence to Tuticorin and Tirunelveli.

3rd Phase: Madras to Tiruchirapalli, via Thanjavur.

NOTES:—(1) The suggestion is that there should be both a broad gauge line and a metre gauge line between Madras and Villupuram at the end of the 1st Phase and till the 3rd Phase is completed. This is to avoid break of gauge for the substantial volume of passenger traffic that exists between South Arcot and Thanjavur Districts on the one hand and Madras and beyond on the other. When the 3rd Phase is implemented, there will be a broad gauge double line between Madras and Villupuram and there will be a need for it not very long afterwards, based on traffic anticipations. There will thus be no wasteful expenditure.

(2) In the first phase the conversion is suggested up to Madurai and not up to Tiruchirapalli only, so as to avoid a break

1 This aspect is to be considered when this Council's Survey of the Transportation Requirements of the Kerala State is over.

of gauge for the passenger traffic from and to Madurai and so as to give a convenient transhipment point for the passenger traffic from and to south of Madurai.

Second Alternative

1st Phase: A new broad gauge line from Salem to Dindigul and conversion of Dindigul-Virudhunagar section into broad gauge.

2nd Phase: An additional broad gauge line from Madras to Villupuram and conversion of the section Villupuram-Dindigul via Vridhachalam, into broad gauge.

3rd Phase: Conversion of Madras to Tiruchirapalli via Thanjavur and Virudhunagar to Maniyachi and thence to Tuticorin and Tirunelveli into broad gauge.

NOTES :—(1) The suggestion is that there should be both a broad gauge line and a metre gauge line between Madras and Villupuram at the end of the 2nd Phase and till the 3rd Phase is completed. The reasons are the same as given in Note (1) to *First Alternative*.

(2) With the completion of Phase 1 and till Phase 2 is completed it is envisaged that some mail, express and passenger trains between Madras and Virudhunagar will run by the all broad gauge route, via Jalarpet, Salem, Karur, Dindigul and Madurai.

7.16 An opinion as to the choice between the two alternatives that have been given can be expressed only after analysis of detailed point to point figures of both passenger and goods traffic between Dindigul and south thereof on the one hand and the area north thereof on the other. We do not have these data and their collection will take time and will involve appreciable labour. Also, the question will have to be examined as to what the implications are of the Second Alternative in regard to the transportation facilities available and expected to be available over the Salem-Madras section. It is considered, in these circumstances, that the Southern Railway administration is in the best position to carry on our analysis further and decide between the two alternatives. There are however three important general factors in favour of the second alternative. Firstly, this alternative will call for a lower investment in the Fourth Plan period compared to the first. Secondly, on completion of its first phase, it will achieve diversion of appreciable volumes of traffic from the Madras-Tiruchirapalli section and will thereby facilitate the construction work on that section in the process of converting it into broad gauge. (The first alternative involves the construction work on that section being undertaken while at the same time

there will be the full pressure of traffic.) Lastly, there will be a permanent advantage from adopting the second alternative, viz., when all the three phases are completed, this alternative, which includes the construction of a broad gauge line from Salem to Dindigul, will facilitate operation both normally and in emergencies, by providing an additional alternative broad gauge mainline routes to the South.

7.17 Whichever be the alternative chosen what we envisage is that Phase 1 be taken in hand and be completed in the Fourth Plan period, and that Phases 2 and 3 be completed in the Fifth Plan period or subsequently depending on the rate of growth of traffic during the Fourth Plan period.

7.18 Over the Tiruchirapalli-Karaikkudi section the shortfall in capacity anticipated is really on account of the sub-standard single line facilities now available. The anticipated traffic density in 1975-76 is less than 15 trains each way daily. The situation can be met by the use of heavier types of engines and the provision of additional crossing facilities. As for the Vridhachalam-Salem section, what steps should be taken to provide additional section capacity will depend on the location and capacity of the steel plant to be sited in that area.

7.19 The problem of the physical ground assets to be created to meet the anticipated traffic density over the existing broad gauge sections in the region is far less complicated. What is required emerges from a comparison of Table 57 with Table 63. The line between Jalarpet and Shoranur will have to be doubled. The work should be completed by the end of the Fourth Plan period. Over the Erode-Tiruchirapalli section the existing single line will continue to be adequate. What will be needed are heavier types of engines and/or better crossing facilities.

7.20 The conversion of metre gauge lines into broad gauge, the construction of the new broad gauge lines and the doubling of the existing broad gauge lines, so far referred to, will call for investments[1] as indicated below:

	Fourth Plan period (Rs. crores)	*Fifth Plan period or subsequently* (Rs. crores)
If the First Alternative is accepted	50.8	29.5
If the Second Alternative is accepted	39.0	51.3

1 The figures of investment have been worked out at the following rates:

	Rs. in lakhs
Cost of conversion of 1 km of railway line from MG to BG	5.0
Cost of doubling 1 km of railway line BG	6.25
Cost of new construction of 1 km railway line BG	6.56

7.21 As has been indicated earlier, over the Erode-Tiruchirapalli and Tiruchirapalli-Karaikkudi sections, additional crossing stations, additional or longer loop lines and improved signalling will be needed. Besides, investment will also be needed on engines, wagons, passenger coaches and workshop facilities for the increased traffic anticipated over all sections. Goods sheds, transhipment sheds, and marshalling yards will need to be extended to enable the smooth flow of the heavier volumes of traffic. We have given our traffic estimates for 1970-71 and 1975-76, not only in the aggregate but by individual sections. On the basis of these figures and with adequate knowledge of the local conditions, the physical assets needed under each of these heads will have to be first worked out and then the investments needed calculated. We have preferred to leave this part of the work to the Southern Railway administration who are in the best position to undertake it.

7.22 So far as roads are concerned, the particular road sections for improvement and the nature of improvements needed in each case have been ascertained by a comparison of the traffic density figures, with the capacity standards we have mentioned in Table 61.

7.23 Map 17[1] brings out what needs to be done to cater adequately to the needs of the traffic in 1975-76, over the National Highways and the State Highways. Over these roads

(1) 663 kms of roads will have to be improved from single lane to two lane;
(2) 479 kms of roads from single lane to four lane; and
(3) 896 kms of roads from two lane to four lane.

Similar figures for Major District Roads and Other District Roads are:

(1) 4,657 kms of roads to be improved from single lane to two lane;
(2) 2,894 kms of roads from single lane to four lane; and
(3) 347 kms of roads from two lane to four lane.

All these works together will call for an investment of Rs. 104.8 crores.[2] In addition these are some sub-standard roads, i.e., single lane roads with less than 12 feet carriageway and two lane roads with less than 22 feet carriageway. These should be brought up to the normal standard and will call for an investment of nearly one crore of rupees.

7.24 The total investment of Rs. 105.8 crores (i.e., Rs. 104.8 crores plus

1 Chapter 6.

2 The figures of investment have been worked out at the following rates:

	Rs. in lakhs
Cost of improving 1 km of road from single lane to two lane	0.33
Cost of improving 1 km of road from single lane to four lane	1.9
Cost of improving 1 km of road from two lane to four lane	1.6

Rs. 1 crore) can be split into Rs. 50 crores in the Fourth Plan period and Rs. 55.8 crores in the Fifth Plan period.

7.25 As in the case of the railways, apart from the roads having to be widened, the traffic levels anticipated in 1970-71 and 1975-76 will call for substantial investments in lorries, buses and workshop facilities. We have made the necessary calculations about the investments needed for these items. In doing so we have assumed that

(i) in the case of buses, the average seating capacity will go up from 47 in 1962-63 to 55 in 1970-71 and 60 in 1975-76, that the average yearly run will increase from 60,000 kms to 77,000 kms and 85,000 kms and that the present occupation-ratio will remain unchanged; and

(ii) in the case of lorries, the average capacity will go up from 5.25 tonnes to 6.2 tonnes and 7.5 tonnes, the average run per year from 65,000 kms to 70,000 kms and 75,000 kms and the load factor will remain unchanged at 80 per cent.

Our estimates are that, for operation in the region in 1970-71 and 1975-76, 1,756 and 1,180 additional buses and 4,606 and 3,121 additional lorries respectively will be needed. They will call for investments of Rs. 28.7 crores and Rs. 19.3 crores in the Fourth and Fifth Plan periods, assuming the prevailing price levels of Rs. 48,000 per bus and Rs. 44,000 per lorry, the prices being of the heaviest types of vehicles, including the body in the case of buses.

7.26 Based on the present ratio of investments on vehicles to those on repair facilities, there will be need also for additional investments on workshop facilities of Rs. 1.9 crores and Rs. 1.3 crores in the Fourth and Fifth Plan periods respectively.

7.27 One point of substantial difference between the creation of the needed ground assets in respect of the railways and the roads is that in the case of the former the time schedule we have indicated is a 'must'. Otherwise the traffic anticipated, if it materialises, cannot move. In the case of the roads the position is not so rigid. Absence of the facilities to the desired standard—up to a point—will result in slowing down of the speed rather than in rigorously limiting the volume of traffic moved. Several sections of road have sustained, in this manner, substantially heavier traffic flows in the past than one would expect from the standards of capacity we have adopted. The total investment of Rs. 104.8 crores we have mentioned in paragraphs 7.23 and 7.24 as needed during the Fourth and Fifth Plan periods taken together can, therefore, to some extent be stretched over a longer period—say over a period of additional three years—should the available financial resources make such a course imperative. In any case we consider that a minimum investment of Rs. 36 crores should be

made in the Fourth Plan period, which is the investment needed to ensure that atleast the more congested roads will be widened.

7.28 Our studies have not covered urban traffic congestions; the investments we have mentioned are exclusive of the needs of urban roads. To assess the needs under this head extensive special studies will be needed by experts in respect of each town separately. Also, the investment figures we have given are exclusive of the amount that may be needed for strengthening or widening major bridges and for providing overbridges or subways at the busier railway-road crossings. Our figures, however, include provision for culverts. We have left to the highway authorities the detailed working involved in estimating the investments needed on the items we have not covered.

7.29 The investments recommended in this chapter are summarised below:

	Fourth Plan period (Rs. crores)	*Fifth Plan period or subsequently*[a] (Rs. crores)
1. Conversions of M.G. railway line into B.G., construction of new B.G. lines and doubling existing B.G. lines[b]	39.0	51.3
2. Improvements to roads by way of widening	50.0	55.8
3. Additional buses and lorries required	28.7	19.3
4. Additional workshop facilities required for road vehicles	1.9	1.3

a Depending on the rate of growth of traffic in the Fourth Plan period.

b Based on the Second of the two alternatives.

In addition, as we have indicated in paragraphs 7.21 and 7.28, there will be investments on certain other items to be worked out by the local railway and highway authorities.

Chapter 8

The Ports : Traffic—Present and Potential : Investments Needed

Ports of the Region

IN THIS CHAPTER we take up the ports of the region to discuss their existing levels of traffic, and their rates of past growth and discuss the methods and the results of estimating their traffic potentials in 1970-71 and 1975-76. We then consider these latter against their present capacities for handling traffic and finally suggest the investment needed to cope with the anticipated demand on port services.

8.2 The coastal and foreign trade of the region is handled not only at its four ports, namely, Pondicherry, Cuddalore, Nagapattinam and Tuticorin, but also at Madras and Cochin Ports. The four regional ports do not serve the entire region but about two-thirds of it. Madras Port, because of its superior facilities and well-established shipping, export and import agencies, serves the whole State including the hinterland of the four regional ports in respect of many items of import and export. The port of Cochin, for similar reasons serves certain parts of the region such as the Coimbatore District.

8.3 The four ports command together a hinterland area of 67,900 sq. kilometres. This is about 63.4 per cent of the area of the region. The population of the hinterland of the ports was 17.95 million in 1961; by 1971 its population is expected to increase to 20.39 million and by 1975 to 21.63 million.

Growth of Port Traffic

8.4 The traffic handled by the four ports of the region was 760,691 tonnes in 1950-51; by 1963-64 the aggregate traffic was almost double, being 1.5 million[1] tonnes (Table 64). The annual rate of growth of traffic was 7.43 per cent per annum during the period from 1950-51 to 1963-64.

1 In 1962-63 the aggregate traffic was slightly more than double the traffic of 1950-51, as it touched 1 55 million tonnes (vide Table 64)

8.5 The tempo of growth of the aggregate traffic of the region quickened only after 1956-57, the annual rate of growth of traffic between 1956-57 and 1963-64 being 12.3 per cent as compared with 0.95 per cent during 1950-51 to 1956-57 (Table 65). The very much faster growth of traffic between 1956-57 and 1963-64 is traceable to increases in the coastal traffic in salt, and coal, a new traffic in cement and foreign imports of foodgrains and fertilizers; from 1958-59 iron ore exports to Japan have further swelled the traffic.

Distribution of Traffic Among the Ports

8.6 In 1963-64, about 96 per cent of the traffic of the ports of the region was handled at Tuticorin and Cuddalore together (62.5% and 33.5% respectively).

8.7 There have been notable changes in the distribution of traffic among the four ports, particularly in favour of Cuddalore and Nagapattinam (Table 66). Tuticorin's share has fluctuated between a high of 71.8 per cent in 1951-52 and a low of 62.2 per cent in 1961-62. The real relative gains have been at Cuddalore, where the traffic has increased from an average of about 25.6 per cent till 1956-57 to 31 per cent subsequently. Nagapattinam increased its share of traffic from about one per cent in 1950-51 to 3.5 per cent in 1963-64. Pondicherry, on the other hand, has steadily obtained a declining share in the traffic. From the point of view of the region, the traffic at the latter two ports has been negligible in tonnage as well as in relative terms.

The Coastal Traffic

8.8 The coastal traffic of the region has varied between 0.80 and 0.97 million tonnes during 1960-61 to 1963-64. The main items of coastal traffic during these years were exports of salt, sugar and cement and imports of coal, cotton, tiles, etc. The coastal traffic constituted about 60.6 per cent of the ports' total traffic in the last four years. Generally, the coastal imports have exceeded the exports. During the last four years the gap between coastal imports and exports has widened from about 83,900 tonnes to 362,000 tonnes, mainly due to a higher level of coal imports. In 1963-64 coastal imports constituted about 80 per cent of the inward traffic and the coastal exports about 39 per cent of the outward traffic of the regional ports (Table 67). There is very little coastal traffic at Pondicherry or Nagapattinam. At Tuticorin the coastal traffic is more than 70 per cent of its total traffic.

Foreign Trade

8.9 The ports handle the foreign traffic in salt, magnesite, iron ore and cement (exports) and foodgrains and fertilizer (imports) on Government account as well as raw cotton and machinery imports. In recent years the annual foreign traffic has been between 0.55 and 0.59 million tonnes. Unlike the coastal trade, exports generally have exceeded imports in the foreign trade (Table 68). The gap between foreign exports and imports has tended to narrow down from 408,000 tonnes in 1960-61 to 272,000 in 1963-64, because of the downward trend in iron ore exports and the upswing in foodgrains and fertilizer imports.

The Inward and Outward Cargoes

8.10 The inward[1] traffic at the ports was generally in excess of the outward[2] between 1950-51 and 1957-58. Signs of change in their relative position were visible in 1957-58 and, with the commencement of iron ore traffic in 1958-59, the position was reversed and it continued to be so till 1962-63. But in 1963-64 the relation between inward and outward traffic appeared to be reverting to the *status quo ante*, mainly because of increased import of coal.

8.11 Till 1956-57 the inward traffic increased at 0.9 per cent per annum and the outward at 1.1 per cent per annum. But since then the respective rates have been 8.5 per cent and 14.0 per cent respectively (Table 69).[3]

8.12 The main items of exports from the ports of the region are cement, salt, palmyra fibre, onions, iron ore and cotton piece-goods. The ports handled import traffic in foodgrains and fertilizers (ammonium sulphate and urea), coal, cotton and machinery.

Steamer Traffic

8.13 At Tuticorin the number of steamers calling has gone down after 1959-60, but their average net registered tonnage has doubled. More steamers are visiting Cuddalore since the commencement of the iron ore exports in 1958-59. Their average net registered tonnage (NRT) is also going up. An exceptional feature that was witnessed in 1960-61 was that the average NRT of the steamers visiting the port in that year was at a maximum (8,196 tonnes). This is probably due to the calling of bigger steamers from Japan for the iron ore exports from the port. The iron ore traffic recorded in that year was also the highest at the port.

1 Coastal and foreign imports.
2 Coastal and foreign exports.
3 Vide para 8.5 for the reasons behind the significant change in the rate of growth of traffic.

8.14 The steamer traffic of the ports of the region has surpassed the million tonne mark since 1958-59, and is at present more than 1.3 million tonnes. The share of the steamers in the port traffic of the region was over 90 per cent till 1957-58, but since then it averages about 87 per cent. The balance is traffic handled by country crafts.

Sailing Vessel Traffic

8.15 Between 1950-51 and 1959-60, the number of sailing vessels visiting the ports of Tuticorin and Nagapattinam as well as their average NRT were going up; at Cuddalore and Pondicherry, their number and the average NRT declined. Since 1960-61, the number of sailing vessels calling has decreased at all the ports, more conspicuously at Cuddalore and Nagapattinam. At Tuticorin, it would appear that it is the smaller vessel that has ceased to call, so that the average NRT has gone up by about two-thirds of what it was between 1950-51 and 1954-55; the same trend is noticeable at Nagapattinam also. At Cuddalore and Pondicherry the picture remains unchanged between 1950-51 and 1962-63.

8.16 Till 1957-58 the total traffic handled by the sailing vessels annually was distinctly less than 100,000 tonnes, the average being 64,229 tonnes between 1950-51 and 1957-58. But since 1958-59 the traffic has never been less than 155,000 tonnes. During the six years, 1958-59 to 1963-64, the sailing vessels' traffic was never less than twice the traffic in 1950-51; in fact it has been more than thrice the traffic in 1950-51, during 1958-59, 1959-60, 1961-62 and 1962-63.[1]

8.17 In the early years of the decade, i.e., between 1950-51 and 1957-58, the traffic by sailing vessels was generally less than 10 per cent of the port traffic of the region; in the latter years this share had gone up to an average of 13 per cent.

Methods of Estimation of the Traffic Potential

8.18 Against the background presented in the previous paragraphs of the growth of port traffic in the past in the region, the following questions are relevant:—

(*a*) What is the most reasonable increase in traffic that we may expect in the aggregate at the ports of the region, and how will it be distributed among them in 1970-71 and 1975-76?

1 Rate of growth of sailing vessel traffic was 8.75 per cent during 1950-51 to 1963-64 and 9.6 per cent during 1957-58 to 1963-64.

(*b*) What would be the additional capacity, if any, that would be required at each of the ports to cope with the anticipated traffic?

(*c*) What investment will be needed to create the additional capacity required at each port?

8.19 Taking up the first question, we indicate here, in brief, the methods of estimating the traffic potential of the ports that we adopted and then proceed to present the results of the estimates.

8.20 We estimated the total traffic at each port in the region in 1970-71 and 1975-76 on the basis of specific, anticipated industrial and agricultural developments in the hinterland of the port. The method is to work out in the period between 1963-64 and 1970-71 and 1975-76,[1] the requirements of port services for each industrial expansion or creation of new units and for the anticipated agricultural developments and to aggregate them to obtain the estimates of traffic potential. The method has the advantage of not merely giving the total traffic potential but also the individual components that will go to make it up, their origins and destinations.

Traffic Potentials of the Port of Tuticorin

8.21 It is estimated by use of the method explained, that the traffic potential of Tuticorin in 1970-71 and 1975-76 will be 1.37 and 1.77 million tonnes respectively (Table 70). The anticipated increase in traffic between 1963-64 and 1970-71 is thus 0.43 million tonnes, and a further increase of 0.40 million tonnes is expected between 1970-71 and 1975-76. The rates of growth of traffic registered or anticipated during the respective Plan periods between 1961-62 and 1975-76 are set down in Table 71.

8.22 The items of cargo and the respective tonnage thereof which will go to make up the traffic potential at Tuticorin in 1970-71 and 1975-76[2] are presented in Table 70. The individual items of potential traffic are discussed in the following paragraphs.

Coal

8.23 During the past three years imports of coal at the port (railway coal and public coal taken together) have averaged 0.37 million tonnes, that is nearly a third of the port's aggregate traffic. Of the coal intake at the port that for the railways was as much as 0.26 million tonnes, i.e., about 70 per cent of the entire coal traffic at the port. In assessing the coal traffic potential at

1 The method is applied also to 1975-76 though the probable industrial developments in that period cannot be visualised firmly now.

2 The quantitative picture for 1975-76 is approximate and will need review in 1971

the port the future of the railway coal traffic is very important and it is in respect of this that certain important reservations have to be made.

8.24 We are informed by the railways that it is their aim to feed their requirements of coal to the sheds now served by the ports of Madras, Cuddalore and Tuticorin to the maximum possible extent from the outlying coalfields, namely, Pench and Chanda, Central India Coalfields and Singareni Collieries during the Fourth Plan period. It is understood further that the Ministry of Steel and Mines have indicated that the entire requirements of grade I coal for the Southern Railway, during the Fourth Plan, can be met from Talcher and Singareni coalfields excepting for about 0.26 million tonnes of selected grade coal which will be moved from the Bengal-Bihar area, and that sufficient rail route capacity will be generated to cope with the required movements. The indications are therefore that there may practically be no movement of sea-borne coal for the railways through the ports of Madras, Cuddalore or Tuticorin by 1970-71.[1]

8.25 We are, however, taking credit for the movement of public coal by sea to Tuticorin port. It is possible that the Government subsidies to coastal shipping would continue particularly in the case of coal, which, along with salt, is the mainstay of our coastal trade.[2] Also, the movement of coal to a port such as Tuticorin is more advantageous than others, as it has offered and will continue to offer increasing return traffic, particularly in bulk shipments, of salt. Further, with the development of deep sea berths at Paradeep, Haldia and Tuticorin, full loads of coal in vessels of 10,000 tonnes would be possible, with consequent lowering of shipping costs,[3] and cutting down or elimination of subsidies to coal movement by sea.[4] It is significant that most of the public coal that will move to Tuticorin will be consumed at Tuticorin itself or places

1 The potential loss of traffic in railway coal, is equivalent to the present traffic of 0.26 million tonnes at Tuticorin together with its anticipated increase to 0.49 million tonnes in 1970-71 and 0.85 million tonnes in 1975-76. This, however, does not allow for the effects of any dieselisation or electrification schemes that the railways may embark upon in the ports' hinterland.

In so far as the Southern Railways take their coal from Talcher, the possibility of a part or whole of it moving by sea to Tuticorin via Paradeep should be considered.

2 On the need to continue the subsidy, please refer to the Report of the First Conference of the Directors in charge of the Regional Transport Survey Units and the associated railway officers with the Joint Technical Group for Transport Planning held at New Delhi on 1st/2nd April, 1965 vide statement of the Secretary, Ministry of Industry and Supply, page 9, para 4.6.

3 Whereas the per tonne rail freight from Bengal-Bihar collieries to Tuticorin is Rs. 41.80 and railway costs are Rs. 65.89, the shipping freight charges including rail movement from colliery to Calcutta and port charges, are Rs. 54.25, (after the Preliminary Report of the Committee on Transport Policy and Coordination, Chapter X, page 78.)

4 Under the present conditions on the Hooghly river, shipments of coal from Calcutta port average less than 5,000 tonnes per vessel.

in close vicinity so that there would not be any additional cost on account of inland movement. Also it would be convenient to move the Talcher coal for the power station at Tuticorin via Paradeep.[1]

8.26 The coal intake at the port, after allowing for the disappearance of the railway coal traffic, would go up by 0.23 million tonnes in 1970-71 on account of industrial requirements in the hinterland. The net additional coal is accounted for by requirements of (1) the thermal station that is proposed to be set up at Tuticorin, 0.35 million tonnes, and (2) the cement factories, paper and paper board plants and units to manufacturing bricks, tiles, industrial chemicals and textiles.

8.27 The coal imports of the port are expected to register a further increase of 93,000 tonnes by the end of the Fifth Plan.

8.28 The coal shipments to the Port could come from Paradeep (Talcher coal) or from Calcutta-Haldia (Bengal/Bihar collieries).

Salt

8.29 The average level of salt traffic at the port during the last three years was about 205,500 tonnes. Additional salt traffic of the order of 60,000 tonnes is expected to move coastally to Orissa and to Calcutta and about 100,000 tonnes to foreign markets, including Ceylon. During the Fifth Plan, the exports may rise further by 140,000 tonnes.[2]

8.30 It may be noted that of the anticipated traffic of about 1.34 million tonnes at Tuticorin port in 1970-71, salt (365,500 tonnes) and coal for the thermal plant at Tuticorin account between them for 715,500 tonnes. This traffic will be moved locally to or from the port and will not, therefore, entail any extra line haul traffic for the railways which connect up with the port.[3] The impact of this traffic in the case of salt will fall on the roads in the immediate vicinity of the port, and on rail sidings in the case of coal.

Cement

8.31 In 1961-64 the cement exports at the port, which commenced in 1951 and which have been going up since 1958-59,[4] have recorded an average of 73,350 tonnes annually.

8.32 The cement traffic may be around 80,000 tonnes in 1965-66, but thereafter it may tend to decline and disappear from among the export items.

1 Vide *Development of Paradeep Port*, NCAER, October 1963, p. 46, *et seq.*

2 The salt traffic will not shift entirely to the new port but partly continue to be handled at the jetties at the existing port or loading places near the salt pans, particularly in the case of sailing vessel traffic in salt, both foreign and coastal.

3 The coal for industrial units (230,900 tonnes) in the hinterland will, however, move by railway over short distances.

4 Shipment were 39,860 tonnes in 1958-59

The regional demands are expected to go up sharply during the Fourth and Fifth Plan periods, and there may not be any surpluses available for export through the port. What surpluses there are, will go by surface modes of transportation to Kerala, Andhra and Mysore from Madras State including the hinterland of this port. From the demand side also, shipments which are at present going to Calcutta are expected to decline gradually and disappear altogether, as important developments in the cement industry in Orissa and other nearby States are likely to take over the supplies to the Calcutta Market.

Cotton Imports

8.33 The imports of cotton at Tuticorin port have averaged 22,500 tonnes during the last three years. Since 1950-51 the traffic has varied; it has never been less than 9,800 tonnes and has shown an upward trend since 1956-57. The traffic anticipated is 25,000 tonnes in 1970-71 and 35,000 tonnes in 1975-76.

Exports of Cotton Waste

8.34 Cotton waste is an important export from the port, mainly going to foreign markets. In recent years it has averaged 14,900 tonnes. Credit is taken for an additional traffic of about 1,500 tonnes in 1970-71 and of about 5,000 tonnes in 1975-76. About 10 per cent of the traffic may be coastal and 90 per cent foreign traffic; the traffic is generally by steamers.

Exports of Cotton, Cotton Yarn and Piece Goods

8.35 The exports of raw cotton—a few hundred tonnes only—will continue to be static. Cotton yarn exports have registered about 59,000 tonnes in recent years, mainly going to Calcutta and U.K. The traffic is drawn to the port from outside the hinterland also, from places such as Coimbatore. Despite the expansion of the textile industry envisaged in the hinterland during 1965-66 to 1975-76, it is difficult to forecast the future growth of this traffic. It is assumed that the traffic will be maintained at present levels. The same remark applies to exports of cotton piece goods, which, however, are at a much lower level (6,000 tonnes in 1963-64, and only 2,062 tonnes in 1962-63).

Agricultural Commodities

8.36 The traffic in onions, chillies, palmyra fibre, and senna leaves has been stable in over a long period of years. These items averaged together 64,000 tonnes during 1961-64. In view of the likely increase in domestic demand as a result of population growth within and without the region, the traffic may not be elastic and no credit over the present levels is taken either for 1970-71 or 1975-76.

Diversion from Madras Port

8.37 A certain amount of traffic, mainly imports for the hinterland, is handled at Madras port. When deep sea port is formed at Tuticorin, this traffic may be gained by the port by diversion. It is estimated that the amount of this traffic will be about 20,000 tonnes and due credits taken for it.

Imports of Foodgrains and Fertilizers

8.38 Certain items such as foodgrains and fertilizers are imported on Government account at the port. The future of this traffic is uncertain in the case of foodgrains, and in the case of fertilizers, production in the State[1] and outside may result in considerable reduction or elimination of the traffic.

Petroleum Products

8.39 No credit is taken in our estimates for the import of petroleum crude and exports of petroleum products at the port in 1971 or 1976. With the coming up of refineries at Cochin and Madras, in our view, there appears to be little prospect of such traffic at Tuticorin during the time horizon of this study.[2] The position may, however, be reviewed in 1971. There is no potential bunkering oil traffic at the port, as ships can get it at Madras and Cochin.[3]

8.40 The port also handles miscellaneous cargo in cane jaggery, dry fish, gunnies, palmyra stalk, potatoes, tamarind, turmeric and beedi leaves as exports and chemicals, hardware, iron and steel, machinery, pulses, rayon yarn, seeds, and firewood as imports. The traffic in these items of cargo over years 1961-64 has averaged 164,000 tonnes. The traffic in these items has grown at a rate of 3.5 per cent during the last 10 years. Projecting at this rate for 1970-71 and 1975-76, this traffic is put at 204,000 and 240,000 tonnes respectively.

The Traffic Pattern

8.41 The pattern of traffic at Tuticorin would thus be stable and maintain

1 At Madras, Neyveli and later at Tuticorin itself

2 It has been pointed out by the Madras Government that the demand for petroleum products in the Southern Region, i e., south of 15 5° Lat / may be of the order of 10 5 million tonnes of finished products in 1975-76 and this would involve 10 to 12 million tonnes of crude for refining. In case the Cochin and Madras refineries are not able to refine more than 4 or 4.5 million tonnes of crude each, there will be need for an additional refinery in the area to refine another 3 million tonnes of crude. In that event, Tuticorin may be considered as a suitable location.

While this possibility may be kept in mind, it is to be noted that the question of location is not a purely regional or State matter and that it would have to be gone into at length at an appropriate time later, and the relative advantages of other locations in the Southern region, such as Mangalore, would have to be examined, if indeed there is need for another refinery.

3 Bunkering facilities do not necessarily exist at all major ports, e.g., Goa

continuity with its past till at least 1971. A new element in the traffic pattern may emerge with imports of phosphatic rock at the port from the beginning of the Fifth Plan. The break could come earlier, if the proposals of the Council for setting up certain export-oriented industries,[1] preferably in Tirunelveli and Ramanathapuram Districts are found feasible and come through in the Fourth Plan. If these industries are set up, raw materials will be imported, and semifinished goods exported through Tuticorin port. But no account has been taken of the possibilities of the export-oriented industries in the current assessment; these, however, need to be kept in mind.

Summing up the Potential

8.42 Summing up the various elements of the potential traffic, it is seen that the aggregate traffic at the port will increase from 935,000 tonnes in 1963-64 to 1.37 million tonnes in 1970-71 and to 1.77 million tonnes in 1975-76, the rates of increase per annum being 5.6 per cent and 5.4 per cent during the respective periods.[2]

8.43 The traffic potential in 1970-71 is about 300,000 tonnes less than what is estimated on the time trend. This result is due to the fact that the loss of traffic in railway coal would not be sufficiently compensated by the growth of traffic attributable to industrialization in the hinterland. The expected rate of industrialization in the hinterland of this port is somewhat lower than in the State[3] during our time horizon. The impact on port traffic will be more significant *(a)* if the hinterland is preferred more for industrial location than is envisaged in the present Plans for 1966-71 and/or *(b)* if the development proposed by the Council referred to in paragraph 8.41 come up.

8.44 The likely distribution of the traffic potential between exports and imports, coastal and foreign trade, and steamers and sailing vessels are set out in Table 72. From the table, it is clear that Tuticorin will be fairly balancing export and import[4] tonnages. While the foreign traffic will increase its share from 28.5 per cent in 1963-64 to 34.2 per cent in 1970-71 and 37.9 per cent in 1975-76, the share of coastal traffic will decrease from 71.5 per cent in 1963-64 to 65.8 per cent in 1970-71 and 62.1 per cent in 1975-76. An important feature

1 The industries referred to are the machine tools, pumps and compressors, prime movers and boilers, construction machinery, transformers, electric motors, switch and switch boards, etc.

2 If, however, the Railways continue to move their requirements of coal by sea to the port the traffic potential at the port would be 1.86 million tonnes in 1970-71 and 2.63 million tonnes in 1975-76, the annual rates of increase being 10.4 per cent and 7.2 per cent during the corresponding periods.

3 Particularly in the vicinity of Madras port

4 Exports and imports are used in the sense of incoming and outgoing traffic respectively.

of relevance to port planning at Tuticorin is the likely division of the traffic between steamers and sailing vessels. The latter may double its traffic from 165,000 tonnes to 321,000 tonnes before 1971, and may gain further by about 50,000 tonnes during the Fifth Plan. The deep-sea berths, where the steamer traffic at Tuticorin will be handled, would have to cope with about a million tonnes in 1970-71 and 1.4 million tonnes in 1975-76.

8.45 Before comparing the present handling capacity and its level of utilisation at Tuticorin with the anticipated traffics at the port in 1970-71 and 1975-76 and assessing the port's future needs of capacity, we may examine the traffic potential at the other ports.

The Traffic Potential at Cuddalore Port

8.46 The traffic at Cuddalore Port was about 0.5 million tonnes in 1963-64. The traffic has shown a significant increase particularly since the commencement of iron ore shipments from the port in 1958-59. The annual rate of increase of the traffic at the port during 1950-51 to 1963-64 was 13.4 per cent; the tempo of growth between 1956-57 and 1963-64 was, however, higher, being 24.4 per cent.

8.47 Important industrial developments are envisaged in the hinterland of the port. Lignite, fertilizers, insulators, etc., in Neyveli and expansion in sugar, hydrogenated oils, salt, textiles and new units in solvent extraction and paper boards are among the more important ones.

8.48 The future growth of traffic is expected to turn mainly on increased iron ore shipments. The Minerals and Metals Trading Corporation is planning to send annually half a million tonnes of iron ore from the port from 1965-66 to 1970-71. On present indications, it is possible that this traffic may decline to 200,000 tonnes after 1970-71.

8.49 The present (1963-64) level of coal intake at the port is 200,000 tonnes, of which, about 147,000 tonnes are for the railways and the balance for industries and industrial dumps in the hinterland. The same remarks apply to the intake of railway coal at Cuddalore as have been made in respect of Tuticorin in paragraph 8.24. As railway coal is about 40 per cent of the traffic at the port at present, its disappearance from the port traffic will make a substantial difference to future traffic potential at the port. The imports of coal for industries and industrial dumps which is about 54,000 tonnes at present, will go up only modestly, by about 20,000 tonnes during the Fourth Plan, another increase of the same order may be expected during the Fifth Plan.

1 It is understood that the Japanese have expressed a preference for the port in order to get their imports of high grade (65%+) iron ore even after 1970-71. No firm forecast can, however, be made of this traffic for the period after 1970-71.

8.50 Among other items of traffic at the port are foodgrains and fertilizer imports on Government account and sugar and cement exports. In case foodgrain imports should continue, the Cuddalore port can be utilised as it is favourably located for distribution; it can also serve as a useful stand-by in case of congestion at the Madras port. As sugar production in the hinterland is likely to expand by about 21 per cent between 1965-66 and 1975-76 and as the factories are close to the port, expansion of sugar export may be feasible. The magnesite exports, modest at present, may rise to over 3,000 tonnes.

8.51 The other traffic at the port was of the order of 88,600 tonnes during 1963-64 During 1958-59 to 1963-64, this other traffic has been going up at a rate of about 10 per cent per annum. Assuming the same rate of growth in the future, credit is taken for 148,000 tonnes in 1970-71 and 212,000 tonnes in 1975-76.

8.52 From enquiries it is understood that the industrial units in the Neyveli area promise little or no traffic to the port at Cuddalore as they get only heavy lift cargo for which Madras is more suitable.

8.53 The Madras Government has intimated to us that a high priority will be given for the setting up of a pig iron plant at Cuddalore in the Fifth Plan, and that it would have a capacity of about 300,000 tonnes. About 600,000 tonnes of iron ore will have to be moved either by rail or by sea depending upon the sources of supply, about which there is no firm information at present; in case the ore comes from Goa, the possibility of coastal movement will have to be kept in mind. The requirement of coke, which has to be imported either from Bengal-Bihar or from abroad, will be about 270,000 tonnes, and in case the plant materializes, this traffic will more than offset the loss of railway coal. The export of 100,000 tonnes of pig iron is being envisaged. But here again, no firm figures can be given as export would depend on foreign buyers about whom we cannot predict at present. In the absence of any firm commitment towards the setting up of a pig iron plant, these items of traffic cannot be counted on firmly. On the other hand, this industrial possibility and its likely impact on port traffic have to be kept in mind in the general planning for the additional capacity we have predicted.

8.54 The traffic potential at Cuddalore is summed up in Table 73. Between 1963-64 and 1970-71, the traffic will go up from about 500,000 tonnes to 725,000 tonnes—an increase of 45 per cent. There are prospects of a decline of the port traffic to 510,000 tonnes in 1975-76 in case the iron ore exports are not maintained. That is to say, the traffic may revert to the levels at present obtaining at the port. It is in this context that the setting up of the pig iron plant is important, as it could make a difference of at least 270,000 tonnes to the port traffic.

Nagapattinam and Pondicherry

8.55 Nagapattinam is expected to handle another 10,000 tonnes by 1970-71 and an extra 25,000 tonnes by 1975-76 over the present level of traffic. The passenger traffic, which is important at the port, is expected to maintain its present level (25,000).

8.56 The Port of Pondicherry's main hope for increasing traffic lies in iron ore; the M.M.T.C. is planning to send 200,000 tonnes of iron ore by 1970-71; besides iron ore, traffic in general cargo may be between 25,000 tonnes and 50,000 tonnes.

8.57 The suggestions in the Council's Techno-Economic Survey of Pondicherry relate to the expansion of sugar and cotton textiles and the setting up of new units in solvent extraction, ethyl alcohol, paper, cement and certain engineering industries. In case some of these proposals are implemented, the import and export trade at the port may expand and be diverse. But, no assessment of the traffic gains from such industrial possibilities can be attempted at present as the proposals are in a very preliminary stage.

8.58 The changes in the distribution of the traffic among the four ports during the span of our study are shown in Table 74. It can be seen that by 1975-76 the share of the port of Tuticorin would rise significantly while that of Cuddalore is likely to fall by a percentage equivalent to the gain at Tuticorin. This is mainly because of the likely decline in iron ore exports at Cuddalore after 1970-71.

Present Port Capacities and the Expected Traffics in 1970-71 and 1975-76

8.59 The facilities available at present, e.g., wharfs and jetties for small steamers and big sailing vessels, godowns and transit sheds, small capacity cranage, lighters, railway sidings, navigational aids, etc., add up to a certain capacity at each port for handling shipments. Port capacity, like other transport capacity, cannot be exactly measured. It depends upon a number of varying factors, e.g., the number and size of ships that can be worked at the berths or in midstream at a time, the differences in the rate of discharge or of the loading of different cargo, the number of working days in a year, etc. In roadsteads such as Tuticorin, other things being equal, port capacity will much depend on the number of lighters available and on the right time for their handling goods between ship and shore.

8.60 The particulars of available port capacity at each port, given these difficulties of definition and measurement, are set out in Table 75. The utilisation of port capacity is also set out in the same table.

8.61 It may be noted that the traffic has been pressing on capacity only at Tuticorin and Cuddalore and there is plenty of spare capacity at the other two ports. As the traffic has been rising in the case of every port[1] during the last decade, the utilisation of capacity is given for the latest year 1963-64 (Table 75).

8.62 It is clear from Table 75 that with the existing facilities, Tuticorin and Cuddalore can handle only a third over their present traffic. But Nagapattinam can easily handle twice its present traffic. In the case of Pondicherry almost all its capacity is spare. The question of providing additional facilities at any of these ports would depend upon whether the traffic increases during the Fourth Plan would exceed the indicated orders of increase.

8.63 The traffic at Tuticorin is bound to go up beyond the existing capacity from about the last year of the Fourth Plan. At present the port has a capacity for handling 1.25 million tonnes per annum. As against this the anticipated level of traffic is 1.37 million tonnes in 1970-71 and 1.77 million tonnes in 1975-76. Out of this the steamer traffic will be 1.04 million tonnes in 1970-71 and 1.40 million tonnes in 1975-76. The port's handling capacity for important individual items of traffic such as coal, salt and general cargo is set out in Table 76 and this has been compared with the expected requirements of capacity for handling each category of traffic in 1970-71 and 1975-76.

8.64 There is clearly the need to provide *(a)* one deep sea berth for coal, and *(b)* one berth for salt and general cargo, for the traffic at Tuticorin in 1970-71 Another berth may have to be added for general cargo during the Fifth Plan, depending upon the development of traffic in the intervening years.

8.65 The anticipated level of sailing vessel traffic[2] and a part of coastal traffic by very small steamers (vide Table 72) may have to be accommodated either at the jetties at the old port site, or facilities in their vicinity will have to be provided so as not to interfere with ocean shipping.

8.66 At present Cuddalore has a port capacity of 0.65 million tonnes. The present level of utilisation of the capacity is of 72 per cent. In 1970-71, the level of traffic as estimated by us (0.725 million tonnes) will be slightly above the port's capacity. But there is some doubt if the quantity of iron ore traffic through the port will really reach 0.5 million tonnes in that year as we have estimated.[3] Also, our own estimate of traffic in 1975-76 is only 0.51 million tonnes. In these circumstances, should the traffic of 0.5 million tonnes in iron ore really materialize in 1970-71, it will be best to bridge the small gap between the traffic and the computor capacity by operational efficiency. In case, however,

1 Except Pondicherry, where the utilisation of capacity since the completion of the new pier was at a maximum in 1963-64.

2 0.32 million tonnes in 1970-71 and 0 37 million tonnes in 1975-76

3 The Joint Technical Group of the Planning Commission have placed this traffic in 1970-71 at 0.3 million tonnes only.

the proposed pig iron plant comes up at Cuddalore during the Fifth Plan, port capacity would have to be raised to about a million tonnes (vide para 8.53). Otherwise the traffic in 1976 will be within limits of port capacity as at present.

8.67 For raising port capacity at Cuddalore, (if it is found necessary) the measures envisaged are deepening the bar, extension of wharfs, provision of transhipsheds, etc.

8.68 At the level of traffic predicted for Nagapattinam port in 1970-71 and 1975-76, that is about 60,000 and 85,000 tonnes respectively, there will be ample spare port capacity for handling the increase in cargo traffic.

Investment on the Ports

8.69 In 1970-71, the anticipated level of traffic at Tuticorin would be about 1.37 million tonnes. As about 0.35 million tonnes of traffic will continue to be handled at the jetties of the old port, new port capacity that is to be created at the proposed deep sea port at Tuticorin will have to be of the order of one million tonnes. In 1975-76, about 0.4 million tonnes will be dealt with at the old jetties, and about 1.37 million tonnes at the new port, so that at the latter the capacity will have to be increased by about half a million tonnes.

8.70 The Tuticorin Port Project is expected to cost Rs. 22.75 crores. In the first stage of the proposed scheme, there will be six berths in deep waters. Of these it is proposed to provide one berth for oil and two for coal (vide Map 19). The deep sea port is expected to be ready in 1968-69.

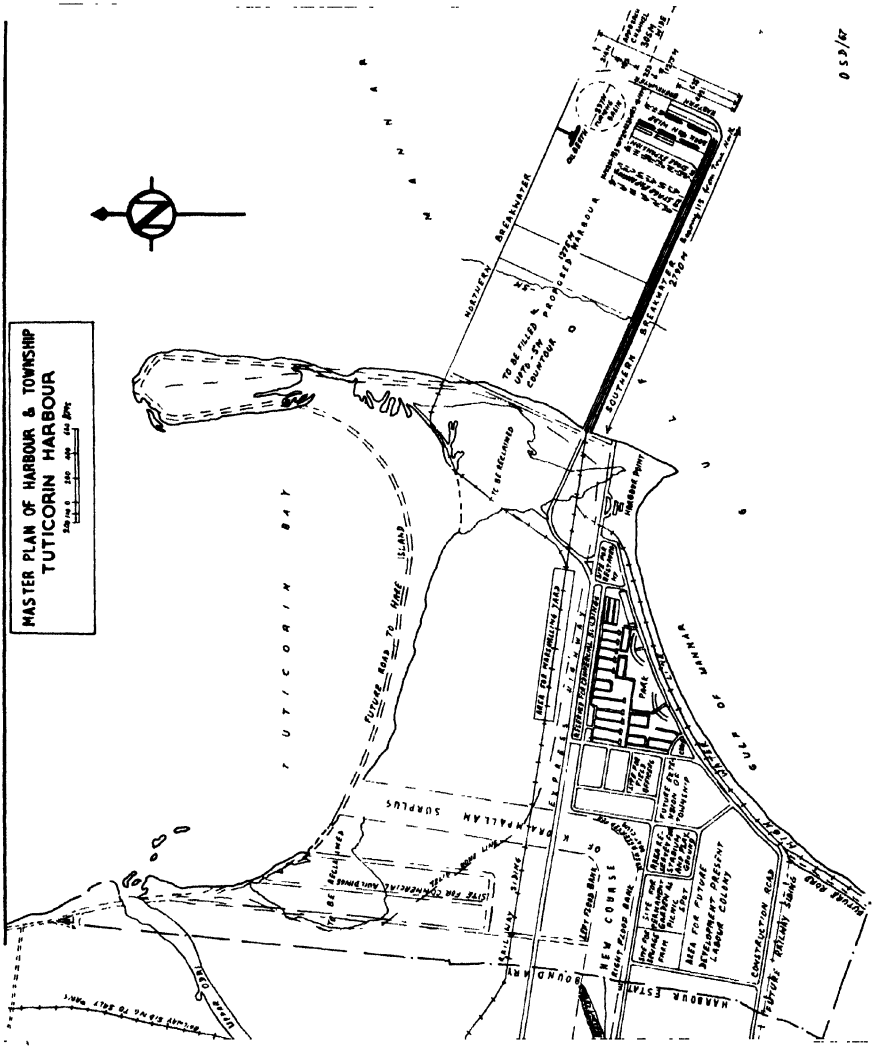
8.71 The installation of the oil berth may have to be deferred to 1970-71 when the matter may have to be reconsidered. This view is taken on the ground that as oil refineries are being set up at Madras and Cochin, it would not be economic to have distribution of oil from Tuticorin. No bunkering oil would be required at Tuticorin. The level of intake of oil in the hinterland would not give the port the minimum of traffic which is required for an economic throughput which is placed at 500,000 tonnes.

8.72 As the coal traffic for the public would be of the order of 0.6 million tonnes, in 1970-71 one berth would be necessary to deal with this traffic satisfactorily.[1] The salt traffic and the general cargo traffic can be dealt with separately at one berth. Depending upon the development of traffic by 1970-71, the further programme of construction of new berths could be considered. It is probable that one more berth may have to be added during the Fifth Plan.

8.73 We have predicted a traffic of between 0.4 to 0.5 million tonnes at the old jetties at Tuticorin. It is also necessary to confine the fishing facilities and the fish traffic to the old jetties so that it may not come in the way of ocean

1 In case, it is desired to move the railway coal by sea, another berth will be necessary for it.

MAP 19


MASTER PLAN OF HARBOUR & TOWNSHIP
TUTICORIN HARBOUR
TUTICORIN BAY
GULF OF MANNAR
SOUTHERN BREAKWATER
NORTHERN BREAKWATER
TO BE RECLAIMED
TO BE FILLED & RECLAIMED UPTO 5FM CONTOUR
FUTURE ROAD TO VAGAI ISLAND
AREA FOR WAREHOUSING YARD
EXTENSION TO CHIDAMBARANAR KOVIL
RAILWAY STATION
RAILWAY YARD
RAILWAY LINE
NEW COURSE
SURPLUS
HARBOUR ESTATE
AREA FOR FUTURE DEVELOPMENT PRESENT LAMBA COLONY
CONSTRUCTION ROAD
FUTURE ROAD
FUTURE ROAD TO SALT WORKS

shipping at the new port. The Madras Government's proposal to deepen the boat channel leading to the old jetties from 13 feet to 15 feet should be considered, particularly in view of the fact that the sailing vessels calling at the old port have tended to increase in size and tonnage since 1960-61.

8.74 To sum up, it is considered necessary to undertake the construction of a deep-sea port at Tuticorin and provide it with two deep-sea berths by about the end of the Fourth Plan. This is estimated to cost Rs. 17.5 crores. Besides, the improvement to the boat channel at the old port of Tuticorin will have to be undertaken at a cost of Rs. 31 lakhs. An additional deep-sea berth will have to be provided during the Fifth Plan at the new port site at Tuticorin, the estimated cost of which is Rs. 2.2 crores.

8.75 At Cuddalore, a programme of improvement is proposed by the Madras Government at a cost of Rs. 1.2 crores for deepening the bar, extension of wharfs, provision of transit sheds, etc. As the growth of the traffic at the port is highly problematic, what with the anticipated decline of iron ore traffic in the Fifth Plan, and the probable disappearance of coal intake for the railways, it would be necessary to proceed with these proposed investments cautiously. In case it is firmly decided to set up a pig iron plant at Cuddalore, then it will be necessary to undertake the proposed investment, as the traffic potential will touch a million tonnes in 1975-76. Capacity would then have to be augmented, and adequate facilities provided for handling alongshore.

Nagapattinam and Pondicherry

8.76 There is hardly any necessity for any major investment at Nagapattinam or Pondicherry. There may, of course, be some minor amenities and improvements which these ports may require; but we are not going into that question here.

The Sethusamudram Project

8.77 Though the proposed project is within the region, the incidence of its benefits will be countrywide as it concerns all shipping between coast to coast in India, and the through steamers from or to the west coast touching the ports on the east coast. For this reason no study is made of the project.

Fishing Harbours

8.78 There are already a number of schemes in the State to develop fishing harbours, e.g., at Ennore and Cuddalore. As a deep-sea port is being developed at a new site in Tuticorin, the old port can advantageously be developed as

a fishing harbour as it has a good record of export traffic in fish. The port of Colachal also deserves to be developed as a fishing harbour with mechanized vessels, and backed by cold-storage facilities and a good coastal road connecting all the fishing villages on its 68 km long coastline in the Kanyakumari District.

Chapter 9

Airports and Air Traffic

MADRAS STATE HAS airports at Madras, Madurai, Tiruchirapalli and Coimbatore. Those at Madras and Tiruchirapalli are first class airports. The other two are comparatively small.

9.2 The scheduled daily services that were in operation in the region on 18th April, 1965 were, (1) Madras-Tiruchirapalli-Trivandrum and back to Madras via Tiruchirapalli, (2) Madras-Bangalore-Coimbatore-Cochin and again back to Madras by the same route, and (3) Madras to Madurai direct and back to Madras.

9.3 More important for the economy of the region are the services from Madras northwards[1]. In 1962-63 there were four such trunk services linking up at Madras with the regional services, as also a local service to and from Hyderabad, and from Madras-Bangalore-Bombay and back to Madras by the same route.

9.4 Four questions that arise and have to be answered are:

(i) What is the volume of traffic carried at present by the services operating within the region?

(ii) Is the traffic at present constrained by the size and the quality of the airports and services? In other words if these were improved would there be a significant increase in the volume of passenger and goods traffic?

(iii) Would any change in Government regulatory or airline fares policy affect traffic volumes appreciably?

(iv) What rates of growth of traffic are probable over the next ten years and are these likely to be limited by the capacity of the existing airports?

9.5 In the following paragraphs the main features of the present and future traffic of the region and their bearing on airport capacity are discussed.

9.6 The regional air traffic was 22 passengers per day, arriving and departing, from 3 airports of the region in 1958-59; by 1962-63 this figure had risen to 67 per day. The average annual rate of growth registered during the period

1 These are: Madras-Nagpur (night service); Madras-Calcutta (two services); Madras-Delhi.

was about 51 per cent; more recently, however, this rate has been much lower, e.g., only 6.6 per cent between 1960-61 and 1962-63. Among the airports, Coimbatore showed a continuous growth of passenger traffic, both outgoing and incoming, during the entire period, except in 1961-62. At Madurai the same trend was observed in regard to incoming traffic, and at Tiruchirapalli in the case of outgoing traffic. The air passenger traffic between Coimbatore, Madurai and Tiruchirapalli was and continues to be insignificant, whereas the traffic between Madras and the three regional airports is substantially higher. Even so the daily average number of passengers between Madras and these three places is not appreciable in absolute terms, being only 11, 9 and 4 outward at Coimbatore, Madurai and Tiruchirapalli respectively and 8, 5 and 2 inward in 1962-63.

9.7 In terms of passenger kms the regional passenger traffic rose between 1958-59 and 1962-63, from 2.7 to 8.8 million, i.e., an increase of 225.9 per cent equivalent to an annual increase of 34 per cent. If the initial years of introduction of air services in the region be ignored, the average annual rate of increase of passenger kms comes only to 8.8 per cent.

9.8 The air passenger traffic of the region measured in passenger kilometres, when compared with the railway first class traffic between airport towns including towns[1] in their hinterland, constitutes 45.2 per cent, i.e., 14.56 million by rail as against 6.6 million by air in 1962-63.

9.9 Prediction of the regional air passenger traffic in 1971 is of some difficulty. The air services in the region are part of a wider service zone, and the services in the region began only from 1958-59 so that time series data are not available for more than five years. Even the available data for the different years are not strictly comparable because there have been changes in the schedule; timings have changed and some intermediate air stations are dropped or new stations added. Further, sometimes bookings are not available for the passengers and they are either put on the waiting list or they themselves choose other modes of transport; the IAC does not have any record of such rejections. Subject to these limitations, projections have been made by relating the number of passengers to the number of income tax assessees and/or the magnitude of the assessed income along with the time trend. The most reliable estimates are those which place the passenger traffic in 1970-71 between 38,000 per year. This means 104 passengers per day and implies a rate of growth of traffic of 5.65 per cent per annum between 1962-63 and 1970-71, as compared with the rate of 5.5 per cent between 1960-61 and 1962-63.

9.10 Assuming the same rate of growth of traffic between 1971 and 1976 as during the Fourth Plan period, it is estimated that the aggregate passenger

1 Including Madras which is outside the region.

traffic of the region will be about 50,000 in 1976, that is, about 137 passengers per day. The experience of the region in air traffic is somewhat recent, and more satisfactory projections of traffic will be possible in the light of further development of the air traffic during the next five years. For this reason the estimates for 1976 should be reviewed in 1971 and revised if necessary.

9.11 For relating the predicted years traffic to the capacity of the airports of the region, the distribution of the estimated aggregate regional traffic among the three airports of the region has also to be predicted. The distribution of the traffic of the region among its airports is made on the assumption that the present pattern would not change. On this assumption it is found that of the 104 passengers that will have to be handled every day at the airports of the region in 1970-71, 58 would be at Coimbatore, 35 at Madurai, and only 16 at Tiruchirapalli.

9.12 Before comparing airport capacity with the anticipated traffic at each airport of the region, the air freight and air mail traffic of the region may be briefly taken note of.

9.13 The air mail and air freight traffic of the region is not very appreciable in itself. The freight traffic rose from 191 kgs per day in 1958-59 to 1,393 kgs per day in 1962-63, the average annual rate of increase being 64 per cent during the period 1958-59 to 1962-63. But the average annual rate comes to 43 per cent only if the year of introduction be ignored. The air mail traffic in the same period rose from 222 kgs to 582 kgs per day, the average annual rate of increase being about 40 to 41 per cent. It is quite probable that more mail was diverted from other modes of transport to air, making the rate of growth appear higher than it would otherwise be.

9.14 Neither the airmail nor the air freight traffic was generally competitive with the passenger traffic for aircraft space, as usually all the passenger, mail and freight traffic offerings were accepted and cleared.

9.15 It is estimated that the air freight traffic and the airmail traffic of the region in 1970-71 would be of the order of 1.7 million kgs and 0.5 million kgs per year respectively, i.e., an average of 4,844 kgs and 1,364 kgs per day respectively. The estimates are 3.7 million kgs per year, or 10,140 kgs per day for freight traffic in 1975-76; and 0.83 million kgs per year, or 2,274 kgs per day for airmail traffic in 1975-76. The estimates of air freight traffic in 1970-71 were obtained by relating it to the growth of national income, and of airmail traffic by relating it to the population growth. The predictions for 1975-76 are based on the assumption that the respective rates of growth of freight and mail traffic would be the same as during the Fourth Plan. This assumption is made for the same reason as in the case of passenger traffic projection for 1975-76 and with the same qualifying remarks, vide paragraph 9.10.

9.16 At present the utilisation of airport capacity[1] is 16.7 per cent at Coimbatore, 12.5 per cent at Tiruchirapalli and 12.5 per cent at Madurai. The utilisation of present airport capacity would go up in 1971 to 20 per cent at Coimbatore and 16.7 per cent both at Madurai and Tiruchirapalli, if the expected increase in passenger traffic at each airport is taken into account. In the result, at every one of the regional airports there would still be more than 80 per cent of spare airport capacity. Clearly, the present capacity in the airports of the region is sufficient to cope with any foreseeable increases in traffic up to 1975-76 and no major airport investment is likely to be called for.

9.17 The basic conclusions that thus emerge are that:

(i) the air traffic in the region is not now appreciable in itself, and

(ii) even allowing for the fact that there has been a rapid expansion of air traffic in the region and a still more rapid expansion is to be expected in the years to come, the anticipted traffic up to the time horizon of the present study (i.e., 1975-76) is not such as to create any problems of airport or air service capacity, or involve any large investment

1 Airport capacity is expressed in terms of the number of planes that can be dealt with by an airport during a day of twelve working hours. Night hours are excluded as no permanent night flying facilities are provided at any of the regional airports. Utilisation is measured by the ratio of number of planes dealt with to what can be dealt with at an airport.

Chapter 10

Transport in Pondicherry

PONDICHERRY AND KARAIKAL settlements, which are included in the region under study, are treated separately in this chapter, since administratively their entity is separate from the Government of Madras State and the proposals for these areas have to be implemented by the Central Government.

10.2 The Union Territory of Pondicherry[1] comprises of four settlements isolated from each other, namely, Pondicherry, Karaikal, Mahe and Yanam. Of these, Mahe and Yanam, which are surrounded by Kerala and Andhra States respectively, are outside the scope of our study.

Our Approach

10.3 Our approach in this chapter is the same as in the case of the districts of Madras State. We first state the current economic and geographic features relevant to a transportation study such as this. We describe also the transportation facilities as now available. We then proceed to project on to the years 1970-71 and 1975-76 the economic factors relevant to transportation predictions, and make assessments of the transportation requirements in these two years, the physical assets they will call for and the investments that will be needed.

General Economic Data

10.4 Pondicherry settlement is about 160 kilometres south of Madras, and Karaikal is 160 kilometres further south. Pondicherry and Karaikal together have an area of 474 sq. kms of which 290 sq. kms are in Pondicherry settlement and the rest in Karaikal settlement. The population of Pondicherry and Karaikal as in 1961 was 369,000 and the density per sq. km was 778. As compared with the rest of the region covered by our study, Pondicherry area[2]

1 Pondicherry State wherever is referred includes the settlements of Pondicherry, Karaikal, Mahe and Yanam. Pondicherry area in the text refers to the two settlements of Pondicherry and Karaikal.

2 Pondicherry and Karaikal settlements are hereinafter referred to as Pondicherry area.

is more densely populated—778 per sq. km as against 248 in the rest of the region. This substantial difference, however, does not arise from the fact that the population features of this area are basically different from those of the region in Madras State. It is the result of the townships of Pondicherry and Karaikal covering relatively a substantial part of the total area of the two settlements.

10.5 The pressure of population on the land is much heavier in Pondicherry State than in the region in Madras State studied by us. The agricultural sectoral income in Pondicherry State in 1960-61 was 28.6 per cent of the State's income and it provided employment for 44 per cent of the workers. Agricultural productivity was somewhat better than in Madras State. The net value of agricultural output per hectare of gross cropped area was Rs. 754 in 1960-61 (Madras Rs. 700), and Rs. 574 per agricultural worker (Madras Rs. 530). The higher productivity in Pondicherry State is primarily due to its superior cropping pattern dominated by high value crops such as rice, sugarcane, groundnuts and coconuts. Taking the total population the income from agriculture per capita is only Rs. 95 and is thus lower than in Madras, Rs. 146, but this again is more a reflection of the relatively larger urban population than of any basic difference.

10.6 The particulars of irrigated area and of agricultural production in Pondicherry area in 1960-61 are set out in Tables 77 and 78. Sugarcane and paddy are the most important crops produced.

10.7 There is no information regarding the industrial income over a period of years. In 1961-62 the income from industry in Pondicherry State was of the order of Rs. 3 crores and constituted about 25 per cent of the total income of Pondicherry State. Sugar, textiles and yarn are the three important items of industrial output. There is one sugar factory with a daily crushing capacity of 800 to 1,000 tonnes. The annual production of sugar in 1962-63 was about 9,700 tonnes. The textile production in 1960-61 was about 5,200 tonnes while the production of yarn was about 6,400 tonnes. As earlier stated, figures are not available to estimate the rate of growth of output of industry.

10.8 The State income of Pondicherry State is estimated to have been Rs. 12.2 crores in 1960-61 at the level of prices then prevailing. The per capita income was Rs. 330.

Transportation Facilities Now Available

Railways

10.9 Pondicherry settlement is connected with Villupuram by a metre

gauge railway line of the length of 12.63 kms.[1] Besides Pondicherry, Villianur is the only other railway station in Pondicherry settlement. Karaikal is connected by a metre gauge branch line with Peralam in Thanjavur District, the length of the line being 16.01 kms.[1] Besides Karaikal, there are four railway stations within Karaikal settlement.

10.10 The existing railway facilities in Pondicherry and Karaikal settlements are adequate for meeting the current needs. In fact the present utilisation of rail facilities is very low. The charted capacity now available is 16 trains per day on Villupuram-Pondicherry section while the expected utilisation at the end of the current Plan period is 5 trains each day. On the Peralam-Karaikal line the charted capacity is 8 trains per day as against the expected utilisation of 2 trains per day in 1966. The present goods traffic density over the two branch lines is only about 203 and 63 freight tonne kilometres per route kilometre per day respectively, and the passenger traffic density 1,331, and 427 passenger kilometres per route kilometre. These traffic density figures are as against the corresponding averages for the entire railway sections lying within the region under study of 2,214 and 2,810. That the two sections are of very light traffic density is at once apparent.

Roads

10.11 Details about roads are given in Tables 79 and 80. The road network of Pondicherry and Karaikal settlements has a total length of 469.07 kms. Of these 236.1 kms are surfaced and 232.97 kms unsurfaced. The road mileage per 100 sq. kms of area is 104 kms, and per lakh of population 120 kms, as compared with the respective figures of 32 and 133 for the region excluding Pondicherry area.

10.12 During the First Plan, Rs. 16.8 lakhs were spent on transport and communication in the State and during the Second Plan, Rs. 66.23 lakhs. Out of the Third Plan provision of Rs. 87.75 lakhs as much as Rs. 60 lakhs were earmarked for road improvement. In the First Plan the entire outlay was spent on roads, while in the Second Plan only Rs. 38.03 lakhs were spent on roads, so that the Third Plan provision is about two-thirds higher than the Second Plan provision.

10.13 The increase in road length was practically negligible in the Second Plan period, being only 3 kms. The main emphasis was on conversion of unsurfaced roads into surfaced roads. Between 1955-56 and 1960-61 the unsurfaced road mileage fell from 318 kms to 233 kms and the surfaced road mileage increased from 168 to 255 kms. Through additions to unsurfaced roads, road length rose further from 489 in 1961 to 506 kms in 1962. The emphasis

1 These are the lengths within the settlement.

in the Third Plan is on the conversion of the main fair weather roads into all weather roads, bridging the important rivers and providing railway level crossings.

10.14 The roads maintained by the Government are in good condition; but those maintained by the communes need improvement. The financial position of the communes is not good and therefore the Government undertook to improve these roads during the Third Plan period. By the end of the Third Plan, it was expected that only about 110 kms of road would remain unsurfaced.

10.15 It is understood that some of the existing bridges and culverts will not be able to take heavy intensity of traffic and will need improvement.

Road Transport

10.16 The buses and trucks in the State are owned privately and at present the services they provide are fairly adequate for the transport needs of the people. Though the length of roads in the State has remained nearly stationary, the number of vehicles registered has increased, from 241 in 1956 to 1,106 in 1961 and further to 1,203 in 1962. These numbers pertain to all types of motor vehicles.

10.17 In Table 81 are given the details of the vehicles registered. The number of buses registered in the State rose from 25 to 86 between 1956 and 1962, i.e., an increase of 244 per cent in six years. The number of lorries increased from 28 to 141 recording an increase of nearly 403 per cent. In inter-State traffic the ratio of the number of buses and lorries of Pondicherry State to those coming in from outside, as in recent years, was, it is understood, of the order of 1 to 3.

10.18 No information is available about the operation of bullock carts in the two settlements.

Ports

10.19 Pondicherry settlement is served by Pondicherry port. It is an open roadstead provided with a new pier recently, and with a handling capacity of about 300,000 tonnes per annum. The traffic handled, in recent years, however, has been less than 10,000 tonnes per year. Karaikal settlement is served by the port of Nagapattinam which is in Thanjavur District and only about 20 kms away. This is also an open roadstead and also has plenty of spare capacity.

Traffic Carried and Trends Therein

Passenger Traffic

10.20 *By Railway:* In the years 1958-59 to 1962-63, the number of passengers booked at the stations in Pondicherry and Karaikal settlements are given

in Table 82. There have been appreciable fluctuations from year to year, and a substantial drop is noticeable in the latest year for which the figures have been given. In contrast, there have been striking increases in the number of buses registered as will be seen from Table 81.

10.21 *By Buses:* The number of buses registered for operation in Pondicherry and Karaikal settlements in 1962 were 81 and 5 respectively. These buses can be divided into three categories: *(i)* those operating within Pondicherry town, *(ii)* those operating within the two settlements, and *(iii)* those operating between the settlements and towns in Madras State. Out of the buses registered for operation at Pondicherry settlement 1, 2 and 78 respectively come in these three categories, the corresponding figures for Karaikal being nil, nil and 5.

10.22 In the case of the services between these settlements and places in Madras State and beyond, the operations are not only by some of the buses registered in Pondicherry and Karaikal but also by those registered in Madras State. Taking these buses also into account, the route kilometres and the passenger kilometres performed in each of the three services are estimated to have been as given in Table 83.

10.23 We have no precise statistics to indicate the rate of increase of passenger traffic in the past. But this can be inferred from the rate of increase of registration of buses as disclosed in Table 81. Between 1956 and 1962 the number of buses went up by 244 per cent.

Goods Traffic

10.24 The traffic carried by the railway from or to Pondicherry and Karaikal settlements in the year 1962-63 is set out in Table 84. Table 85 gives the trend in the traffic. Whereas the traffic at Pondicherry has been going up that of Karaikal has been steadily declining.

10.25 As for traffic carried by lorries, in the absence of statistics, it is not possible to give equally precise figures. We estimate, however, that in other than what we have defined as "Collection and Distribution Services" (vide Para 5.11) approximately 3,00,000 tonnes have been moved in the year 1963. The principal commodities carried were sugar, iron and steel, drugs and chemicals, timber, vegetables and fruits. No figures of the trends in this traffic are available or can be estimated.

10.26 Apart from the lorries permitted to carry inter-State traffic the rest of them carry goods locally within the settlement. We have no statistics indicating either the volume or the nature of the goods carried in them.

10.27 As earlier stated, we have also no statistics of the volume and nature of the traffic carried by bullock carts.

Economic Projections Relevant to Transportation

10.28 The background of anticipated agricultural and industrial developments, against which the future transportation requirements of Pondicherry and Karaikal settlements have to be predicted, is now briefly sketched.

10.29 The population of Pondicherry and Karaikal is expected to grow from 369,000 in 1961 to 393,000 in 1971 and 420,000 in 1976.

10.30 The anticipated production of agricultural crops in Pondicherry State in 1971 and 1976, for the more important crops such as paddy, other cereals, pulses, sugarcane and groundnuts, is set out in Table 86. Notably, sugarcane production is expected to grow from 1,14,000 tonnes in 1960-61 to 2,62,000 tonnes in 1970-71 and to 3,50,000 tonnes in 1975-76, and paddy output is expected to go up from 50,000 tonnes in 1960-61 to 80,000 tonnes in 1970-71 and 1,10,000 tonnes in 1975-76.

10.31 The particulars or anticipated industrial production in 1970-71 and 1975-76 are set out in Table 87.

10.32 Substantial advances in such industries as textiles, cement, sugar, paper board and yarn are expected to take place in the coming decade. Cement production is likely to commence during the Fourth Plan and may be of the order of 90,000 tonnes in 1970-71 and a further expansion to 1.5 lakh tonnes is expected of the year 1975-76. Sugar output is expected to go up from 9,700 tonnes in 1962-63 to 17,300 tonnes in 1970-71 and 25,900 tonnes in 1975-76. Paper and paper board is another industry which may be newly set up in the Fourth Plan period and produce 7,200 tonnes by 1970-71 and 14,400 tonnes by 1975-76. These are all transportation intensive industries and there will be a corresponding increase in the demand for transportation.

10.33 As a result of industrial and agricultural developments in Pondicherry State the regional income is expected to go up from Rs. 12.2 crores in 1960-61 to Rs. 21.7 crores by 1970-71 and Rs. 34.9 crores by 1975-76. These figures represent rates of growth of about 6 per cent and 9.7 per cent per annum compound.

10.34 The details of the per capita income, State income by sectors and the sectoral rates of growth are set out in Tables 88, 89, and 90. In 1960-61, the contribution of the railways to the State income of Pondicherry was 0.2 per cent, of road transport 2.9 per cent and of other modes of transport 0.2 per cent, making altogether a total of 3.3 per cent. It is anticipated that in 1970-71 and 1975-76, transport will contribute 4.4 per cent and 4.3 per cent respectively to the State income of Pondicherry.

Projections of Passenger Traffic and Goods Traffic to 1970-71 and 1975-76

Passenger Traffic

10.35 A picture of the volume of bus and rail passenger traffic at present is given in paragraphs 10.20 to 10.23. In the case of the rest of the region, we obtained projections of the aggregate passenger traffic on to the years 1970-71 and 1975-76 based on N.S.S. data on household expenditure and the time sequence statistics of aggregate passenger traffic. The same method is not available in respect of passenger traffic in Pondicherry and Karaikal settlements, as neither the required N.S.S. data nor time sequence figures of passenger traffic are available. We have been constrained to predict the future traffic in these two areas, by buses and by rail separately, based on the anticipated increase in the regional income of these settlements and our knowledge of the increase we anticipate in the nearby districts of Madras State. We anticipate that the railway passenger traffic will increase by 8 per cent in the period 1962-63 to 1970-71 and a further 2 per cent up to 1975-76. The increase in the bus traffic is likely to be far more substantial and is expected to be 12 per cent and 15 per cent per year in these two periods respectively.

Goods Traffic

10.36 So far as goods traffic is concerned, the anticipated demands for industrial products, raw materials and consumer goods in Pondicherry and Karaikal have been worked out and are set out in Tables 91 and 92. It is primarily on the basis of these estimates of consumption and those of production given in Tables 86 and 87 that the surpluses, deficits and traffic flows have been determined, commoditywise. The division of the traffic between the railway and the roads has been based on the present pattern of division of traffic for the particular commodity wherever possible. In other cases the general pattern of the present division has been adopted.

10.37 The commoditywise picture of the aggregate traffic in the two years 1970-71 and 1975-76 thus arrived at is presented in Table 92.

10.38 Whereas the State income of Pondicherry will go up by 168.5 per cent between 1962-63 and 1975-76, it is anticipated that the aggregate goods traffic of Pondicherry area in terms of tonnes will go up by 267.8 per cent, i.e., the rate of increase of goods traffic in terms of tonnes will be about one and a half times the rate of increase of the State Income.

10.39 The anticipated increase in railway traffic will result in an increase in the density of traffic from 255 tonne kilometres per route km per day in 1962-63 to 1,180 net tonne kms per route km per day in 1970-71. In terms of

trains this increase in traffic density will mean about two trains extra per day. The increase is not large and is well within the capacity of the present lines. So far as 1975-76 is concerned, a *decrease* to 980 tonne kms per route km per day is expected due to the anticipated diversion of traffic in iron ore for export to other ports.

10.40 The increase in goods traffic by road is expected to be by 113.5 per cent between 1962-63 and 1970-71 and by 69.8 per cent between 1970-71 and 1975-76 in terms of tonnes. This is in respect of traffic other than in "collection and delivery services". The traffic in these services will also correspondingly increase.

Investments Needed

10.41 Our predictions in respect of both passenger and goods traffic by rail call for no investments except in rolling stock. In the case of traffic by road, the anticipated traffic will call for 59 and 88 additional buses and 114 and 103 lorries by 1970-71 and 1975-76 respectively. The resulting financial investments are Rs. 78.5 lakhs and Rs. 87.5 lakhs in the two periods. These figures of number of lorries, buses and investments needed are after excluding the due proportion of Madras registered vehicles which will also continue to carry inter-State traffic on a reciprocal basis. Investments of Rs. 5.2 lakhs and Rs. 5.8 lakhs will also be needed on workshop facilities.

10.42 In order to prepare statements of the investments needed on individual sections of road to cope with the traffic, it would be necessary to have the figures of the number of vehicles of each type passing each of a number of selected census points on each of the main roads of the road network of the territory. This information is not available and it is recommended that immediate steps may be taken by the Pondicherry administration to take a census on the lines on which various State Governments, such as Madras, Mysore and Kerala have been conducting it.

Port of Pondicherry

10.43 Regarding the port of Pondicherry, the present traffic, the future prospects, and the likely industrial developments which are relevant to the growth of port traffic have all been dealt with in Chapter 8 of this Report. The conclusion to which our studies have led us is that since the provision of a new pier at Pondicherry, adequate port capacity exists to meet any foreseable increase in traffic up to 1975-76.

Conclusions

10.44 *(a)* No investments on railway lines will be called for, but investments will be needed in respect of rolling stock.

(b) Investment on lorries, buses and workshop facilities will be needed as indicated in Table 93.

(c) To work out investments for increasing capacity of individual sections of roads, it is recommended that the Pondicherry Administration conduct at their earliest convenience Road Census, such as, is conducted by the Madras Government. From such data, the investments on specific sections of road can be worked out. In the mean time the Road Investments suggested in the Techno-Economic Survey, mainly for better surfacing of 110 kms at a cost of Rs. 60 lakhs, and Rs. 40 lakhs for giving new links, together of the order of Rs. 100 lakhs between 1966 and 1976, may be provisionally accepted.

(d) There is no need for any major investment on the port.

Chapter 11

Summary of Findings and Conclusions

THE REGION COVERED by this study comprises nine out of thirteen districts of Madras State and the settlements of Pondicherry and Karaikal. It has an area of 1.06 lakh square kilometres and has a population of 26.6 millions as per the Census of 1961. The density of population works out to 250 per sq. km as against 146 for the country as a whole. (Paras 2.3 & 2.4)

Transport Facilities Now Available

11.2 The transportation facilities available in the region are :

1. railway lines 2,942 kms long, of which 2,420 kms are in metre gauge, and 522 kms in broad gauge;
2. a road network 35,286 kms long, of which 24,996 kms are surfaced and 10,290 kms unsurfaced;
3. inland waterways, over a small stretch of 57 kms;
4. four sea ports, namely, the intermediate port at Tuticorin and the minor ports at Nagapattinam, Cuddalore and Pondicherry; and
5. the airports at Coimbatore, Madurai and Tiruchirapalli. (Para 2.39)

11.3 This region, at one end of peninsular India, has not suffered in the past from any critical inadequacy of transportation facilities such as was faced in the iron and steel belt. It had, however, its own local problems which are referred to further on. (Para 2.40)

11.4 The aggregate expenditure on transport by the transport users in the region in 1963 was about Rs. 59 crores or nearly 6.0 per cent of the regional income. Of the total expenditure on transport 72.2 per cent was on road transport against only 26.9 per cent on rail transport. Road transport, whether for passengers or for goods, is thus in a dominant position.

The Railways

11.5 The railway route kilometres in the region is 2.77 per 100 sq. kilometres and 11.07 per lakh of population compared with 1.84 and 12.81 for the country as a whole. (Para 2.41)

11.6 The problems in the past in the case of the railways in the region

related not to any inadequate capacity of the system within the region itself but to shortage of capacity over the 'North-East' and 'North-West' lines of the Southern Railway, via Waltair-Vijayawada and via Raichur. The region's requirements of coal, steel, grams and pulses have to come regularly and in substantial quantities from the north through these junction points. These commodities needed by the other areas in the south have also to be similarly drawn from the north over the same routes. Restrictions in booking over these routes have been persistent due to want of railway section capacity. Many measures to augment capacity over these sections have been taken by the railway and they are bearing fruit. By the end of the Third Plan period this particular problem is expected to be eliminated. (Para 2.44)

11.7 The Southern Railway has had to face losses annually particularly in the operation of their metre gauge sections. The losses can be attributed to *(i)* low density of goods traffic, *(ii)* steadily rising cost of fuel, *(iii)* working of certain uneconomic trains, branch lines and "Train Halts", and *(iv)* intense road competition in the carriage of passengers and high rated goods.

The Road System

11.8 The road system of the region, so far as its length is concerned, is much in advance of what obtains in the rest of the country, whether judged by the number of road kms per sq. km of area or per lakh of population. The ratio of surfaced to unsurfaced mileage is also substantially better. In fact the road mileage in the region has already surpassed the 1981 target of the "Bombay Plan" for 1961-81. (Para 2.48)

11.9 The problems which the road users encounter in the region relate not so much to the length of roads as to sectional capacity due to want of adequate width, alignment and accessibility. (Para 2.51)

11.10 The growth of traffic density between 1950-51 and 1960-61 for mechanised vehicles and bullock carts taken together has been at a rate of 8 per cent per annum, so that during the decade the total density has more than doubled. This increase is almost entirely due to the growth of motor vehicular traffic which increased at an annual rate of 12.6 per cent. The bullock cart traffic has remained more or less stationary in absolute terms. (Para 2.53)

11.11 Both in respect of traffic density and its rate of growth, the different categories of roads can be ranked in the descending order of magnitude as follows:

(1) National highways, (2) State highways, (3) major district roads, and (4) other roads.

This means that the roads with heavier traffic densities are also those with higher potentials for future growth. (Para 2.54)

11.12 Based merely on the previous growth rates of traffic, there is no room for any doubt that the problem of augmenting sectional capacities of the roads to meet anticipated demands will be very pressing in the future even in this region which is very much in advance of the Bombay Plan targets in the matter of road mileage. Over many sections the existing roads will have to be given a wider "black top". (Para 2.54)

11.13 In the context of the need to speed up road traffic in the future, so that the road system can handle considerably larger volumes of traffic at lesser unit costs, it may be necessary to straighten out road alignments particularly in districts like Thanjavur where they are tortuous and circumambulatory. Cost of land to be acquired is no doubt high at present, but if this problem is postponed the costs will be much higher later on. (Para 2.55)

11.14 Even though road accessibility in this region has generally satisfied the norms of the Bombay Plan, it is poor in certain hilly and forest areas, and also in the interior of certain districts such as Ramanathapuram. (Para 2.56)

Mechanised Road Transport Services

11.15 The region is notable for its very well organised road services which are intensely competitive with the railway services for the carriage of both passengers and goods. This competition has been facilitated by the fact that 94 per cent of the railway lines in the region have roads close to and parallel to themselves. (Para 2.57 *et. seq.*)

11.16 The long distance express bus services run by the State Government are a special feature of passenger transport services in this area. These services compete with railway travel. They have been particularly successful alongside the metre gauge lines specially for journeys where railway travel involves change of trains at intermediate junctions.

11.17 Some of the best organised units of the road goods transport industry in the country are to be found in the region. Nearly half the vehicles in the industry are operated by such organised agencies. Goods vehicles running to a time schedule, particularly for the conveyance of parcels and smalls, in standard closed vehicles of 110 maunds carrying capacity, is a special feature; but unions of operators acting together to secure patronage are conspicuously absent in the region. (Paras 2.57 & 2.61)

11.18 The problems of the road transport industry in the region are the same as those generally faced elsewhere in the country. They pertain to the level of taxation, the procedures adopted for licensing and the difficulties in obtaining spare parts and financial accommodation at reasonable rates of interest. (Para 2.64)

Bullock-carts

11.19 Bullock-carts are used mostly for carrying goods over distances up to 40 kms. The volume of the traffic carried by them has been stationary over the last few years. (Paras 2.65 & 2.66)

Cycles

11.20 Cycles are coming in larger numbers on to the roads in and around all the towns and even in the rural areas. The number of cycles in the region has gone up at an annual rate of 15.3 per cent compound between 1960-61 and 1962-63 and the expected rate of future growth up to 1975-76 is higher, being 10.1 per cent annum. The cycles are most likely to raise problems of capacity in the future in road sections in and around industrial and other work centres.

The Inland Waterways

11.21 The only inland waterway in the region is the Vedaranyam canal, the traffic on which has been very modest, about 10,000 tonnes or less per year. There has been no problem in meeting the demands for transportation on this canal and no problems are anticipated in the future. (Para 2.67)

The Ports

11.22 The ports of the region—Tuticorin, Cuddalore, Nagapattinam and Pondicherry—have generally been adequate in their capacity to meet traffic demands. At Tuticorin, however, traffic has been pressing on capacity to such an extent that the need for deep sea berths has been felt for some time, and at Cuddalore shipping has had to contend with somewhat poor facilities. (Paras 8.61 & 8.62)

Air Services

11.23 Air services in the region are not always conveniently scheduled to meet the needs of the local population but otherwise have been by and large adequate and satisfactory. Airport capacity is very much in excess of traffic demands. (Para 9.16)

Economic Data Relevant to Transportation Planning

11.24 The region is experiencing an annual rate of growth of 5.3 per cent in its income during the current Plan period. This rate is much faster than that during the Second Plan period when it was at 3.9 per cent.[1] The per capita income is expected to go up from Rs. 338 to Rs. 412 during the Third Plan period. (Paras 3.15, 3.18 & 3.20)

1 This is the estimate of NCAER. The State Government's estimate is 2.6 per cent.

11.25 During the decade from 1966, the regional income is expected to grow at an accelerated pace, with an average annual rate of between 6.1 and 6.2 per cent. The rate of growth of industrial output is expected to be around 10.0 per cent. For agriculture the annual rates of growth of output envisaged are 5.1 per cent, 4.9 per cent and 2.9 per cent in the Third, Fourth and Fifth Plan periods respectively, the declining rate being mainly due to the meagre possibilities of further sources of irrigation. (Paras 3.18 & 3.19)

11.26 Though the rates of growth anticipated in the agricultural sector are lower, still important agricultural achievements are expected in the future. The surplus position in respect of rice, which has been achieved by the State during the last decade, would be further strengthened and exports to adjacent States are expected to go up appreciably. Even more important, this achievement is likely to be repeated in the case of sugarcane and sugar manufacture. The region, which now imports sugar, is expected during the next ten years to commence and then increase its exports of sugar. (Paras 2.13 & 2.14)

11.27 Resulting from the developments in industry and agriculture, the per capita income is expected to rise from Rs. 412 in 1966, to Rs. 522 in 1971 and to Rs. 655 in 1976, all in terms of 1960-61 prices. (Para 3.20)

Passenger Traffic—Present Position and Projections

11.28 The principal means of passenger transportation in the region are the buses and the trains. Their relative importance in the carriage of passengers may be judged from the fact that in 1962-63 in terms of passenger kilometres, they carried, respectively, 71.5 per cent and 24.5 per cent of the aggregate passenger traffic. The balance of 4 per cent of passenger traffic in the region was by cars and taxis. (Para 4.7)

11.29 If attention is confined only to the sections over which both the buses and the trains provide services, their relative shares in 1962-63 were 43.1 per cent and 56.9 per cent. (Para 4.9)

11.30 The rate of increase of passenger traffic, by road and by rail taken together, between 1956-57 and 1962-63 was 6.9 per cent. Whereas the rate of growth of traffic by buses was 10.2 per cent, the traffic by trains limped far behind and grew at a rate of only 0.2 per cent. (Para 4.25)

11.31 Breaking down the traffic by lead groups, it is found that between 1956-57 and 1962-63 the railway traffic of the region in lead group of less than 80 kilometres declined by 3.7 per cent, while that with leads over 80 kilometres increased at 3.2 per cent per year. It is the latter which has helped to sustain the railway traffic. (Para 4.17)

11.32 We have projected on to the years 1970-71 and 1975-76 the aggregate

passenger traffic in the region by bus and by rail taken together. This has been based on N.S.S. sample data regarding expenditure on travel by buses and trains in the year 1957-58 and the known volumes of traffic by trains and by buses in the years 1957-58 and 1962-63. The process adopted has enabled us to break down the total traffic into two components, namely, personal journeys and business travel and also to predict the changes with time in the propensity to spend on travel either on account of personal reasons or on business. (Para 4.39 *et. seq.*)

11.33 It is estimated that the anticipated aggregate passenger traffic by trains and by buses in 1970-71 and 1975-76 would be respectively 1.9 times and 2.6 times the traffic during 1962-63. In the year 1962-63 the level of traffic was 11,266 million passenger kilometres. It is expected to be 21,681 million passenger kilometres in 1970-71 and 29,667 million in 1975-76. (Paras 4.42 & 4.54)

11.34 We have attempted to assess, quantitatively, the extent to which different factors influence a prospective passenger in his choice of the mode of transport. Field studies were made on four selected sections to observe and record, quantitatively, each of these factors, as also the resulting division of traffic as between the trains and buses. The factors taken into account are fare differences, differences in the time taken by train and by bus in covering the journey, differences in walking distances to railway station and bus stand, expectation of availability of seats in the buses and the relative frequency of services by rail and by bus. A regression analysis was made of the factual data collected. The analysis disclosed correctly the nature of the effect of each factor on the division of traffic; but we do not have sufficient confidence in the exact value of the coefficients we obtained to make use of them for predicting the division of traffic in future. Certain morals can, however, be drawn from them which have a bearing on policy. For example, it is noted that the choice of the mode of transport is very sensitive to fare differentials between buses and trains. Also the factor next in importance affecting the ratio of division significantly is the relative frequencies of the two competing services. Other things being equal, it was found that the travellers attached relatively much less significance to relative travel and waiting times. Our observations were confined to a few sections and only up to the distance of 52 kms. More studies and on a wider scale alone will help to get coefficients on which a greater quantitative reliance can be placed. (Paras 4.27 to 4.32)

11.35 We were, in the circumstances, left to use the past trends for our estimates of the future divisions of traffic between the buses and the trains. Our estimates are that in 1962-63 the bus traffic will increase by 216 per cent in 1970-71 and by 308 per cent in 1975-76 of that in 1962-63. The short lead railway passenger traffic is expected to remain stationary while the long distance traffic

is expected to be 1.57 times the present traffic in 1970-71 and 1.76 times in 1975-76. (Para 4.54)

11.36 The anticipated aggregate growth in passenger traffic by rail and by road has been broken down by districts and then by individual road and rail sections, making due allowances for known local factors. (Paras 4.4 to 4.8 & Paras 6.24 to 6.34)

Long Distance Express Buses

11.37 The long distance express bus services which are in operation in the State since 1958-59 raise important issues of policy and therefore our findings and conclusions about them are presented here in some detail.

11.38 In 1963-64 there were 72 long distance express buses in operation in the region on a total route kilometrage of 7,872, performing 27,178 bus kilometres per day. The traffic registered was 174.45 million passenger kms in 1962-63. For lengths of journeys over 80 kms the traffic in these buses was 8.8 per cent of similar traffic over the railway.

11.39 In respect of travel time, the railway has a definite advantage compared with the long distance express bus in the case of pairs of stations served by the broad gauge main line sections It has a slight advantage in the case of pairs of stations on the metre gauge main line sections. Where the railway journey is partly over the main line and partly over other sections, the advantage in regard to travel time shifts distinctly to the bus services.

11.40 The basic fares charged for the express bus services are approximately 20 per cent more than the corresponding third class mail train fares.

11.41 In cases in which the railway journeys are entirely over the broad gauge main line sections, e.g., Madras-Salem or Madras-Coimbatore, the proportion of the total traffic between the terminal points moved by the bus is not very significant. In the case of similar journeys over the metre gauge, the proportions of the bus traffic, though larger than in the case of corresponding journeys on the broad gauge, are still not very large in themselves. It is in the case of routes lying partly over the main line and partly over the branch lines of the railway that the share of the express bus traffic is a considerable proportion of the total and in some cases even greater than the share of the railway.

11.42 The reasons for the division of traffic in this manner are not far to seek. They are the relative journey times by rail and by bus and the need to change trains at junction stations in some cases. Also, that a faster train is not available during day time and at or about the particular hour preferred by passengers is another important consideration in the preference for the buses where it exists.

Town Bus Services

11.43 There are town bus services in 23 towns of the region, the town sizes varying in population from 27,000 to 425,000. 406 buses are in operation in these services and the number of passengers carried is about 194 million. In terms of passenger kms the traffic is 674 million or 8 per cent of the passenger kms by buses in inter-city traffic. It is expected that this traffic will go up by 12 to 15 per cent per annum depending upon the size of the town, its working force and industrial income and their rates of growth. (Paras 4.67 & 4.68)

Air Transport

11.44 Travel by air is to some extent an alternative to railway first class journeys. The number of rail journeys in first class from airport-towns and towns in their hinterland was 28,600 in the year 1963. The number of comparable air journeys was 14,159 in 1963, i.e., 49.5 per cent of first class railway journeys from the airport towns and the towns in their hinterland. In absolute terms the number of air journeys averaged only to about 39 per day and it is estimated that the three airports of the region will handle a daily traffic of about 104 passengers per day in 1971 and 137 in 1976. It is found that the airport facilities will be quite adequate to meet the needs of the traffic even in 1975-76. (Paras 4.66, 9.9 & 9.10)

Journeys in Private Cars and Taxis

11.45 Inter-city journeys by private cars and taxis are also in the same category as first class rail journeys. In 1963, the inter-city travel in private cars and taxis was about 472.2 million passenger kms, i.e., about 13 times the passenger kms of first class rail travel in the region. The inter-city traffic by these two means of transportation was, however, only 4 per cent of the aggregate inter-city passenger traffic in all classes and by all modes of transport. It is estimated that this traffic in 1971 will be 2.38 times and in 1976, 3.90 times the traffic in 1963. (Paras 4.64 & 4.65)

Goods Traffic— Present Position and Projections

11.46 The goods traffic of the region in 1963 is estimated to have been 5.84 million tonnes by railway, 16.09 million tonnes by public carriers' vehicles, 1.57 million tonnes by private carriers' vehicles and 25 million tonnes by bullock-carts. In terms of tonne kms, which gives a truer picture of transportation performance (as it allows for differences in lengths of haul), the traffic was 2,378 million tonne kms by rail, 1,563 by public carriers' vehicles, 349 million by private carriers' vehicles and 500 million by bullock-carts. In other

words, 49.7 per cent of the goods traffic went by rail, 39.9 per cent by public and private carriers' vehicles taken together, and about 10.4 per cent by bullock-carts. (Para 5.10)

11.47 A distinction is made between "Long and Medium Distance Transportation Services" and "Collection and Distribution Services", the latter expression covering all transportation within 40 kms. This distinction is made as, in the case of the former, the competition is between the railway and lorries, and in the case of the latter, between bullock-carts and lorries. The division of traffic was 19.8 per cent in Collection and Distribution Services and 80.2 per cent in Long and Medium Distance Transportation. Bullock-carts accounted for 52.7 per cent of the transportation in Collection and Distribution Services as compared with the motor vehicles, 47.3 per cent. In Long and Medium Distance Transportation, the railways accounted for 61.9 per cent of the traffic as against the road vehicles, 38.1 per cent. These latter percentages are relative indices of the extent of competition between railways and the mechanised road vehicles as it now prevails. (Paras 5.11 to 5.15)

11.48 During the period 1956-57 to 1962-63 the originating goods traffic of the railways increased by 2.1 per cent per annum compound and the terminating traffic by 4.8 per cent. In terms of tonne kilometres (which covers both originating and terminating traffic), the increase was at 6.9 per cent. (Para 5.20)

11.49 In the absence of statistics we had indirectly to infer the relative annual increase in the goods traffic by lorries in the region. Between 1956-57 and 1962-63 it was about 16.6 per cent per annum. The significantly higher rate of growth of the goods traffic by lorries should not be missed. (Para 5.22)

11.50 Looking more closely at past trends, particularly the trends in railway traffic, a drop in the railway traffic in the case of the high-rated commodities, as high as 51 per cent in the ten-year period, 1952-53 to 1962-63, is noticed. In sharp contrast with this decline in high rated traffic is an increase of 39 per cent in the low rated commodities such as coal, manures, ores, cement, etc. It is these commodities, which have helped to sustain and improve the goods traffic of the railways. (Para 5.24)

11.51 There is little room for doubt that the impressive fall in the high rated traffic of the railways in the region, particularly in a period of economic expansion, is due to the competitive diversion of traffic to the road services. (Para 5.25)

11.52 We made projections of production and consumption on to the years 1970-71 and 1975-76 in the case of the more important agricultural and industrial commodities using methods appropriate to each item. The units of area adopted for the purpose were either individual towns or taluks wherever

this was possible. Where it was not possible each district was taken as the unit. (Para 5.28)

11.53 From projections of production and consumption for the more important commodities we identified the areas of their surplus and deficit. Making the assumption that flows from the areas of surplus to those in deficit would be such as to minimise the tonne kilometres of transportation, we predicted the quantum and pattern of desire for movement in the aggregate whether by road or by rail, in the years 1970-71 and 1975-76. (Para 5.29)

11.54 In regard to the other commodities we estimated the aggregate tonnage that will have to be transported based on the rate of economic growth, without being able to state the particular points or areas between which there will be movements (Paras 5.35 & 5.36)

11.55 Our estimate is that the total regional goods traffic by road and by rail in medium and long distance transportation would rise from 16.75 million tonnes in 1962-63 to 32.8 million tonnes in 1970-71 and to 51.4 million tonnes in 1975-76. (Table 46)

11.56 We have next proceeded to allocate the anticipated aggregate traffic by road and by rail between these two main modes of transport. In the case of the more important commodities (for which we have predicted the aggregate flows between specific points or areas) we have made the allocation according to their present pattern of division over different lengths of haul. For another group of commodities, their known "flows" in the past are suitably inflated based on their anticipated production or consumption. The residuary commodities, which are not individually important, are assumed as moving to the same pattern in the aggregate as the commodities in the first two categories. (Paras 5.32 to 5.38)

11.57 The process adopted has enabled us not only to distribute the traffic in medium and long distance transportation between the railway and the road services but also to attribute each item of traffic to specific sections of rail and road. (Paras 5.32 to 5.38)

11.58 The aggregate traffic in collection and distribution service in 1970-71 and 1975-76 is estimated on the assumption that in these years also it will bear the same relation to tonnage of traffic in medium and long distance transportation as in 1962-63. The traffic by bullock-carts, it is assumed, will go up by only 20 per cent in 1970-71 and by a further 10 per cent by 1975-76. The rest of this traffic is expected to move by lorries and is suitably distributed over different sections of roads. (Para 5.38)

11.59 The aggregate goods traffic is expected to divide between road and rail in the year 1970-71 in the ratio of 43 to 57 in terms of tonne kilometres. The average annual rate of increase of goods traffic on the railway would be

6.1 per cent per annum between 1962-63 and 1970-71 and 9.1 per cent per annum between 1970-71 and 1975-76. The corresponding figure for lorry traffic, including those in collection and distribution services, is 9.6 per cent per annum and 10.6 per cent per annum. The bullock-carts would gain traffic at 2.3 per cent per annum between 1962-63 and 1970-71 and 2.0 per cent per annum between 1970-71 and 1975-76. (Tables 38 & 47)

Comparison of Present Rail Capacities with the Anticipated Traffic Densities

11.60 The "section capacity" available over each section of railway in the region in 1962-63 is first compared with the traffic density in that year. A similar comparison is then made in respect of the position that is expected to prevail at the end of the current Plan period. It is found that the section capacities were adequate to meet the traffic needs in 1962-63 and are also expected to be adequate at the end of the current Plan. (Para 6.6)

11.61 A similar examination is made in respect of the capacities of the important marshalling yards, goods sheds and tranship sheds. Their capacities are found to be adequate so far as traffic expectations up to the year 1965-66 are concerned. (Paras 6.7 & 6.8)

11.62 As a first step towards assessing the section capacities that will be needed in 1970-71 and 1975-76, the anticipated traffic densities over each section of railway worked out in terms of "passenger kilometres per route kilometre" and "net tonne kilometres per route kilometre" are converted into "train kilometres per route kilometre". In doing so due note is taken of the fact that the increase in the railway passenger traffic in the future will be almost entirely in the relatively longer distance traffic, so that any appreciable strengthening of the existing short distance trains cannot be expected to cater to the anticipated additional journeys. In the case of goods traffic, attention is focussed on the traffic in the "direction of loads". The traffic densities in terms of "net tonne kilometres" are first converted in terms of "wagon kilometres" making due allowance for the difference in the loadability of commodities. Then taking due note of the nature of motive power expected to be used and the average train load expected to be achieved over each section in the direction of heavier traffic, the figures are converted into "train kilometres per route kilometre per day". (Paras 6.10 & 6.11)

11.63 The anticipated traffic density figures for goods and passenger traffic thus worked out being in a common unit, "train kilometres per route kilometre per day", are added together and integrated. The resulting figures for each section for 1970-71 and 1975-76 are then compared with the capacity

expected to be available by the end of the Third Plan period on that section, after making due allowance for the paths required for departmental trains. (Paras 6.12 & 6.13)

11.64 It is found that in the year 1975-76, of the total railway route kilometres of 2,942 in the region, additional section capacity will be needed over 1,596 kilometres. The resulting position is pictorially depicted in Map 16. Additional railway sectional capacity will need to be provided over most of the metre gauge and broad gauge mainline sections within the region, and over the Tiruchirapalli-Erode broad gauge section and the Tiruchirapalli-Karaikkudi metre gauge section. It will also be needed over the Vridhachalam-Salem and Neyveli-Vridhachalam sections, should the steel plant in this area materialise. (Para 6.14)

Comparison of Present Load Capacities with the Anticipated Traffic Densities

11.65 To make a similar comparison of the capacities of the several sections of roads with the anticipated traffic densities in 1970-71 and 1975-76 the difficulties arising from the absence of any traditionally accepted standard of road capacity and in integrating the traffic moving in different types of vehicles such as cars, bullock-carts, cycles, etc., are stressed. The results of certain speed tests conducted by the Madras Highways Research Centre are given along with the capacity standards derived by us therefrom as also the "passenger car equivalents" adopted by us for the different types of vehicles. (Paras 6.16 to 6.23)

11.66 Apart from the basis adopted by us to project the passenger traffic by buses and the goods traffic by lorries and bullock-carts referred to earlier, the basis adopted for projecting on to 1970-71 and 1975-76 traffics in private cars, cycles, hand-carts, etc., are stated. (Para 6.30)

11.67 The anticipated aggregate traffic on each section of the road network is built up in terms of 'passenger car units' by adding together the figures in that unit pertaining to: (*a*) Medium and Long Distance transportation by lorries, (*b*) transportation in Collection and Distribution Services by lorries and bullock-carts, *(c)* bus traffic, and *(d)* traffic in cars and other fast moving vehicles, cycles, etc. A comparison is made of the anticipated road traffic density over each section of the road in 1970-71 and 1975-76 thus arrived at with its capacity based on the standards we have explained and adopted. (Paras 6.24 to 6.31).

11.68 This comparison has revealed that in the year 1975-76, out of 34,817 kms of roads in the region the traffic will be in excess of capacity over 10,936

kms. The position is pictorially depicted in Map 17, so far as the national highways and State highways are concerned. (Paras 6.33 & 6.34)

Matching Railway and Road Capacities with Anticipated Traffic Densities : Investments Needed

11.69 The various alternative means available for increasing railway section capacity are stated, giving for each alternative an estimate of the extent to which it can increase the capacity. (Paras 7.2 and 7.3)

11.70 Certain broader aspects of transport planning are stated with reasons. These are:

(i) that the ground assets[1] required for increasing transportation capacity cannot and should not be designed for each Plan period just to match the traffic density then anticipated. Planning and execution have to be on a long-term basis. Broad objectives over a wider time horizon have first to be conceived and our immediate requirements appropriately fitted into an integrated scheme to achieve those objectives; and

(ii) that it is substantially costlier to haul a tonne of goods over the metre gauge than over the broad gauge. In the case of a metre gauge single line, the traffic density over which is expected to reach the limit of its capacity, it would be a substantial advantage if it is converted from metre gauge to broad gauge instead of from single line to double line metre guage. This is particularly so when it is the goods traffic that is expected to grow appreciably. (Paras 7.5 to 7.9)

11.71 Comparison of the section capacity expected to be available over each section of railway by the end of the current Plan period with the traffic density expected in 1975-76 clearly shows that most of the metre gauge main line sections in the region will be reaching the limits of their capacity before that year. There is nothing to commend the doubling of these metre gauge lines for providing the additional capacity needed. Such a course will be uneconomical and will also not be in keeping with the long-term needs of the area. These lines must be converted into broad gauge and the only question for detailed consideration really is the phasing and time schedule of such conversion. (Para 7.10)

11.72 It will be an advantage to take up simultaneously for consideration the benefits that will accrue from a new broad gauge line from Salem to Dindigul, via Karur. Such a line has certain *prima facie* advantages. It will make the broad gauge route from Arkonam to Dindigul and beyond 17 kms

1 As distinct from rolling stock assets.

shorter than the existing metre gauge route via Chingleput, Vriddhachalam and Tiruchirapalli. Even from Madras, the opening of such a line will make the broad guage route to Dindigul and beyond only 59 kms longer than the existing shortest metre guage route. (Para 7.11)

11.73 The following two alternative phasing programmes for conversion from metre gauge to broad gauge are put forward:

1st Alternative

1st Phase—Villupuram to Madurai, via Vriddhachalam, with a new broad gauge line from Madras to Villupuram.

2nd Phase—Madurai to Maniyachi and thence to Tuticorin and Tirunelveli.

3rd Phase —Madras to Tiruchirapalli, via Thanjavur.

2nd Alternative

1st Phase—A new broad gauge line from Salem to Virudhunagar.

2nd Phase—An additional broad guage line from Madras to Villupuram and conversion of the section Villupuram-Dindigul, via Vriddhachalam into broad guage.

3rd Phase —Conversion of Madras to Tiruchirapalli, via Thanjavur and Virudhunagar to Maniyachi and thence to Tuticorin and Tirunelveli into broad gauge. (Para 7.15)

11.74 The aspects kept in mind while recommending the phasings are stated. They are:

(i) that it is particularly in the case of goods traffic that the maximum benefits accrue from the conversion from metre guage to broad gauge; so sections with heavier goods traffic density should be taken up for conversion first; and

(ii) that in the case of passenger traffic, as far as possible, transhipment should not be forced on large streams of traffic, and where it is inescapable the points of transhipment should be such that it can be done during convenient hours. (Para 7.14)

11.75 An opinion as to the choice between the two alternatives that have been given can be expressed only after analysis of detailed point to point figures of both passenger and goods traffic between Dindigul and south thereof on the one hand and the area north thereof on the other. This data we do not have and its collection will take time. Also, the question will have to be examined as to what the implications are of the second alternative in regard to the transportation facilities available and expected to be available over the Salem-Madras section, an area outside the region covered by our study. Therefore, the choice between the two alternatives has been left to the Southern

Railway administration which is in the best position to carry on our analysis further. It is pointed out at the same time, however, that apart from the relative financial returns from the investments involved in the two alternatives, the second alternative holds three important advantages of a general character. Firstly, it calls for lower investment in the Fourth Plan period as compared with the first alternative; secondly, it will relieve the Madras-Tiruchirapalli section of appreciable volumes of traffic during the period construction works will have to be undertaken thereon, and lastly it will provide an additional alternative broad gauge route for long term use. (Para 7.16)

11.76 Whichever be the alternative chosen, what we envisage is that the Phase 1 be taken in hand and completed in the Fourth Plan period and that Phases 2 and 3 be completed in the Fifth Plan period or subsequently depending on the rate of growth of traffic during the Fourth Plan period. (Para 7.17)

11.77 Over the Tiruchirapalli-Karaikkudi section the shortfall in capacity anticipated is really on account of the sub-standard single line facilities now available. The situation can be met by the use of heavier types of engines and the provision of additional crossing facilities. (Para 7.18)

11.78 Over the Vriddhachalam-Salem section, what steps should be taken to provide additional sectional capacity will depend on the location and capacity of the steel plant to be sited in that area. (Para 7.18)

11.79 The line between Jalarpet and Shoranur will have to be doubled and the work should be completed by the end of the Fourth Plan period. (Para 7.19)

11.80 Over the Erode-Tiruchirapalli section, the existing single line will continue to be adequate. What will be needed are heavier types of engines and/or better crossing facilities. (Para 7.19)

11.81 Investments will also be needed on engines, wagons, passenger coaches and workshop facilities for the increased traffic anticipated over all sections. Goods sheds, transhipment sheds and marshalling yards will need to be extended. We have given our traffic estimates for 1970-71 and 1975-76, not only in the aggregate but by individual sections. On the basis of these figures and with adequate knowledge of the local conditions, the physical assets needed under each of these further heads will have to be first worked out and then the investments needed calculated. We have preferred to leave this particular part of the work also to the Southern Railway administration who are in the best position to undertake it. (Para 7.21)

11.82 So far as roads are concerned, to cater adequately to the needs of the traffic in 1975-76, over the national highways and the State highways:

(1) 663 kms of roads will have to be improved from single-lane to two-lane;

(2) 479 kms of roads from single-lane to four-lane; and

(3) 896 kms of roads from two-lane to four-lane.

Similar figures for major district roads and other district roads are:

(1) 5,657 kms of roads to be improved from single-lane to two-lane;

(2) 2,894 kms of roads from single-lane to four-lane; and

(3) 347 kms of roads from two-lane to four-lane. (Para 7.23)

11.83 As in the case of the railway, apart from the roads having to be widened, the traffic levels anticipated in 1970-71 and 1975-76 will call for substantial investments in lorries, buses, and workshop facilities. For operation in the region in 1970-71 and 1975-76, 1,756 and 1,180 additional buses and 4,606 and 3,121 additional lorries respectively will be needed. There will also be need for additional investments on workshop facilities. (Para 7.25)

11.84 The investments recommended by us are:

(Rs. crores)

	Fourth Plan period	*Fifth Plan period or subsequently*[b]
1. Conversions of M. G. railway lines into B. G. construction of new B. G. lines and doubling existing B. G. lines[a]	39.0	51.3
2. Improvements to roads by way of widening	50.0	55.8
3. Additional buses and lorries required	28.7	19.3
4. Additional workshop facilities required for road vehicles	1.9	1.3

a Based on the second alternative.

b Depending on the rate of growth of traffic in the Fourth Plan period.

In addition, there will be need for investments on certain other items such as railway rolling stock, urban roads, etc., which we have suggested be worked out by the local railway and highway authorities. (Para 7.29)

Ports : Capacities to be Created and the Investments Needed

11.85 Traffic to be handled at Tuticorin port is expected to go up from 9.53 lakh tonnes in 1963-64 to 13.4 lakh tonnes in 1970-71 and to 17.4 lakh tonnes in 1975-76, the rate of increase per annum being 5.3 per cent and 5.4 per cent during the respective periods. There is some doubt as to how the coal required by the railway will move. If, as in the past, the railways continue to move their requirements by sea from Calcutta to the port, the traffic potential at Tuticorin would be higher—18.3 lakh tonnes in 1971 and 26.0 lakh tonnes in 1976, the annual rate of increase being 10.1 per cent and 7.2 per cent during the two periods. According to the information we have from the Railway

Ministry, however, it is their intention to move their coal by the all rail route. (Para 8.24)

11.86 Between 4 to 5 lakh tonnes of the traffic at Tuticorin will continue to be handled at the old jetties, particularly in the case of sailing vessels traffic and in such items as salt, fish, etc. As recently the sailing vessels calling at the port have tended to be larger in size and tonnage and as it is proposed to develop the fishing harbour at the old port, the Madras Government's proposal to deepen the boat channel leading to the old jetties from 13 ft to 15 ft is a move in the right direction. (Para 8.73)

11.87 At the new port at Tuticorin it is necessary to have two deep-sea berths during the Fourth Plan period and one more berth in the Fifth Plan period to handle the anticipated volume of traffic. (Para 8.72)

11.88 The investments needed for the deep-sea berths at Tuticorin are Rs. 17.5 crores in the Fourth Plan and Rs. 2.2 crores in the Fifth Plan. For improving the boat channel to the old jetties an investment of Rs. 31 lakhs is called for during the Fourth Plan. (Para 8.74)

11.89 The traffic at Cuddalore is expected to go up from 5 lakh tonnes in 1963-64 to 7.26 lakh tonnes in 1970-71, i.e., at an annual rate of 5.4 per cent. This is on the assumption that the coal requirements of the railway will not move by sea. The position in this respect is similar to that at Tuticorin. It is possible that the port traffic may decline to 5.1 lakh tonnes in 1975-76 in case the iron ore exports are not maintained and if the railway coal traffic also disappears. In that event the traffic may revert to the levels at present obtaining at the port. In case the Madras Government's proposal to set up a pig iron plant near Cuddalore comes through, it would add at least 2.7 lakh tonnes to the port traffic. In that event the Madras Government's proposals for port improvements, such as deepening the bar, extension of wharfs, provision of transhipment sheds, etc., at a cost of Rs. 1.2 crores would be needed. (Para 8.54)

11.90 At the ports of Nagapattinam and Pondicherry there is not likely to be any problem of port capacity being short of traffic demands. (Paras 8.68 & 8.76)

Air Transport

11.91 Airport capacity will be very much in excess of air traffic demands up to 1976 at every one of the airports of the region, namely, Tiruchirapalli, Madurai and Coimbatore. (Paras 9.16 & 9.17)

Pondicherry

11.92 No investments on railway lines will be called for, but investments

will be needed in respect of rolling stock.

11.93 Investments on lorries, buses and workshop facilities will be needed as indicated below:

(Rs. lakhs)

Period	*Investment on*		
	Buses	*Lorries*	*Workshop facilities*
1963-64 to 1970-71	28.3	50.2	5.2
1971-72 to 1975-76	42.2	45.3	5.8

11.94 To work out investments for increasing the capacity of individual sections of roads, it is recommended that the Pondicherry Administration conduct at their earliest convenience Road Census such as is conducted by the Madras Government. In the mean time the Road Investments suggested in the Techno-Economic Survey, mainly for better surfacing of 110 kms at a cost of Rs. 60 lakhs and Rs. 40 lakhs for giving new links, together of the order of Rs. 100 lakhs between 1966 and 1976, may be provisionally accepted.

11.95 There is no need for any major investment on the port.

Methodology

11.96 As one of the objects of this survey is to evolve a proper methodology for similar regional transport surveys in other parts of the country, certain aspects relating to methodology are briefly set down here:

(1) It is not possible to proceed with transport planning unless it is preceded by a detailed regional economic survey which would place, in time and location, every major industrial and agricultural development that is both feasible and likely in the region under study.

(2) The assumptions regarding industrial and agricultural development (in detail including facts about particular developments) which are anticipated should be laid bare, at every step, so that if there are changes in the intention to proceed or changes in the basic plan itself, the effects of such changes on transport planning can also be worked out and the necessary changes made in the recommendations for transport planning contained in the Report.

(3) The basic procedure in the methodology of a regional transport survey is to build up the picture of the present flows of commodities individually for the more important ones in the regional economy and for passenger traffic by each of the main modes.

(4) The picture of flows should cover also, to the maximum extent feasible, the past trends.

(5) The capacity picture for every railway and road section as at present must also be compiled and depicted.

(6) By careful projections of production and consumption of the more important commodities, the areas of surplus and deficit should be identified and therefrom the future patterns of flow of these commodities worked out. The aggregate "desire for movement" thus worked out should be allocated between the railway and the roads on the basis of past patterns and likely changes therein. The traffic flows in other commodities will have to be arrived at based on certain broad assumptions and then the aggregate flow pattern of "Medium and Long Distance Goods Transportation" depicted.

(7) The transportation needs "Collection and Distribution Services", (including in that expression all transportation for distances of less than 40 kms, i.e., 25 miles) will also have to be assessed and allocated between the lorries and the bullock-carts and as between the different road sections. This can only be done on certain broad assumptions. While making the assumptions, however, due regard should be had for the fact that generally distribution services are more intense near the larger towns and that traffic by bullock-carts has registered very little increase in the past.

(8) There is need for a sound statistically tested picture of the general distribution of traffic over a road network in the case of different types of traffic, such as *(a)* Medium and Long Distance Transportation, *(b)* transportation in Collection and Distribution Services (including the relation between the growth of transportation in Medium and Long Distance movements and the growth in Collection and Distribution Services), and *(c)* distribution between bullock-carts and mechanised vehicles, etc.

(9) In the projection of passenger traffic, the method of using the N.S.S. sample data of expenditure on travel adopted in this Report needs to be further refined with more information regarding business travel and the changes in propensity to travel. Also the method should provide the *raison d' etre* for the more careful collection of sample data regarding the expenditure on travel by different expenditure groups.

(10) The multi-variate analysis of the passenger traffic in each district using variables such as population-density, per capita income, ratio of metalled roads to rail mileage, etc., though it has failed to give

useful coefficients, must be explored further with more extensive data and on a wider area, as it is likely to be useful not merely in prediction of future volumes of passenger traffic but its division between buses and trains.

(11) It will be useful also if our pioneering efforts in passenger and goods traffic consumer preference studies are carried on further.

(12) It is vital to carry out extensively speed tests over road sections with different specifications, i.e., with different conditions of terrain, width of carriageway, nature of surface, geometrics of the road sections, and varying proportions of slow moving to fast moving vehicles, so that scientifically tested standards of capacity may be evolved. In the future road investments are likely to be considerably higher, and sound capacity measures of road sections are essential for making investments discriminatingly among different road sections of each regional network.

Tables

Table 1

Area, Population and Density of Population in the Districts of the Region, in Madras State and India (1961)

District	Area		Population		
	Sq. km.	Per cent of Madras State (including Pondicherry)	Number	Per cent of Madras State (including Pondicherry)	Density per sq. km.
(1)	(2)	(3)	(4)	(5)	(6)
A. Region					
South Arcot	10,762	8.32	30,27,973	8.95	283
Salem	17,992	13.91	38,04,108	11.17	211
Coimbatore	15,406	11.91	35,57,471	10.44	231
Tiruchirapalli	14,116	10.91	31,90,078	9.37	226
Madurai	12,570	9.72	32,11,227	9.43	255
Ramanathapuram	12,413	9.60	24,21,788	7.11	195
Tirunelveli	11,313	8.75	27,30,279	8.02	241
Thanjavur	9,574	7.40	32,45,927	9.53	339
Kanyakumari	1,657	1.28	9,96,915	2.93	602
Pondicherry	474	0.37	3,69,079	1.08	778
TOTAL (INCLUDING PONDICHERRY)	**1,06,277**	**82.17**	**2,65,74,845**	**78.03**	**250**
TOTAL (EXCLUDING PONDICHERRY)	**1,05,803**	**81.80**	**2,62,05,766**	**76.95**	**248**
B. Portion of the State Outside the Region					
Madras	125	0.10	17,29,141	5.08	13,832
Chingleput	7,759	6.00	21,96,412	6.45	283
North Arcot	12,652	9.78	31,46,326	9.24	249
The Nilgiris	2,519	1.95	4,09,308	1.20	162
TOTAL	**23,055**	**17.83**	**74,81,187**	**21.97**	**953**
C. **STATE (INCLUDING PONDICHERRY)**	**1,29,332**	**100.00**	**3,40,56,032**	**100.00**	**263**
D. INDIA	**30,18,227**		**43,92,35,082**		**146**

SOURCE:—*The Census of India*, 1961

Table 2

Growth in the Number of Towns in the Region (1951-61)

Population range	*Census* 1951	1961
1,00,000 and above	6	9
50,000 to 99,999	14	19
20,000 to 49,999	51	59
10,000 to 19,999	82	95
Less than 10,000	88	100
TOTAL IN THE REGION	**241**	**282**

SOURCE: *Census of India*, 1961, Vol. IX, Madras, pp. 193-206.

Table 3

Statistics of Land Utilization in the Region[a] (1960-61)

Sl. No.	*Land classification*	*Acres* (In million)	*Percentage of geographical area*
1.	Area under forests	3.40	12.87
2.	Barren and unculturable lands	2.00	7.57
3.	Land put to non-agricultural use	2.46	9.31
4.	Pastures, grazing land and land under tree crops	1.15	4.35
5.	Fallow lands (including current fallows)	3.40	12.87
6.	Cultivable waste	1.41	5.34
7.	Net area sown[b]	12.60	47.69
8.	GEOGRAPHICAL AREA	**26.42**	**100.00**
9.	Area sown more than once	2.57	-
10.	TOTAL AREA SOWN (ITEMS 7+9)	**15.17**	-
11.	Area sown more than once as percentage of net area sown	–	20.40
12.	Area sown more than once as percentage of total area sown	–	16.94
13.	TOTAL AREA SOWN AS PERCENTAGE OF GEOGRAPHICAL AREA	–	**57.42**

a Excluding Pondicherry.

b Net area sown was made up as shown below

	Acres (In million)	*Percentage to geographical area*
Area irrigated by canals	2.13	8.06
Area irrigated by tanks and wells	2.78	10.52
Other irrigated lands	0.17	0.64
Unirrigated lands	7.52	28.47
TOTAL	**12.60**	**47.69**

Table 4

Reclamation of Wasteland in the Region[a] (1956-57 and 1960-61)

(In million acres)

Land Classification	1956-57	1960-61
Cultivable waste	1.58	1.41
Fallows (including current fallows)	3.58	3.40
Reclaimed area	—	0.35

a Excluding Pondicherry.

Table 5

Particulars of Irrigated and Sown Area in the Region[a] (1956-57 and 1960-61)

(In million acres)

Land classification	1956-57		1960-61	
Area irrigated by canals	1.94	(42.4)	2.13	(41.9)
Area irrigated by tanks and wells	2.56	(56.0)	2.78	(54.7)
Area irrigated by other sources	0.07	(1.6)	0.17	(3.4)
TOTAL AREA IRRIGATED	**4.57**	**(100.0)**	**5.08**	**(100.0)**
Net area sown	12.40		12 60	
Area sown more than once	2.07		2.57	
TOTAL SOWN AREA	**14.47**		**15.17**	

a Excluding Pondicherry.
NOTE :—The figures in brackets are percentages.

Table 6

Cropping Pattern in the Region[a] During 1960-61

Crop	*Irrigated acreage* (In lakhs)	*Sown un-irrigated* (In lakhs)	*Total* (In lakhs) (*Col.* 2 + *Col.* 3)	*Col.* 5 *as per cent of total cropped area*	*Total yield* (In lakh tonnes)	*Average yield per acre* (In tonnes)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rice	44.1	3.6	47.7	31.4	28.5	0.597
Sugarcane	1.6	—	1 6	1 1	5.5	3.438
Jowar (cholam)	3 6	14.3	17.9	11.8	5.9	0.330
Bajra (cumbu)	1 3	10.1	11.4	7.5	2 9	0.254
Ragi	3.1	4.2	7.3	4.8	2.9	0.397
Other cereals	0.8	9.6	10.4	6.9	3.6	0.346
Pulses	0 3	9.2	9 5	6.3	0.9	0.095
Cotton	2 4	7 4	9 8	6 5	0.7	0.071
Groundnut	2.1	13 8	15 9	10.4	7 8	0.491
Other crops	4 7	15 6	20.3	13 3	4.9	0 241
TOTAL	**64.0**	**87.8**	**151.8**	**100.0**	**63.6**	—

a Excluding Pondicherry.

SOURCE :—*Statistical Abstract of Madras State*, 1960-61

Table 7

Agricultural Production in the Region[a] (1951-52 and 1960-61)

('000 tonnes)

Crop	Production 1951-52[b]	Production 1960-61[b]	Growth index 1951-52=100
Rice	1,550[c]	2,851	183.9
Jowar	434	590	135.9
Bajra	251	286	113.9
Ragi	268	288	107.5
Other cereals[d]	277	364	131.4
Pulses[e]	73	85	116.4
Chillies[f]	58	94	162.1
Sugarcane	2,886	5,547	192.2
Cotton	53	66	124.5
Groundnut	615	780	126.8
Tobacco	23	29	126.1
Ginger	39	40	102.6

a The region excluding Pondicherry State.

b Excludes Kanyakumari District.

c Published figures for Paddy converted into rice using conversion ratio of paddy to rice (3:2).

d Other cereals include *Korra, Varagu, Samai* and Maize only.

e Pulses include Bengalgram, Horsegram, Greengram, Blackgram and Redgram only. The production of the last three pulses in 1951-52 has been calculated on the basis of yield rate obtaining in the whole State in the year 1951-52.

f The production of chillies in 1951-52 is arrived at as the product of yield rate in 1956-57 and area under chillies in 1951-52.

SOURCES :– (*i*) *Annual Statistical Abstract for Madras State*, 1960-61.

(*ii*) *Quinquennial Statistical Abstract for the Period* 1949-50 *to* 1953-54.

Table 8

Indices of Acreage Under Crops and Agricultural Production in the Region[a]

Year	*Index of net area sown*	*Index of agricultural production of principal crops*[b]
1956–57	100.0	100.0
1957–58	97.5	106.0
1958–59	99.4	104.2
1959–60	99.9	110.3
1960–61	101.7	119.7

a Excluding Pondicherry.
b Production in tonnes, not in terms of value.

Table 9

Average Yield Per Acre of the Principal Crops in the Region and in India (1960-61)

(In tonnes)

Crop	*Region*	*All-India*
Rice	0.597	0.404
Sugarcane[a]	3.438	1.517
Cotton	0.071	0.050
Groundnuts	0.491	0.281

a In terms of gur.

Table 10

Tonnage of Production of Important Forest Products in the Region[a] (1958-59 to 1962-63)

(In tonnes)

	1958-59	1959-60	1960-61	1961-62	1962-63
Firewood	95,212	1,19,661	1,13,645	1,78,227	1,99,054
Casurina fuel	10,052	11,135	10,908	11,791	12,009
Sandalwood	59	39	14	16	443
Bamboos	10,045	7,764	5,799	12,800	5,325

a Excluding Pondicherry.
SOURCE :—Chief Conservator of Forests, Madras.

Table 11

Fish Production in the Region (1956-57 to 1962-63)

Year	*Marine*		*Inland*		*Total*	
	Tonnes	*Index*	*Tonnes*	*Index*	*Tonnes*	*Index*
1956-57	58,680	100	38,315	100	96,995	100
1960-61	91,120	155	43,130	113	1,34,255	138
1961-62	93,280	159	48,490	127	1,41,770	146
1962-63	1,34,035	228	52,292	136	1,86,327	192

Table 12

Output of Major Minerals in the Region

Mineral	*Production in* 1956 (Tonnes)	*Value* (Rs. '000)		*Production in* 1961 (Tonnes)	*Value* (Rs. '000)		*Percentage increase or decrease of production*
Bauxite	1,632	50	(0.26)	553	11	(0.05)	–66.12
Corundum	10	3	(0.02)	28	8	(0.04)	180.00
Gypsum	48,380	696	(3.63)	74,676	828	(3.97)	54.35
Magnesite	93,188	1,846	(9.63)	203,446	3,193	(15.32)	118.32
Limestone	1,082,235	2,794	(14.58)	1,867,664	6,530	(31.34)	72.57
Fireclay	4,301	15	(0.08)	16,565	30	(0.15)	285.14
Ilmenite	26,629	1,312	(6.85)	4,055	216	(1.04)	–84.77
Salt	592,570[a]	12,444	(64.95)	630,285	10,020	(48.09)	6.36
TOTAL		**19,160**	**(100.00)**		**20,836**	**(100.00)**	

a Estimated.

NOTES : –(1) Lignite has not been included in this list as the production commenced only recently. Upto March 1964, about 1.16 million tonnes had been mined.

(2) The figures in the brackets are the percentages.

SOURCES :—(1) *Mineral Production in India*, 1956

(2) *Indian Minerals Year Book*, 1961.

Table 13

Production and Rates of Increase of Principal Items of Industrial Output in the Region (1955-56—1962-63)

('000 tonnes)

Industry	*Capacity* (1962-63)	*Production* 1955-56	*Production* 1962-63	*Percentage increase*
Cement	2,278	710.4[a]	1,281.2[b]	80.3
Sugar	8.7[h]	60[a]	94.485[b]	57.3
Paper	20	...[i]	14 359	+
Cotton yarn ('000 kg.)	—[c]	104[a]	134[b]	28.8
Caustic soda	93	15[d]	43.1	187.0
Lignite	3,500	—	1,160[e]	—
Rayon yarn	3,628	—	2,895	—
Alluminium and alloys	10	..	—[f]	—
Rerolled steel	n a	26.4	21.0[g]	—20.8

a Figures refer to 1956.
b Figures refer to 1963
c Capacity in spindles is 3.1 million.
d Estimated.
e Total production during May 1962 to March 1964.
f Has gone into production in June 1965.
g Estimated on seven months' (ending Oct. 1963) production.
h Cane crushing capacity per day.
i Negligible.
NOTE :—The particulars given in the table relate to the region excluding Pondicherry.
n.a.—Not available.

Table 14

Density of Commercial Vehicles per Million Population and per Road Kilometre

	Commercial vehicles per million population	*Vehicle density per road kilometre*
Region	3.9	0.29
Madras State	5.2	0.42
India	5.8	0.57

Table 15

Estimated Expenditure on the Main Modes of Transport in the Region (1963)

	Rs. in crores	*Per cent of the total*
Railways—Passenger traffic	6.1	10.3
Railways—Goods traffic	9.8	16.6
Road transport—Passenger traffic	22.3	37.7
Road transport—Goods traffic	20.4	34.5
Ports	0.4	0.7
Inland waterways	—*a*	—*a*
Airlines—Passenger freight	0.1	0.2
TOTAL	**59.1**	**100.0**

a Negligible.

Table 16

Anticipated Population (Net of Migration) in the Districts of Madras State and Pondicherry in 1971 and 1976

District	1961 *actual*	1971	1976	*Annual rate of growth per cent* 1961-71	1971-76
A. Region					
South Arcot	3.0	3.4	3.7	1.1	1.3
Salem	3.8	4.3	4.5	1.2	1.1
Coimbatore	3.6	3.9	4.2	1.0	1.4
Madurai	3.2	3.6	3.9	1.3	1.3
Tiruchirapalli	3.2	3.5	3.8	1.1	1.3
Thanjavur	3.3	3.5	3.8	0.9	0.8
Ramanathapuram	2.4	3.0	3.1	2.0	0.9
Tirunelveli	2.7	3.1	3.2	1.2	0.9
Kanyakumari	1.0	1.2	1.2	1.7	0.9
Pondicherry	0.4	0.4	0.4	0.6	1.3
TOTAL (INCLUDING PONDICHERRY)	**26.6**	**29.9**	**31.8**	**1.2**	**1.2**
TOTAL (EXCLUDING PONDICHERRY)	**26.2**	**29.5**	**31.4**	**1.2**	**1.2**
B. Portion of the State Outside the Region					
Madras	1 7	2.5	2.9	3.8	3.1
Chingleput	2.2	2.6	2.7	1.5	1.1
North Arcot	3.2	3.3	3.5	0.5	1.1
Nilgiris	0.4	0.6	0.7	4.1	3.4
TOTAL	**7.5**	**9.0**	**9.8**	**1.8**	**1.8**
C. **TOTAL STATE (EXCLUDING PONDICHERRY)**	**33.7**	**38.5**	**41.2**	**1.4**	**1.4**
D. **REGION AS PER CENT OF MADRAS STATE**	**77.8**	**76.7**	**76.1**		

Table 17

Projection of Agricultural Production in the Region[a] (1970-71 and 1975-76)

('000 tonnes)

Crop	*Production*			*Growth rate* (Percentage)		
	1960-61	1970-71	1975-76	1960-61– 1970-71	1970-71– 1975-76	1960-61– 1975-76
Rice	2,851	4,875	6,282	5.5	5.2	5.4
Jowar	590	715	748	2.0	0.9	1.6
Bajra	286	336	349	1.6	0.8	1.3
Ragi	288	377	422	2.7	2.3	2.6
Other cereals[b]	364	407	415	1.1	0.4	0.9
Pulses[c]	85	98	103	1.4	1.0	1.3
Chillies	94	101	105	0.7	0.8	0.7
Sugarcane	5,546	8,540	8,860	4.4	0.7	3.2
Cotton	66	97	111	3.9	2.7	3.5
Groundnut	780	1,044	1,130	2.9	1.6	2.5

a The Region excluding Pondicherry State.

b Other cereals include *Korra, Varagu, Samai* and Maize only.

c Pulses include Bengalgram, Horsegram, Greengram, Blackgram and Redgram only.

Table 18

Estimates of Production in the Principal Industries in the Region[a] in 1965-66, 1970-71 and 1975-76

('000 tonnes)

Industry	*Production in* 1960-61 *(Actual)*	*Estimated production*		
		1965-66	1970-71	1975-76
Textile (Mill sector)	17.0	18.6	35.4	54.0
Cement	1,231.0	1,785.6	2,635.3	4,176.5
Sugar	105.9	193.0	345.6	388.8
Fertilizers	—[b]	303.5	547.5	907.7
Paper and paper board	10.0[c]	71.3	118.8	237.6
Pig iron	Nil	25.2	108.0	115.2
Mild steel	—	—	425.0	465.0
Soda caustic	34.0	72.2	72.2	128.0
Glass and glassware	N.A.	9.0	18.0	36.0
Yarn[d]	140.9	214.7	231.9	324.7
Salt	630.3	1,022.5	1,254.5	1,543.5

a Excluding Pondicherry.
b Negligible.
c Approximate.
d Inclusive of that consumed by the textile Industry.

Table 19

Estimates of Production of Industrial Raw Materials in the Region in 1965-66, 1970-71 and 1975-76

('000 tonnes)

Raw material	*Production in* 1961 *(Actual)*	*Estimated production*		
		1965-66	1970-71	1975-76
Bauxite	0.6	63.8	232.2	401.2
Magnesite (Raw)	203.4	411.6	473.0	564.1
Gypsum	74.7	108.4	158.9	242.0
Limestone	1,857.7	2,917.0	5,446.0	8,809.0
Iron ore	Neg.	Neg.	1,139.0	2,250.0

NOTE:—The projected production of agricultural raw materials for industry such as sugarcane, cotton and oilseeds are given in Table 17.

Table 20

Estimated District Incomes in Madras State in 1970-71 (at 1960-61 Prices)

(Rs. lakhs)

District	*Agriculture*	*Industry*	*Other sources*	*Total*
Madras	25	178,69	27,55	206,49
Chingleput	55,45	29,99	42,70	128,14
North Arcot	70,46	18,16	51,86	140,48
South Arcot	83,32	52,14	65,00	200,46
Salem	60,67	64,87	50,55	176,09
Coimbatore	109,36	88,72	87,74	285,82
The Nilgiris	16,45	26,24	14,74	57,43
Madurai	67,31	27,09	50,71	145,11
Tiruchirapalli	79,78	46,77	61,85	188,40
Thanjavur	113,24	24,34	82,77	220,35
Ramanathapuram	57,32	17,24	42,48	117,04
Tirunelveli	73,16	28,04	54,95	156,15
Kanyakumari	23,21	13,71	18,01	54,93
MADRAS STATE	**809,98**	**616,00**	**650,91**	**2,076,89**
REGION (EXCLUDING PONDICHERRY)	**667,37**	**362,92**	**514,06**	**1,544,35**

Table 21

Estimated District Incomes in Madras State in 1975-76 (at 1960-61 Prices)

(Rs. lakhs)

District	*Agriculture*	*Industry*	*Other sources*	*Total*
Madras	25	275,89	148,72	424,86
Chingleput	67,28	43,74	59,84	170,86
North Arcot	82,81	35,37	63,64	181,82
South Arcot	97,33	86,19	98,72	282,24
Salem	68,43	130,60	107,17	306,20
Coimbatore	123,00	135,29	139,08	397,37
The Nilgiris	17,98	32,71	27,39	78,08
Madurai	78,13	37,54	62,22	177,89
Tiruchirapalli	91,33	77,61	90,97	259,91
Thanjavur	136,01	34,93	92,04	262,98
Ramanathapuram	64,60	23,64	47,51	135,75
Tirunelveli	85,85	40,35	67,95	194,15
Kanyakumari	26,57	18,04	24,02	68,63
MADRAS STATE	**939,57**	**971,90**	**1,029,27**	**2,940,74**
REGION (EXCLUDING PONDICHERRY)	**771,25**	**584,19**	**729,68**	**2,085,12**

Table 22

Anticipated Population, Income and Per Capita Income in the Region[a] and Madras State during Third, Fourth and Fifth Five Year Plan Periods

Year	*Population* (In million)		*Income* (In Rs. crores)		*Per capita income* (In rupees)	
	State	*Region*	*State*	*Region*	*State*	*Region*
1960-61	33.7	26.2	1178.6	886.0	350.0	338.1
1965-66	36.1	27.8	1518.2	1146.4	420.4	412.1
1970-71	38.5	29.5	2076.9	1544.4	540.7	522.5
1975-76	41.2	31.4	2940.7	2085.1	714.7	664.7

a Excluding Pondicherry.

Table 23

Anticipated Growth Rate of Population, Income and Per Capita Income in the Region[a] and Madras State during Third, Fourth and Fifth Five Year Plan Periods

(Per cent)

Period	*Population*		*Income*		*Per capita income*	
	State	*Region*	*State*	*Region*	*State*	*Region*
Third Plan	1.4	1.2	5.2	5.3	3.7	4.0
Fourth Plan	1.4	1.2	6.5	6.1	5.2	4.85
Fifth Plan	1.4	1.2	7.1	6.2	5.7	4.9

a Excluding Pondicherry.

Table 24

Growth Rates of the Sectoral Incomes in the Region[a] and Madras State (1960-61 to 1975-76)

(Per cent)

Sector	1960-61 to 1965-66		1965-66 to 1970-71		1970-71 to 1975-76	
	State	*Region*	*State*	*Region*	*State*	*Region*
Agriculture	2.4	5.1	4.3	4.9	3.0	2.9
Industry	9.6	8.6	11.5	10.3	9.5	10.0
Others	6.5	3.7	5.4	5.3	8.7	6.5
TOTAL	**5.2**	**5.3**	**6.5**	**6.1**	**7.1**	**6.2**

a Excluding Pondicherry.

Table 25

Sectoral Contributions to the State and Regional Incomes (1960-61 to 1975-76)

(Per cent)

Sector	1960-61		1965-66		1960-71		1975-76	
	State	*Region*	*State*	*Region*	*State*	*Region*	*State*	*Region*
Agriculture	49.47	46.13	43.17	45.93	38.87	43.21	31.95	37.00
Industry	19.24	16.56	23.58	19.36	29.56	23.50	33.05	28.00
Others	31.20	37.31	33.25	34.71	31.37	33.29	35.00	35.00
TOTAL	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Table 26

Anticipated Demand for Consumer Goods in the Region[a] (1965-66, 1970-71 and 1975-76)

('000 tonnes)

Consumer goods	1960-61 *(Estimated)*	1965-66	1970-71	1975-76
Sugar	105.1	138.8	187.7	242.0
Salt	180.7	215.9	234.5	255.3
Kerosene	127.3	208.6	380.2	679.3
Cotton cloth	51.5	62.1	77.2	92.3
Rice	—	2900.3	3133.9	3540.1
Other cereals	—	817.3	847.9	640.8
Pulses	—	542.2	608.4	728.3

a Excluding Pondicherry.

Table 27

Regional[a] Demand for Fuels, Industrial Raw Materials and Intermediate Goods

('000 tonnes)

	1965-66	1970-71	1975-76
A. Fuels—Industrial and Domestic			
Public coal	625.0	1285.2	1563.9
Lignite[b]	3500.0	5850.0	6500.0
Petroleum products	682.2	1245.5	2408.0
B. Industrial Raw Materials			
Sugarcane	2592.0	4320.0	4970.0
Oilseeds	889.2	1024.4	1108.9
Cotton	250.7	270.9	379.2
Salt	220.0	240.0	360.0
C. Intermediate Goods			
Cement	837.2	1539.1	2831.6
Fertilizers	697.6	1222.8	2143.8
Mild steel and pig iron	322.1	658.3	1340.0
Yarn	214.7	231.9	324.7

a Excluding Pondicherry.

b A substantial portion of this is consumed by the integrated lignite project at Neyveli for which there is no corresponding, transportation demand in Tables 46, 47 and 48.

Table 28

Aggregate Passenger-Kilometres (Inter-city) by Different Modes of Transport in the Region (1962-63)

Mode	*Passenger-kilometres* (In millions)	*Per cent of the total*
Railway	2,864.5	24.4
Bus[a]	8,401.6	71.5
Passenger car	436.7	3.7
Taxi	35.5	0.3
Air	7.0	0.1
Ports	Neg.	Neg.
TOTAL	**11,745.3**	**100.0**

a Includes long distance express buses.

Table 29

Competitive Bus and Train Traffic (1962-63)[a]

	Passenger kms (In million)			*Per cent of passenger kms*	
	Rail	*Bus*	*Total*	*Rail*	*Bus*
Region (excluding express buses)	736.9	1628.8	2365.7	31.2	68.8
Region (including express buses)	736.9	1803.3	2540.2	29.0	71.0

a The comparison in this table is between the third class rail and the bus journeys. The one limitation of the figures furnished is that while they take fully into account all the competitive traffic local to the individual sections of road or rail, they leave out competitive traffic from continguous sections, i.e., the inter-change traffic.

Table 30

Passenger Traffic by Districts, Lengths of Journey and Modes of Transport (1962-63)

District	*Passenger kms per capita per annum*								
	Bus			*Train*			*Total of bus and train*		
	Journeys under 80 *kms*	*Journeys over* 80 *kms*	*All journeys*	*Journeys under* 80 *kms*	*Journeys over* 80 *kms*	*All journeys*	*Journeys under* 80 *kms*	*Journeys over* 80 *kms*	*All journeys*
South Arcot	217.3	19.3	237.1	48.6	56.5	105.1	265.9	76.3	342.2
Thanjavur	221.4	31.6	253.0	35.1	79.6	164.7	306.6	111.2	417.7
Madurai	357.5	26.1	383.6	32.8	97.4	130.2	390.3	123.5	513.8
Ramanathapuram	364.7	18.6	283.3	41.0	65.6	106.6	305.7	84.2	389.9
Coimbatore	377.4	26.4	403.8	37.3	76.7	114.0	414.7	103.1	517.8
Salem	211.9	40.4	252.3	12.1	29.1	41.2	224.0	69.5	293.5
Tiruchirapalli	305.8	20.4	326.2	54.6	77.5	132.2	360.4	97.9	458.3
Tirunelveli	310.1	22.8	341.9	39.9	71.0	110.9	359.0	93.8	452.8
Kanyakumari	231.7	14.5	346.2	—	—	—	231.7	14.5	246.2
REGION	**282.3**	**26.0**	**308.2**	**41.5**	**65.8**	**107.3**	**323.8**	**91.8**	**414.6**

Table 31

Values of Traffic-generating Variables in the Districts of the Region (1962-63)

District	*Bus pass.-kms* (–80 kms)	*Railway pass kms* (–80 kms)	$\frac{\textit{Bus pass.}}{\textit{bus + railway pass.}\ (\text{kms})}$ $\frac{\textit{Col.}\ (2)}{\textit{Col.}\ (2)+(3)}$	*Metalled road* (Length in kms)	*Railway route* (kms)	$\frac{\textit{M. road}}{\textit{M. road + Railway}\ (\text{kms})}$ $\frac{\textit{Col.}\ (5)}{\textit{Cols.}\ (5)+(6)}$	*Area* (in sq. kms)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
South Arcot	669.4	149.6	0.817	2273	402	0.850	10762
Thanjavur	726.4	279.1	0.772	2457	488	0.834	9574
Madurai	1169.1	107.3	0.916	2828	316	0.899	12570
Ramnad	659.2	102.2	0.866	2226	451	0.834	12413
Coimbatore	1366.2	135.2	0.910	3717	328	0.919	15406
Salem	820.2	46.9	0.946	3423	271	0.910	17992
Tiruchirapalli	993.9	177.6	0.848	2978	364	0.881	14116
Tirunelveli	884.0	110.5	0.889	2964	299	0.883	11313
Kanyakumari	245.6	—	1.000	1090	—	1.000	1657
REGION	**7534.0**	**1108.4**	**0.872**	**23953**	**2919**	**0.891**	**105803**

(*Continued*)

Table 31 (*Contd.*)

Values of Traffic-generating Variables in the Districts of the Region (1962-63)

District	*Metalled road* / *Per 100 sq. kms area* — $\frac{Col\ (5)}{Col.\ (8)} \times 100$	*Railway line* (kms) / *Per 100 sq. kms of area* — $\frac{Col.(6)}{Col.\ (8)} \times 100$	*Population* (in million)	*Rural population* (in million)	*Urban population* (in million)	*Population per 100 sq. kms of area* (in million) — $\frac{Col.\ (11)}{Col.\ (8)} \times 100$	*Per capita income* (in Rs.)
(1)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
South Arcot	21.12	3.74	3.08	2.68	0.40	.0286	352
Thanjavur	25.66	5.10	3.29	2.61	0.67	.343	404
Madurai	22.50	2.51	3.27	2.24	1.03	.02601	361
Ramnad	17·93	3.63	2.49	1.87	0.62	.0200	304
Coimbatore	24.11	2.13	3.62	2.57	1.05	.0235	513
Salem	19.02	1.51	3.87	3.24	0.63	.0215	288
Tiruchirapalli	21.10	2.58	3.25	2.56	0.69	.0230	367
Tirunelveli	26.20	2.64	2.77	1.91	0.86	.0244	376
Kanyakumari	65.78	—	1.06	0.90	0.16	.0640	368
REGION	**22.64**	**2.76**	**26.69**	**20.58**	**6.11**	**.0252**	**372**

Table 34

Projections of Passenger Kilometres on to 1970-71 and 1975-76 Based on Past Trends

Method	*Annual rate of growth* (1956-57 *to* 1962-63) (*compound*)		*Projected estimates of passenger kms* (million)						*Percentage rate of growth* (*compound*)			
			Rail		*Road*		*Total*		*From* 1962-63 *to*			
			1970-71	1975-76	1970-71	1975-76	1970-71	1975-76	1970-71	1975-76	1970-71	1975-76
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Projection of aggregate traffic	6.9	—	—	—	—	—	18915.7	26405.9	70.54	138.1	6.9	6.9
Projection of traffic of each mode	0.2	10.2	2898.9	2921.0	17893.9	29081.2	20792.8	32002.2	87.5	188.5	8.2	8.5
Projection of traffic according to lead groups												
(a) Aggregate traffic												
(i) Long distance	4.95	—	—	—	—	—	3614.0	4597.4	47.0	87.0	4.95	4.95
(ii) Short distance	7.80	—	—	—	—	—	16117.9	23384.1	83.0	165.5	7.80	7.80
TOTAL	—	—	—	—	—	—	**19731.9**	**27981.5**	**75.1**	**148.4**	**7.25**	**7.25**
(b) According to each mode												
(i) Long distance	3.23	10.05	2318.1	2651.7	1469.1	2372.6	3787.2	5024.3	55.2	105.9	5.65	5.70
(ii) Short distance	-3.67	10.25	821 7	680.9	16466.7	26840.7	17288.4	27521.6	99.8	218.1	9.05	9.32
TOTAL	—	—	**3139.8**	**3332.6**	**17935.8**	**29213.3**	**21075.6**	**32545.9**	**90.0**	**193.4**	**8.36**	**8.64**
Projections of traffic on parallel and non-parallel routes												
(a) Parallel routes	0.2	10.0	2898.9	2921.0	4630.4	7457.3	7529.3	10378.3	49.8	106.5	5.2	5.7
(b) Non-parallel routes	—	10.8	—	—	13781.2	23014.0	13781.2	23014.0	127.2	279.3	10.8	10.8
TOTAL	—	—	**2898.9**	**2921.0**	**18411.6**	**30471.3**	**21310.5**	**33392.3**	**92.1**	**201.0**	**8.5**	**8.8**
Projections based on N.S.S. data (adjusted to business travel and change in propensity to travel)	—	—	—	—	—	—	21681.0	29667.2	92.4	163.3	8.5	7.7

Table 35

Anticipated Passenger Traffic in 1970-71 and 1975-76 by Districts (Aggregates by Rail and Bus)

(In million passenger kms)

District	1962-63	1970-71	1975-76
South Arcot	1054.5	2428.3	3287.6
Thanjavur	1370.2	2765.9	3566.9
Madurai	1680.1	2707.8	3558.6
Ramnad	970.9	1882.0	2374.4
Coimbatore	1874.6	3583.6	5073.4
Salem	1136.3	2217.9	3471.7
Tiruchirapalli	1489.9	3276.3	4624.5
Tirunelveli	1254.1	2351.8	3093.9
Kanyakumari	261.0	467.4	616.2
REGION	**11091.6**	**21681.0**	**29667.2**

Table 36

Anticipated Traffic by Bus in each District in 1970-71 and 1975-76

District	*Non-competitive routes*			*Competitive routes*			*Total*		
	1962-63	1970-71	1975-76	1962-63	1970-71	1975-76	1962-63	1970-71	1975-76
South Arcot	496.4	1321.3	1866 1	234.0	622.9	879.7	730.4	1944.2	2745.8
Thanjavur	499.0	1140.6	1520.6	331.0	756.7	1009.0	830.0	1897.3	2529.6
Madurai	708.8	1232.5	1682.4	545.7	948.8	1295.3	1254.5	2181.3	2977.7
Ramnad	441.6	942.9	1229.8	263.9	563.7	735.2	705.5	1506.6	1965.0
Coimbatore	1218.4	2602.1	3824.4	243 4	519.5	763.4	1461.8	3121.6	4587.8
Salem	801.5	1678.4	2700.2	174.9	366.3	589.5	976.4	2044.7	3289.7
Tiruchirapalli	923.1	2329.6	3444.9	137.2	346.2	512.0	1060.3	2675.8	3956.9
Tirunelveli	717.2	1491.9	2038.2	230.0	478.3	653.4	947.2	1970.2	2691.6
Kanyakumari	261.0	467.4	616.2	—	—	—	261.0	467.4	616.2
REGION	**6067.0**	**13206.7**	**18922.8**	**2160.1**	**4602.4**	**6437.5**	**8227.1**	**17809.1**	**25360.3**

Table 37

Anticipated Traffic by Rail by Districts (1970-71 and 1975-76)

(In million passenger kms)

District	1962-63	1970-71	1975-76
South Arcot	324.1	484.1	541.8
Thanjavur	540.2	868.6	1037.3
Madurai	425.6	526.5	580.9
Ramnad	265.4	375.4	409.4
Coimbatore	412.8	462.0	485.6
Salem	159.9	173.2	182.0
Tiruchirapalli	429.6	600.5	667.6
Tirunelveli	306.9	381.6	402.3
Kanyakumari			
REGION	**2864.5**	**3871.9**	**4306.9**

Table 38

Goods Traffic by Different Modes of Transport (1962-63)

Mode of transport	*Volume of traffic*			
	Tonnes (In million)	*Per cent of total*	*Tonne kilometres* (In million)	*Per cent of total*
Railway	5.84	12.0	2,378	49 7
Public carriers' lorries	16.09	33.1	1,563	32.6
Private carriers' lorries	1.67	3.4	349	7.3
Bullock-carts[a]	25.00	51.5	500	10.4
TOTAL	**48.60**	**100.0**	**4,790**	**100.0**

a The figures for bullock-carts are very rough estimates which alone are possible in the absence of relevant statistics. Also, these figures are exclusive of transport between the fields and the villages.

Table 39

Relative Volumes of Traffic by Different Modes of Transport in Collection and Distribution Services in the Region (1962-63)

Mode of transport	*Tonne kms* (In million)	*Per cent of total*
Bullock-carts	500	52.7
Public carriers' motor vehicles	432	45.5
Private carriers' motor vehicles	17	1.8
TOTAL	**949**	**100.0**

Table 40

Relative Volumes of Traffic by Railway and Public and Private Carriers' Motor Vehicle in Medium and Long Distance Transportation in the Region (1962-63)

Mode of transport	*Tonne kms* (In million)	*Per cent of total*
Railway	2,378	61.9
Public carriers' motor vehicles	1,131	29.4
Private carriers' motor vehicles	332	8.7
TOTAL	**3,841**	**100.0**

Table 41

Flow of Commodities by Railways and by Road in 1962-63 over Different Distance Zones

(Quantity in tonnes; distance in kms)

Commodity	*Distance zone*	0–16	17–40	41–80	81–160	161–240	241–400	401–800	801–1200	*Above* 1200	*Total*
Rice and paddy	Road	84,000 (3.9)	228,000 (10.7)	142,500 (6.7)	271,500 (12.7)	202,500 (9.5)	363,000 (17.0)	207,000 (9.7)	1,500[b] (0.1)		1,500,000 (70 3)
	Rail	659[a] (*)		806 (*)	6,553 (0.3)	23,090 (1.1)	278.387 (13.1)	222,875 (10 5)	78.106 (3.7)	21,789 (1.0)	632,265 (29.7)
	TOTAL	**312,659[a] (14.6)**		**143,306 (6.7)**	**278,053 (13.0)**	**225,590 (10.6)**	**641,387 (30.1)**	**429,875 (20.2)**	**101,395[b] (4.8)**		**2,132,265 (100.0)**
Other cereals, pulses and products	Road,	31,000 (3.2)	24.000 (2.5)	57.000 (5.9)	78,000 (8.0)	129,000 (13 3)	99.000 (10.2)	82,000 (8.4)	—	—	500,000 (51.4)
	Rail	272[a] (*)		342 (*)	4.124 (0.4)	13.123 (1 3)	61,543 (6.3)	44,311 (4.6)	115,512 (11.9)	233.688 (24.0)	472.915 (48.6)
	TOTAL	**55,272[a] (5.7)**		**57,342 (5.9)**	**82,124 (8.4)**	**142,123 (14.6)**	**160,543 (16.5)**	**126,311 (13.0)**	**115,512 (11.9)**	**233,688 (24.0)**	**972,915 (100.0)**
Vegetables and fruits	Road	29,000 (2.8)	44,000 (4.3)	109,000 (10.7)	151,000 (14.8)	174,000 (17.0)	269,000 (26.3)	217,000 (21.2)	7,000[b] (0.7)		1,000,000 (97.8)
	Rail	—	—	—	—	124 (*)	286 (*)	135 (*)	821 (0.1)	21,570 (2.1)	22,886 (2.2)
	TOTAL	**29,000 (2.8)**	**44,000 (4.3)**	**109,000 (10.7)**	**151,000 (14.8)**	**174,124 (17.0)**	**269,286 (26.3)**	**217,135 (21.2)**	**29,341[b] (2.9)**		**1,022,886 (100.0)**
Sugar	Road	3,500 (2.8)	8,000 (6.4)	12,800 (10.2)	10,600 (8.4)	22,000 (17.5)	31,300 (24.9)	11,800 (9.4)	—	—	100,000 (79.7)
	Rail	—	—	—	1,091 (0.9)	7,473 (6.0)	6,771 (5.4)	7,650 (6.1)	1,554 (1.2)	955 (0.8)	25,494 (20.3)
	TOTAL	**3,500 (2.8)**	**8,000 (6.4)**	**12,800 (10.2)**	**11,691 (9.3)**	**29,473 (23.5)**	**38,071 (30.3)**	**19,450 (15.5)**	**1,554 (1.2)**	**955 (0.8)**	**125,494 (100.0)**

(Continued)

Table 41 (Contd.)

Commodity	*Distance zone*	0–16	17–40	41–80	81–160	161–240	241–400	401–800	801–1200	*Above* 1200	*Total*
Salt	Road	78,900	10,500	23,400	42,600	22,508	90,300	31,800	—	—	300,000
		(15.0)	(2.0)	(4.5)	(8.1)	(4.3)	(17.2)	(6.1)			(57.1)
	Rail	105[a]		197	143	3,602	7,899	99,027	40,699	74,471	225,343
		(*)		(*)	(*)	(0.7)	(1 4)	(18.8)	(7.7)	(14.1)	(42.9)
	TOTAL	**89,505[a]**		**23,597**	**42,743**	**26,102**	**97,399**	**130,827**	**40,699**	**74,471**	**525,343**
		(17.0)		**(4.5)**	**(8.1)**	**(5.0)**	**(18.6)**	**(24.9)**	**(7.7)**	**(14.1)**	**(100.00)**
Oils and fats	Road	21,000	22,000	25,750	41,750	47,750	50,000	38,500	3,250[b]		250,000
		(8.1)	(8 5)	(9.9)	(16.1)	(18.4)	(19.3)	(14.9)	(1.3)		(96.5)
	Rail	—	—	—	476	924	4,782	1,504	562	928	9,176
					(0 2)	(0.4)	(1 8)	(0.6)	(0,2)	(0.4)	(3.5)
	TOTAL	**21,000**	**22,000**	**25,750**	**42,226**	**48,674**	**9,782**	**40,004**	**4,740[b]**		**259,176**
		(8.1)	**(8.5)**	**(9.9)**	**(16.3)**	**(18.8)**	**(21.1)**	**(15.5)**	**(1.9)**		**(100.0)**
Oilseeds	Road	20,400	19,200	32,700	90,000	58,800	47,700	30,300	900[b]		300,000
		(5.8)	(5.4)	(9.2)	(25.4)	(16 6)	(13.5)	(8.5)	(0.3)		(84.6)
	Rail	19[a]		216	40	596	900	11,299	39,030	2,299	54,399
		(*)		(0.1)	(*)	(0.2)	(0.3)	(3.2)	(11.0)	(0.6)	(15.4)
	TOTAL	**39,619[a]**		**32,916**	**90,040**	**59,396**	**48,600**	**41,599**	**42,299[b]**		**354,399**
		(11.2)		**(9.3)**	**(25.4)**	**(16.8)**	**(13.8)**	**(4.7)**	**(11.9)**		**(100.0)**
Raw cotton	Road	33,500	26,000	39,000	92,000	88,500	107,000	105,000	9,000[b]		500,000
		(5.9)	(4.6)	(6.8)	(16 1)	(15.5)	(18.8)	(18.4)	(1.6)		(87.7)
	Rail	—	—	71	152	2,696	10,267	4,384	30,664	21,828	70,062
				(*)	(*)	(0.5)	(1.8)	(0.8)	(5.4)	(3.8)	12.3)
	TOTAL	**33,500**	**26,000**	**39,071**	**92,152**	**91,196**	**117,267**	**199,384**	**61,492[b]**		**570,062**
		(5.9)	**(4.6)**	**(6.8)**	**(16.1)**	**(16.0)**	**(20.6)**	**(19.28)**	**(10.8)**		**(100.0)**
Cotton cloth	Road	3,619	3,728	6,798	11,841	19,735	33,659	29,712	548[b]		109,640
		(2.5)	(2.6)	(4.7)	(8.2)	(13 7)	(23.4)	(20.6)	(0.4)		(76.1)
	Rail	101[a]		48	1,357	491	1,023	2,041	3,392	25,933	34,386
		(0.1)		(*)	(0.9)	(0.3)	(0.7)	(1.4)	(2.4)	(18.0)	(23.9)
	TOTAL	**3,720[a]**		**6,846**	**13,198**	**20,226**	**34,682**	**31,753**	**29,873[b]**		**144,036**
		(5.2)		**(4.7)**		**(14.0)**	**(24.1)**	**(22.0)**	**(20.8)**		**(100.0)**

(Continued)

Table 41 (Contd.)

Commodity	*Distance zone*	0–16	17–40	41–80	81–160	161–240	241–400	401–800	801–1200	*Above 1200*	*Total*
Firewood	Road	67,800	99,000	210,600	127,200	48,000	30,600	16,800	—	—	600,000
		(9.3)[a]	(13.6)	(28.9)	(17.4)	(6.6)	(4.2)	(2.3)			(82.2)
	Rail	716		6,694	41,205	50,828	19,484	565	60	386	127,938
		(0.1)		(0.9)	(5.6)	(7.0)	(2.7)	(1.2)	(*)	(0.1)	(17.8)
	TOTAL	**167,516[a]**		**217,294**	**168,405**	**98,828**	**50,084**	**5,364**	**60**	**386**	**727,938**
		(23.0)		**(29.8)**	**(23.0)**	**(13.6)**	**(6.9)**	**(3.5)**	**(*)**	**(0.1)**	**(100.0)**
Timber	Road	18,000	20,600	35,000	27,800	27,800	36,600	32,200			200,000
		(6.5)	(7.4)	(12.6)	(10.0)	(10.8)	(13.2)	(11.6)			(72.1)
	Rail	920[a]		450	2,313	8,647	14,501	45,705	3,003	1,528	77,066
		(0.3)		(0.2)	(0.8)	(3.1)	(5.2)	(16.5)	(1.3)	(0.6)	(27.9)
	TOTAL	**39,520[a]**		**35,450**	**30,113**	**38,447**	**36,600**	**77,905**	**3,003**	**1,528**	**277,066**
		(14.2)		**(12.8)**	**(10.8)**	**(14.1)**	**(18.4)**	**(28.1)**	**(1.3)**	**(0.6)**	**(100.0)**
Building material	Road	811,900	669,300	234,600	112,700	202,400	216,200	48,300	4,600[b]	—	2,300,000
		(33.7)	(27.8)	(9.7)	(4.7)	(8.4)	(9.0)	(2.0)	(0.2)		(95.4)
	Rail	45[a]		2,800	17,222	19,286	1,042	29,297	4,909	6,087	110,688
		(*)		(0.1)	(0.7)	(0.8)	(1.3)	(1.2)	(0.2)	(0.3)	(4.5)
	TOTAL	**1,481,245[a]**		**237,400**	**129,922**	**221,686**	**247,242**	**77,597**	**15,596[b]**	—	**2,410,346**
		(61.5)		**(9.8)**	**(5.4)**	**(9.2)**	**(10.3)**	**(3.2)**	**(0.7)**		**(100.0)**
Cement	Road	38,400	36,300	45,000	149,700	99,000	14,700	6,000	—	—	300,000
		(3.2)	(3.9)	(3.7)	(2.3)	(0.8)	(1.2)	(0.5)			(24.7)
	Rail	8,984[a]		122,926	146,133	93,112	289,173	213,655	392,250	113	913,346
		(0.7)		(10.1)	(12.1)	(7.7)	(23.8)	(17.6)	(3.2)	(*)	(75 3)
	TOTAL	**83,684[a]**		**167,926**	**295,833**	**103,012**	**303,873**	**219,655**	**392,250**	**113**	**1,213,346**
		(6.9)		**(13.8)**	**(24.4)**	**(8.5)**	**(25.0)**	**(18.1)**	**(3.2)**	**(*)**	**(100.0)**
Iron and steel	Road	10,200	6,100	5,600	7,800	8,600	34,600	26,400	700[b]		100,000
		(2.6)	(1.5)	(1.4)	(2.0)	(2.2)	(8.7)	(6.6)	(0.2)		(25.1)
	Rail	997[a]		606	2,831	8,737	51,229	55,436	23,371	155,617	298,824
		(0.2)		(0.2)	(0.7)	(2.2)	(12.8)	(13.9)	(5.9)	(39.0)	(74.9)
	TOTAL	**17,297[a]**		**6,200**	**10,631**	**17,337**	**85,829**	**81,836**	**179,668[b]**	**155,617**	**398,824**
		(4.3)		**(1.6)**	**(2.7)**	**(4.4)**	**(21.5)**	**(20.5)**	**(45.1)**	**(39.0)**	**(100.0)**

(Continued)

Table 41 (Contd.)

Commodity	*Distance zone*	0–16	17–40	41–80	81–160	161–240	241–400	401–800	801–1200	*Above* 1200	*Total*
Manures and fertilizers	Road	24,160	16,960	20,000	25,170	25,180	38,560	11,040	—	—	160,000
		(4 9)	(3 4)	(4 1)	(5 1)	(4 9)	(7 8)	(2 2)			(32.4)
	Rail	3,116[a]		10,771	27,723	68,238	103,585	62,240	20,172	36,518	332,363
		(0.6)		(2 2)	(5.6)	(13 8)	(21 0)	(12 6)	(4.1)	(7.4)	(67.6)
	TOTAL	**44,236[a]**		**30,771**	**52,843**	**92,398**	**142,145**	**73,280**	**20,172**	**36,518**	**492,363**
		(8.9)		**(6.3)**	**(10.7)**	**(18.7)**	**(28.8)**	**(14.8)**	**(4.1)**	**(7.4)**	**(100.0)**
Others	Road	431,220	493,943	705,632	1,113,331	1,113,331	2,171,780	1 732,720	78,404		7,840,361
		(4 2)	(4.8)	(6.9)	(10 8)	(10 8)	(21 1)	(16.9)	(0 8)		(32.4)
	Rail	35,818[a]		233,459	374,573	333,104	538,513	264,312	356,362	293,436	2,429,577
		(0.3)		(2 3)	(3 6)	(3 2)	(5 2)	(2 6)	(3 5)	(2 9)	(23.7)
	TOTAL	**960,981[a]**		**939,091**	**1,487,904**	**1,446,435**	**2,710,293**	**1,997,032**	**728,202**		**10,269,938**
		(9.3)		**(9.2)**	**(14.4)**	**(14.0)**	**(26.3)**	**(19.5)**	**(7.2)**		**(100.0)**
ALL COMMODITIES	ROAD	**1,706,599**	**1,727,631**	**1,705,380**	**2,352,942**	**220,976**	**3,633,999**	**2,625,572**	**105,902**		**16059,001**
		(7.8)	**(7.9)**	**(7.8)**	**(10.7)**	**(10.1)**	**(16.6)**	**(12.0)**	**(0.5)**		**(73.3)**
	RAIL	**51,750[a]**		**379,387**	**625,936**	**634,070**	**1,418,585**	**1,072,437**	**757,464**	**887,095**	**5,836,724**
		(0.2)		**(1.7)**	**(2.9)**	**(2.9)**	**(6.5)**	**(4.9)**	**(3.5)**	**(4.1)**	**(26.7)**
	TOTAL	**3,485,980[a]**		**2,084,767**	**2,978,878**	**2,835,046**	**5,052,584**	**3,698,009**	**1,760,461**		**21,895,725**
		(15.9)		**(9.5)**	**(13.6)**	**(13.0)**	**(23.1)**	**(16.9)**	**(8.1)**		**(100.0)**

* Indicates negligible

a The figures are for distance zone 0-40 kms

b The figures are for distance zone over 800 kms

Table 42

Rate of Growth of Railway Goods Traffic in the Region

(In million)

Year	*Originating traffic*		*Terminating traffic*		*Originating and terminating*[a]	
	Tonnes	*Index*	*Tonnes*	*Index*	*Tonne kms*	*Index*
1956-57	2.96	100	3.60	100	1,623	100
1960-61	2.92	99	4.16	116	2,296	141
1962-63	3.34	113	4.78	133	2,378	149

a Estimated.

SOURCE:—*Goods Revenue Statistics*, Southern Railway.

Table 43

Number of Public Carriers' Vehicles with Primary Permits Issued in Each District in the Region

District	1956		1961		1962	
	No	*Index*	*No*	*Index*	*No*	*Index*
Madurai	497	100	628	126	665	134
Tirunelveli	380	100	470	124	509	134
Ramanathapuram	179	100	438	245	619	346
Tiruchy	563	100	485	86	836	148
Thanjavur	124	100	261	210	358	289
South Arcot	288	100	435	151	542	189
Salem	538	100	561	104	716	133
Coimbatore	959	100	1,383	144	1,796	187
TOTAL EXCLUDING KANYAKUMARI AND PONDICHERRY	**3,528**	**100**	**4,661**	**132**	**6,041**	**171**
Kanyakumari	241	100	251	104	283	117
Pondicherry	N.A.	--	N.A.	—	6	—

NOTE:—N.A. = Not available.

Table 44

Railway Traffic in Different Commodities in the Region (1952-53 and 1962-63)

Commodity	*Railway rating classification*	1952-53		1962-63	
		Tonnes	*Index*	*Tonnes*	*Index*
Coal	Special Scale	292,935	100	884,613	302
Manure	22.5A	145,951	100	385,442	264
Oilcake	25A	81,145	100	56,996	70
Grain and pulses	30A	1,209,235	100	1,202,363	99
Firewood and charcoal	30A	164,536	100	107,441	65
Stones	32.5A	311,032	100	222,733	72
Ores	32.5A	1,517	100	212,646	14,017
Salt	35A	331,635	100	319,407	96
Cement	37.5A	601,328	100	1,256,574	209
Timber	37.5A	91,274	100	71,485	78
Magnesite	40A	54,172	100	91,198	168
Fruits and vegetables	40A	226,976	100	56,401	25
Jaggery	42.5A	52,328	100	58,402	102
Oilseeds	45A	88,763	100	52,115	59
Fodder	52.5B	26,065	100	27,566	106
Mineral oils	57.5B	208,102	100	377,311	162
Sugar	65B	49,897	100	21,421	43
Vegetable oils	65B	39,263	100	35,670	91
Iron and steel	65B	183,743	100	371,037	202
TOTAL FOR LOW RATED COMMODITIES		**4,159,897**	**100**	**5,770,821**	**139**
Hides and skins	70B	8,056	100	1,841	23
Provisions as preserves	85B	119,482	100	63,282	53
Cotton (raw)	92.5B	94,123	100	70,857	75
Tobacco	92.5B	16,104	100	1,411	9
Dyes and tanstuffs	92.5B	15,480	100	8,179	53
Spices	100B	32,478	100	15,710	48
Tea	105B	20,542	100	8,129	40
Cotton manufactured	120B	87,358	100	23,887	27
TOTAL FOR HIGH RATED COMMODITIES		**393,623**	**100**	**193,296**	**49**

Table 45

Gross Tonne Kilometres per Road Kilometre per Day of Traffic in Bullock-carts Over Roads of Different Categories in the Region

Year	*National highways*	*State highways*	*Major district roads*	*Other roads*	*All roads*
1950-51	487	554	476	374	449
	(100)	(100)	(100)	(100)	(100)
1954-55	509	519	436	412	445
	(105)	(94)	(92)	(111)	(99)
1957-58	484	669	503	405	484
	(95)	(121)	(106)	(108)	(108)
1960-61	477	637	464	385	482
	(98)	(115)	(97)	(103)	(107)

NOTE: Figures within brackets are indices, with 1950-51 as base year = 100.

Table 46

Aggregate Traffic in the Region in 1962-63 and as Anticipated (1970-71 and 1975-76)

(Annual flow in '000 tonnes)

Commodity	1962-63 *Actual*	1970-71 *Anticipated*	1975-76 *Anticipated*
Public coal	737.76	935.20	1,213.90
Cement	1,213.40	2,635.30	4,176.50
Petroleum products	436.30	1,217.96	2,407.82
Carbonised briquettes	Nil	380.00	760.00
Lignite char	Nil	819.00	2,054.00
Iron ore	180.40	972.00	729.50
Bauxite	Nil	232.20	401.20
Iron and steel	337.89	617.97	1,249.71
Magnesite (Calcined)	87.23	225 00	259.60
Magnesite (Raw)	Nil	5.60	10.24
Limestone	503.91	1,294.00	2,026.00
Gypsum	87.31	158.90	242.05
Salt	525.34	480.00	610.30
Sugarcane	479.56	881.32	1,013.92
Sugar	125.49	311.13	360.80
Fertilizers	443.35	1,222.76	2,143.79
Fruits and vegetables	1,022.89	1,440.00	1,810.01
Paper and paper board	20.81	176.57	279.60

(Continued)

Table 46 (Contd.)

Commodity	1962-63 *Actual*	1970-71 *Anticipated*	1975-76 *Anticipated*
Building materials	2,410.70	6,725.85	12,376.53
Timber	277.08	773.55	1,422.41
Firewood	546.29	607.94	634.25
Cotton (Yarn) Cotton (Piece goods)	98.29	293.75	445.36
Raw cotton	570.10	773.51	888.10
Oilseeds	354.41	420.79	462.13
Rice and paddy	1,858.00	1,275.39	1,669.91
Grams and pulses Wheat and wheat flour Other cereals	972.96	1,253.99	1,616.06
Other commodities	2,941.63	5,715 85	9,005.98
SUB TOTAL	**16,231.10**	**31,845.53**	**50,269.67**
Railway coal	522.80	836.58	977.10
Diesel oil for railways	—	84.68	124.10
GRAND TOTAL	**16,753.90**	**32,766.79**	**51,370.87**

Table 47

Commoditywise Goods Traffic by Rail in the Region in 1962-63 and as Anticipated (1970-71 and 1975-76)

(Annual flow in '000 metric tonnes)

Commodity	1962-63 *Actual*	1970-71	1975-76
Public coal	737.76	914.70	1,189.90
Cement	913.40	1,638.90	2,449.51
Petroleum products	357.90	915.48	1,777.41
Carbonised briquettes	Nil	380.00	760.00
Lignite char	Nil	819.00	2,054.00
Iron ore	180.40	972.00	729.50
Bauxite	Nil	9.00	118.00
Iron and steel	298.79	521.87	1,055.91
Magnesite (Calcined)	87.23	225.00	259.60
Magnesite (Raw)	Nil	Nil	Nil
Limestone	12.91	25.00	30.00
Gypsum	87.31	110.60	157.25
Salt	225.34	249.90	357.70
Sugarcane	29.56	69.12	79.52
Sugar	25.49	81.86	81.64
Fertilizers	333.15	1,034.53	1,639.19
Fruits and vegetables	22.89	32.30	50.31
Paper and paper board	20.81	94.17	153 40
Building materials	110.70	308.85	568.33
Timber	77.08	215.45	395.71
Firewood	114.29	129.74	136.45
Cotton (Yarn)	4.00	7.67	11.38
Cotton (Piece goods)	30.39	58.28	86.48
Raw cotton	70.10	95.11	109.20
Oilseeds	54.41	64.59	70.93
Rice and paddy	632.30	406.39	571.71
Grams and pulses	331.21	325.78	397.66
Wheat and wheat flour	122.24	129.67	160.99
Other cereals	19.51	46.24	64.21
Other commodities	415.73	799.67	1,261.29
SUB-TOTAL	**5,314.90**	**10,680.87**	**16,777.18**
Railway coal	522.80	836.58	977.10
Diesel oil for railways	—	84.68	124.10
GRAND TOTAL	**5,837.70**	**11,602.13**	**17,878.38**

Table 48

Commoditywise Goods Traffic by Road in the Region in 1962-63 and as Anticipated (1970-71 and 1975-76)

(Annual flow in '000 metric tonnes)

Commodity	1962-63 *Actual*	1970-71	1975-76
Public coal	N.A.	20.50	24.00
Cement	300.00	996.40	1,726.99
Petroleum products	78.40	302.48	630.41
Carbonised briquettes	Nil	Nil	Nil
Lignite char	Nil	Nil	Nil
Iron ore	Nil	Nil	Nil
Bauxite	Nil	223.20	283.20
Iron and steel	39.10	96.10	193.80
Magnesite (Calcined)	Nil	Nil	Nil
Magnesite (Raw)	Nil	5.60	10.24
Limestone	491.00	1,269.00	1,996.00
Gypsum	Nil	48.30	84.80
Salt	300.00	230.10	252.60
Sugarcane	450.00	812.20	934.40
Sugar	100.00	229.27	279.16
Fertilizers	110.20	188.23	504.60
Fruits and vegetables	1,000.00	1,407.70	1,759.70
Paper and paper board	Nil	82.40	126.20
Building materials	2,300.00	6,417.00	11,808.20
Timber	200.00	558.10	1,026.70
Firewood	432.00	478.20	497.80
Cotton (Yarn) Cotton (Piece goods)	63.90	227.80	347.50
Raw cotton	500.00	678.40	778.90
Oilseeds	300.00	356.20	391.20
Rice and paddy	1,225.70	869.00	1,098.20
Gram and pulses Wheat and wheat flour Other cereals	500.00	752.30	993.20
SUB-TOTAL	**8,390.30**	**16,248.48**	**25,747.80**
Other commodities	2,525.90	4,916.18	7,744.69
GRAND TOTAL	**10,916.20**	**21,164.66**	**33,492.49**

Table 49
Goods Traffic by Different Modes of Transport in the Region (1970-71 and 1975-76)
(In million)

Mode of transport	*Volume of traffic*			
	1970-71		1975-76	
	Tonnes	*Tonne kms*	*Tonnes*	*Tonne kms*
Railways	11.60	3,818.68	17 88	5,897 35
	(12)	(46)	(12)	(45)
Road transport (Mechanised)	54 57	3,976.98	99 23	6,581.09
	(57)	(47)	(66)	(50)
Bullock-carts	30.00	600.00	33 00	660 00
	(31)	(7)	(22)	(5)
TOTAL	**96.17**	**8,395.66**	**150.11**	**13,138.44**
	(100)	**(100)**	**(100)**	**(100)**

NOTE The figures in brackets are the percentages of the respective totals

Table 50
Relative Volumes of Traffic by Different Modes of Transport in Collection and Distribution Services in the Region (1970-71 and 1975-76)

Mode of transport	1970-71		1975-76	
	Tonne kms (Million)	*Per cent of total*	*Tonne kms* (Million)	*Per cent of total*
Bullock-carts	600 00	34	660 00	24
Road transport (Mechanised)	1,151 50	. 66	2,089.75	76
TOTAL	**1,751.50**	**100**	**2,749.75**	**100**

Table 51
Relative Volumes of Traffic by Railway and Road Transport (Mechanised) in Medium and Long Distance Transportation in the Region (1970-71 and 1975-76)

Mode of transport	1970-71		1975-76	
	Tonne kms (Million)	*Per cent of total*	*Tonne kms* (Million)	*Per cent of total*
Railways	3,818.68	57	5,897.35	57
Road transport (Mechanised)	2,825.48	43	4,491 34	43
TOTAL	**6,644.16**	**100**	**10,388.69**	**100**

Table 52

Sectional Railway Capacity Utilisation in Terms of Number of Trains as on 31-3-63 and as Expected to be on 31-3-66

Section	*Gauge*	*Single, double or quadruple line*	*Train service during 1962-63*				*Charted line capacity on 31st March 1963*	*Capacity required at the end of the Third Plan*	*Charted capacity expected to be available at the end of the Third Plan*	*Capacity expected to be available at the end of the Third Plan in terms of wagons each way daily*
			Passenger	*Goods*	*Departmental*	*Total*				
Jalarpet-Salem	B.G.	Patch doubling	6	6	1	13	17	17	19	550[a]
Salem-Erode	,,	,,	7	6	1	14	18	18	25	780[a]
Erode-Coimbatore-Podanur	,,	Single	7	5	1	13	17	18	19	450[a]
Podanur-Olavakot	,,	,,	7	6	1	14	16	18	18	450
Coimbatore-Mettupalayam	,,	,,	6	1	—	7	15	9	15	180
Erode-Karur	,,	,,	7	2	--	9	13	14	15	150
Karur-Kulitalai	,,	,,	8	2	--	10	14	15	16	150
Kulitalai-Tiruchirapalli Fort	,,	,,	9	2		11	15	16	17	150
Tiruchirapalli Fort-Tiruchirapalli Jn.	,,	,,	12	2	—	14	16	19	20	150
Salem-Mettur Dam	,,	,,	2	1	--	3	10	6	14	200
Chingleput-Tindivanam	M G	,,	10	4.2	1	15.2	17	17	25	735
Tindivanam-Villupuram	,,	,,	11	4.2	1	16 2	18	18	25	650
Villupuram-Vridhachalam	,,	,,	5	4 9	0.7	10.6	16	12	16	350
Virdhachalam-Ariyalur	,,	,,	9	4 9	0.7	15.6	18	14	19	450
Ariyalur-Lalgudi	,,	,,	9	44.9	0.7	14 6	19	17	20	350
Lalgudi-Golden Rock	,,	,,	14	4.9	0 7	19.6	24	21	23	300
Villupuram-Cuddalore	,,	,,	9	3	0.4	12.4	23	15	23	450
Cuddalore-Mayuram	,,	,,	8	2.5	0.2	10.5	21	15	21	350
Mayuram-Thanjavur	,,	,,	10	2 3	0.2	12.4	24	16	24	450
Thanjavur-Golden Rock	,,	,,	11	3	0 9	14.9	23	17	23	400
Golden Rock Tiruchirapalli	,,	,,	25	–	—	25	48	26	48	—

(Continued)

Table 52 (Contd.)

Section	*Gauge*	*Single, double or quadruple line*	*Train service during 1962-63*				*Charted line capacity on 31st March 1963*	*Capacity required at the end of the Third Plan*	*Charted capacity expected to be available at the end of the Third Plan*	*Capacity expected to be available at the end of the Third Plan in terms of wagons each way daily*
			Passenger	*Goods*	*Departmental*	*Total*				
Tiruchirapalli-Karaikkudi	M. G.	Single	7	3.5	1	11.5	15	12	15	225
Karaikkudi-Manamadurai	,,	,,	4	3.5	1	8.5	17	10	17	405
Manamadurai-Mandapam	,,	,,	5	0.5	1	6.5	12	7	12	215
Pamban-Rameswaram	,,	,,	6			6	15	6	13	160
Mandapam-Dhansushkodi	,,	,,	5		1	6	12	9	12	100
Tiruchirapalli-Manaparai	,,	,,	9	2.8		6	12	14	17	150
Manaparai-Dindigul	,,	,,	7	2.8	1	10.8	16	13	16	150
Dindigul-Madurai	,,	,,	9	2.8		11.8	18	15	13	200
Madurai-Manamadurai	,,	,,	5	3.75	1	9.75	14	7	14	300
Madurai-Tirumangalam	,,	,,	14	5.7		19.7	22	20	22	250
Triumangalam-Virudhunagar	,,	,,	11	5.7		16.7	19	17	20	250
Virudhunagar-Maniyachi	,,	,,	6	4.1		10.7	17	12	17	350
Maniyachi-Tuticorin	,,	,,	—	4.0		10.8	17	14	17	400
Virudhunagar-Tenkasi	,,	,,	4	1.8	1	6.8	11	8	12	250
Tenkasi-Shencottah	B.G.	Single	8	3.7	1	12.7	24	12	22	450
Shencottah-Tirunelveli	,,	,,	4	1.9		5.9	13	10	13	190
Tirunelveli-Maniyachi	,,	,,	6	2.5	1	9.5	16	13	16	300
Coimbatore-Pollachi	,,	,,	5	1		6	15	8	15	115
Pollachi-Palni	,,	,,	5	2.1	—	7.1	13	9	13	130
Palni-Dindigul	,,	,,	6	2.1	—	8.1	15	10	15	150
Tirunelveli-Tiruchendur	,,	,,	5	0.8	—	5.8	14	7	14	120
Madurai-Bodinayakkanur	,,	,,	2	0.3	—	2.3	8	3	8	100
Salem-Salem Market	,,	,,	8	1	—	9.7	25	11	25	330
Mayuram-Peralam	,,	,,	6	1.6	0.1	7.7	17	8	17	360

(Continued)

Table 52 (Contd.)

Section	*Gauge*	*Single, double or quadruple line*	*Train service during 1962-63*				*Charted line capacity on 31st March 1963*	*Capacity required at the end of the Third Plan*	*Charted capacity expected to be available at the end of the Third Plan*	*Capacity expected to be available at the end of the Third Plan in terms of wagons each way daily*
			Passenger	*Goods*	*Departmental*	*Total*				
Peralam-Tiruvarur	,,	,,	6	1.6	0.1	7.7	17	8	17	360
Tiruvarur-Tiruturaipundi	,,	,,	5	1.3	0.1	6.4	18	9	16	360
Tiruturaipundi-Karaikkudi	,,	,,	3	0.7	0.7	4.4	11	4	7	40
Nagore-Nagapattinam	,,	,,	6/1 mixed	—	—	6	16	6	16	—
Nagapattinam-Tiruvarur	,,	,,	6	1	—	7	16	8	16	225
Tiruvarur-Nidamangalam	,,	,,	7	—	0.3	8.6	17	11	17	225
Nidamangalam-Thanjavur	,,	,,	—	1.3	—	—	—	11	17	225
Mayuram-Tranquebar	,,	,,	3	0.5	—	3.5	17	4	17	220
Peralam-Karaikal	,,	,,	2/1 mixed	—	—	2	8	2	8	80
Tiruturaipundi-Point Calimere	,,	,,	3	0.7	—	3.7	9	7	9	80
Nidamangalam-Mannargudi	,,	,,	6/1 mixed	0.5	—	6.5	15	7	14	100
Tiruvannamalai-Villupuram	,,	,,	4	4	0.4	8.5	14	9	14	210
Villupuram-Pondicherry	,,	,,	3	1	0.3	4.3	16	5	16	300
Cuddalore-Vridhachalam	,,	,,	3	2	0.3	5.3	14	10	17	320

a By "double-heading" through goods trains.

Table 53

Capacities of Marshalling Yards and the Average Traffic Dealt with, as on 31-3-1964 and as Expected to be on 31-3-1966

Name of marshalling yard	*Capacity on 31-3-64 (Number of wagons that can be passed through in a day)*	*Average number of wagons that passed the yard per day in the busy season* 1963-64	*Capacity expected to be available on* 31-3-66	*Average number of wagons expected to pass through the yard per day in the busy season in* 1965-66
Madurai	808	608	808	500
Virudhunagar	983	194[a]	983	800
Erode	758	800	1,157	900
Tiruchirapalli Goods	1,000	719	1,100	900
Villupuram	1,000	680	1,000	900

Goods train service has been introduced on Manamadurai-Virudhunagar section on and from 1-10-64 and the highest number of wagons that passed the yard per day during October 1964 was 565.

Table 54

Capacities of Transhipment Sheds and the Average Traffic Dealt With, as on 31-3-1964 and as Expected to be on 31-3-1966

Name of transhipment shed	*Capacity as on 31-3-64 (Number of wagons that can be passed through in a day)*		*Average number of wagon loads dealt with per day in the busy season in* 1963-64		*Capacity expected to be available on* 31-3-66 *(Number of wagons that can be passed through in a day)*		*Average number of wagon loads expected to be dealt with per day in busy season in* 1965-66	
	BG to MG	*MG to BG*	*BG to MG*	*MG to BG*	*BG to MG*	*MG to BG*	*BG to MG*	*MG to BG*
Coimbatore	25	33	5	11	25	33	6	12
Mettupalayam	10	12	14	4	10	12	15	5
Salem market	15	26	6	30	15	26	7	28
Tiruchirapalli Goods	87	128	43	82	87	128	70[a]	100

[a] Due to diversion of broad gauge loads from Arkonam.

NOTE :—At some places traffic in excess of the capacity has been dealt with. Apparently this has been achieved by working during the night.

Table 55

Capacity of the Goods Sheds in the Region and the Average Traffic Dealt With, as on 31-3-64 and as Expected to be on 31-3-1966

Name of goods shed	*Capacity as on* 31-3-64 *(In wagon loads)*	*Average number of wagon loads dealt with per day in the busy season in* 1963-64	*Capacity expected to be available on* 31-3-66 *(In wagon loads)*	*Average number of wagon loads expected to be dealt with per day in the busy season in* 1965-66
Broad Gauge				
Coimbatore Jn.	60	80	80	80
Erode Jn.	32	37	40	60
Madukkarai	9	3	9	3
Mettur Dam	9	23	9	30
Mettupalayam (BG)	43	50	43	50
Salem Jn.	20	24	25	25
Salem Market	52	46	52	50
Tirupur	54	40	54	45
Tiruchirapalli Goods (BG)	54	45	54	54
Metre Gauge				
Agastiyampalli	76	17	76	28
Arumuganeri	30	15	30	20
Cuddalore Jn.	130	121	155	150
Dalmiapuram	200	160	200	180
Madurai Jn.	201	105	201	105
Nagappattinam	96	60	96	75
Tiruchirapalli Goods (MG)	88	52	88	62
Tuticorin	305	150	305	200
Villupuram	40	30	45	30
Virudhunagar	35	40	40	40
Nellikuppam	60	13	—	15
Pollachi	50	21	50	21
Pondicherry	100	55	100	70
Samayanallur	50	57	60	60
Talaiyuthu	22	20	22	20
Tirunelveli Jn.	45	50	45	50

NOTE:—In certain cases the volume of traffic dealt with has exceeded capacity. This has been possible by double placements on certain days and by consignees taking delivery of consignment from wagons standing outside the platform.

Table

Comparison of Railway Sectional Capacity in Terms of with Traffic Requirements

Section	*Charted line capacity at the end of the Third Plan* (1965-66) *with steam traction except on Chinglèput-Villupuram Section where electric traction is assumed*				*Utilisation as on* 1-4-66		
	Charted capacity	*Optg. requirements*	*Deptl. trains*	*B/S paths for regular service*	*Passenger*	*Goods*	*Total*
Main Lines (BG)							
Jalarpet-Salem.	19	2	1	16	8	8	16
Salem–Virapandy Rd.	25	3	1	21	9	8	17
Virapandy Rd Sankaridurg	25	3	1	21	9	8	17
Sankaridurg–Erode	25	3	1	21	9	8	17
Erode – Tiruppur	21	2	1	18	10	7	17
Tiruppur–Coimbatore	21	2	1	18	10	7	17
Coimbatore–Madukkarai	18	2	1	15	9	8 + 1 Pilot to MDKI	18
Madukkarai–Olavakkot	18	2	1	15	9	8	17

56

Number of Trains Expected to be Available on 31-3-66 in 1970-71 and 1975-76

Requirements in 1970-71					*Anticipated shortfall in capacity in* 1970-71	*Requirements in* 1975-76					*Anticipated shortfall in capacity in* 1975-76	*Nature of traction assumed for working out requirements in* 1970-71 *and* 1975-76
Passenger	*Goods*			*Grand Total*		*Passenger*	*Goods*			*Grand Total*		
	As assessed	*Plus 20% to cover secondary movements*	*Total*				*As assessed*	*Plus 20% to cover secondary movements*	*Total*			
8	9.7	1.9	11.6	19.6	—3.6	9	13.2	2.6	15.8	24.8	—8.8	Diesel for goods trains, steam WP/XB for passenger trains
9	9.4	1.9	11.3	20.3	+0.7	11	13.0	2.6	15.6	26.6	—5.6	—do—
9	9.7	1.9	11.6	20.6	+0.4	11	13.4	2.7	16.1	27.1	—6.1	—do—
9	9.5	1.9	11.4	20.4	+0.6	11	13.4	2.7	16.1	27.1	—6.1	—do—
11	7.8	1.6	9.4	20.4	—2.4	12	11.3	2.3	13.6	25.6	—7.6	—do—
11	7.5	1.5	9.0	20.0	—2.0	12	10.9	2.2	13.1	25.1	—7.1	—do—
9	6.3	1.3	7.6	16.6	—1.6	10	9.0	1.8	10.8	20.8	—5.8	—do—
9	6.3	1.3	7.6	16.6	—1.6	10	9.0	1.8	10.8	20.8	—5.8	—do—

(*Continued*)

Table

Section	*Charted line capacity at the end of the Third Plan* (1965-66) *with steam traction except on Chingleput-Villupuram Section where electric traction is assumed*				*Utilisation as on* 1-4-66		
	Charted capacity	*Optg. requirements*	*Deptl. trains*	*B/S paths for regular service*	*Passenger*	*Goods*	*Total*
Main Lines (MG)							
Tindivanam Villupuram	25	2	1	22	13	4	17
Villupuram— Vriddhachalam	16	2	1	13	7	5	12
Vriddhachalam— Ariyalur	19	2	1	16	7	5	12
Ariyalur - Dalmiapuram	21	3	1	17	8	5	13
Dalmiapuram— Lalgudi	21	2	1	18	10	5	15
Lalgudi– Tiruchirapalli	23	2	1	20	14	5	19
Tiruchirapalli— Manaparai	17	1	1	15	10	4	14
Manaparai Dindigul	16	1	1	14	9	4	13

56 (*Contd.*)

Requirements in 1970-71					*Anticipated shortfall in capacity in* 1970-71	*Requirements in* 1975-76					*Anticipated shortfall in capacity in* 1975-76	*Nature of traction assumed for working out requirements in* 1970-71 *and* 1975-76
Passenger	*Goods*			*Grand Total*		*Passenger*	*Goods*			*Grand Total*		
	As assessed	*Plus 20% to cover secondary movements*	*Total*				*As assessed*	*Plus 20% to cover secondary movements*	*Total*			
13	7.4	1.5	8.9	21.9	+0.1	15	13.2	2.6	15.8	30.8	—8.8	Electric traction for both passenger and goods assumed.
8	5.9	1.2	7.1	15.1	—2.1	9	7.9	1.6	9.5	18.5	—5.5	Diesel traction for goods and YP steam for passenger assumed.
9	6.0	1.2	7.2	16.2	—0.2	10	8.7	1.7	10.4	20.4	—4.4	—do—
10	6.0	1.2	7.2	17.2	—0.2	11	8.7	1.7	10.4	21.4	—4.4	—do—
12	5.7	1.1	6.8	18.8	—0.8	13	8.1	1.6	9.7	22.7	—4.7	—do—
17	5.7	1.1	6.8	23.8	—3.8	18	8.1	1 6	9.7	27.7	—7.7	Diesel traction for goods and YP steam for passenger assumed
12	3.6	0.7	4.3	16.3	—1.3	14	5.0	1.0	6.0	20.0	—5.0	—do—
11	3.6	0.7	4.3	15.3	—1.3	13	5.0	1.0	6.0	20.0	-6.0	—do—

(*Continued*)

Table

Section	*Charted line capacity at the end of the Third Plan* (1965-66) *with steam traction except on Chinglèput-Villupuram Section where electric traction is assumed*				*Utilisation as on* 1-4-66		
	Charted capacity	*Optg. require-ments*	*Deptl. trains*	*B|S paths for regular service*	*Passenger*	*Goods*	*Total*
Dindigul—Kodaikanal Rd.	19	2	1	16	11	4	15
Kodaikanal Rd.—Samayanallur	19	2	1	16	11	4	15
Samayanallur—Madurai	19	2	1	16	11	4	15
Madurai—Virudhunagar	22	1	1	20	15	4	19
Virudhunagar—Tulukkappatti	17	2	1	14	6	6	12
Tulukkappatti—Satur	17	2	1	14	6	6	12
Satur—Maniyachi	17	2	1	14	6	6	12
Maniyachi—Tuticorin	20	3	1	16	6	5	11
Maniyachi—Talaiyuthu	22	3	1	18	6	4	10
Talaiyuthu—Tirunelveli	22	3	1	18	6	4	10

56 (*Contd.*)

Requirements in 1970-71					*Anticipated shortfall in capacity in 1970-71*	*Requirements in 1975-76*					*Anticipated shortfall in capacity in 1975-76*	*Nature of traction assumed for working out requirements in 1970-71 and 1975-76*
Passenger	*Goods*			*Grand Total*		*Passenger*	*Goods*			*Grand Total*		
	As assessed	*Plus 20% to cover secondary movements*	*Total*				*As assessed*	*Plus 20% to cover secondary movements*	*Total*			
13	3.3	0.7	4.0	17.0	—1.0	15	4 4	0.9	5.3	20.3	—4.3	Diesel traction for goods and YP steam for passenger assumed.
13	3.2	0.6	3.8	16.8	—0.8	15	4 2	0.8	5.0	20.0	—4.0	
13	2.8	0.6	3.4	16.4	—0.4	15	3 6	0.7	4.3	19.3	—3.3	—do—
18	2.0	0.4	2.4	20.4	—0.4	21	2 7	0.5	3.2	24.2	—4.2	—do—
8	2.4	0.5	2.9	10.9	+3.1	9	4 0	0.8	4.8	13.8	+0.2	—do—
8	2.1	0.4	2.5	10.5	+3.5	9	3.6	0.7	4.3	13.3	+0.7	—do—
8	2.1	0.4	2.5	10.5	+3.5	9	3.6	0.7	4.3	13.3	+0.7	—do—
6	2.2	0.4	2.6	8.8	+7.2	6	3 0	0.6	3.6	9.6	+6.4	—do—
8	2.0	0.4	2.4	10.4	+7.6	9	2.5	0.5	3.0	12.0	+6.0	—do—
8	2.5	0.5	3.0	11.0	+7.0	9	2.1	0.4	2.5	11.5	+6.5	—do—

(*Continued*)

Table

Section	*Charted line capacity at the end of the Third Plan* (1965-66) *with steam traction except on Chingleput-Villupuram Section where electric traction is assumed*				*Utilisation as on* 1-4-66		
	Charted capacity	*Optg. require-ments*	*Deptl trains*	*B/S paths for regular service*	*Passenger*	*Goods*	*Total*
Villupuram—Nellikuppam	25	3	1	21	11	3	14
Nellikuppam—Cuddalore	25	3	1	21	12	3	15
Cuddalore—Chidambaram	22	2	1	19	11	3	14
Chidambaram—Mayuram	22	2	1	19	11	3	14
Mayuram—Kumbakonam	24	2	1	21	12	3	15
Kumbakonam-Papanasam	24	2	1	21	12	3	15
Papanasam—Thanjavur	24	2	1	21	12	3	15
Thanjavur—Tiruchirapalli	23	2	1	20	14	3	17
Virudhunagar—Srivilliputur	12	1	1	10	5	2	7

56 (*Contd.*)

Requirements in 1970-71					*Anticipated shortfall in capacity in* 1970-71	*Requirements in* 1975-76					*Anticipated shortfall in capacity in* 1975-76	*Nature of traction assumed for working out requirements in* 1970-71 *and* 1975-76
Passenger	*Goods*			*Grand Total*		*Passenger*	*Goods*			*Grand Total*		
	As assessed	*Plus 20% to cover secondary movements*	*Total*				*As assessed*	*Plus 20% to cover secondary movements*	*Total*			
14	4.4	0.9	5.3	19.3	+1.7	16	4 9	1.0	5.9	21.9	—0.9	Diesel traction for goods and YP steam for passenger assumed.
14	4.2	0.8	5.0	19.0	+2.0	16	4 7	0.9	5.0	21.6	—0.6	
13	3.2	0.6	3.8	16.8	+2.2	15	4 3	0 9	5.2	20.2	—1.2	—do—
13	3.1	0.6	3.7	16.7	+2 3	15	4 3	0.9	5.2	20.2	—1.2	—do—
14	2.0	0.4	2.4	16.4	+4.6	16	3.0	0.6	3.6	19.6	+1.4	—do—
14	2.0	0.4	2.4	16.4	+4.6	16	2.5	0.5	3.0	19.0	+2.0	—do—
14	2.0	0.4	2.4	16.4	+4.6	16	2.5	0.5	3.0	19.0	+2.0	—do—
16	2.0	0.4	2.4	18.4	+1.6	17	2.7	0.5	3.2	20.2	—0.2	—do—
6	4.0	0.8	4.8	10.8	—0.8	7	5.6	1.1	6.7	13.7	—3.7	—do—

(*Continued*)

Table

Section	*Charted line capacity at the end of the Third Plan* (1965-66) *with steam traction except on Chinglèput-Villupuram Section where electric traction is assumed*				*Utilisation as on* 1-4-66		
	Charted capacity	*Optg. require-ments*	*Deptl. trains*	*B/S paths for regular service*	*Passenger*	*Goods*	*Total*
Srivilliputur—Sankaranayanarkoli	12	1	1	10	5	2	7
Sankaranayanarkoli—Tenkasi	12	1	1	10	5	2	7
Tenkasi—Shencottah	22	3	1	18	9	4	13
Branch Lines (BG)							
Erode—Karur	13	1	1	11	7	4	11
Karur—Kulitalai	14	1	1	12	8	4	12
Kulitalai—Tiruchirapalli	15	1	1	13	9	4	13
Branch Lines (MG)							
Tiruchirapalli—Pudukkottai	15	2	1	12	7	4	11

56 (*Contd.*)

Requirements in 1970-71					*Anticipated shortfall in capacity in* 1970-71	*Requirements in* 1975-76					*Anticipated shortfall in capacity in* 1975-76	*Nature of traction assumed for working out requirements in* 1970-71 *and* 1975-76
Passenger	*Goods*			*Grand Total*		*Passenger*	*Goods*			*Grand Total*		
	As assessed	*Plus 20% to cover secondary movements*	*Total*				*As assessed*	*Plus 20% to cover secondary movements*	*Total*			
6	3.5	0.7	4.2	10.2	—0.2	7	4.8	1.0	5.8	12.8	—2.8	Diesel traction for goods and YP steam for passenger assumed.
6	3.4	0.7	4.1	10.1	—0.1	7	5.1	1.0	6.1	13.1	—3.1	
9	4.0	0.8	4.8	13.8	+4.2	10	6.1	1.2	7.3	17.3	+0.7	—do—
7	4.3	0.9	5.2	12.2	—1.2	7	6.0	1.2	7.2	14.2	—3.2	WG steam for goods and XB steam for passenger assumed.
8	3.0	0.6	3.6	11.6	+0.4	8	4.3	0.9	5.2	13.2	—1.2	—do—
9	3.0	0.6	3.6	12.6	+0.4	9	4.1	0.8	4.9	13.9	—0.9	—do—
7	4.3	0.9	5.2	12.2	—0.2	7	6.0	1.2	7.2	14.2	—2.2	Diesel traction for goods and YP steam for passenger assumed.

(*Continued*)

Table

Section	*Charted line capacity at the end of the Third Plan* (1965-66) *with steam traction except on Chinglèput-Villupuram Section where electric traction is assumed*				*Utilisation as on* 1-4-66		
	Charted capacity	*Optg. require-ments*	*Deptl. trains*	*B/S paths for regular*	*Passenger*	*Goods*	*Total*
Pudukkottai—Karaikkudi	15	2	1	12	7	4	11
Karaikkudi—Manamadurai	17	2	1	14	5	4	9
Manamadurai—Virudunagar	16	3	1	12	2	3	5
Madurai—Manamadurai	14	2	1	11	5	2	7
Manamadurai—Ramanathapuram	13	2	1	12	5	1	6
Ramanathapuram—Rameswaram	14	1	1	12	7	--	7
Çoimbatore—Pollachi	17	2	1	14	5	1	6
Pollachi—Udumalpet	14	2	1	11	5	3	8

56 (*Contd.*)

Requirements in 1970-71					*Anticipated shortfall in capacity in* 1970-71	*Requirements in* 1975-76					*Anticipated shortfall in capacity in* 1975-76	*Nature of traction assumed for working out requirements in* 1970-71 *and* 1975-76
Passenger	*Goods*			*Grand Total*		*Passenger*	*Goods*			*Grand Total*		
	As assessed	*Plus 20% to cover secondary movements*	*Total*				*As assessed*	*Plus 20% to cover secondary movements*	*Total*			
7	4.3	0.9	5.2	12.2	—0.2	7	5.3	1.1	6.4	13.4	—1.4	Diesel traction for goods and YP steam for passenger assumed.
5	4.1	0.8	4.9	9.9	+4.1	5	5 3	1.1	6.4	11.4	+2.6	
2	3.6	0.7	4.3	6.3	+5.7	2	5.4	1.1	6.5	8.5	+3.5	—do—
5	1.0	0.2	1.2	6.2	+4.8	5	1.0	0.2	1.2	6.2	+4.8	—do—
5	2.2	0.4	2.6	7.6	+4.4	5	3 0	0.6	3.6	8.6	+3.4	YP steam for passenger and YG steam for goods assumed
5	1.0	0.2	1.2	6.2	+5.8	5	1.0	0.2	1.2	6.2	+5.8	—do—
5	2.0	0.4	2.4	7.4	+6.6	5	2.2	0.4	2.6	7.6	+6.4	YG steam for goods and YP steam for passenger assumed.
5	2.2	0.4	2.6	7.6	+3.4	5	3.3	0.7	4.0	9.0	+ 2.0	—do—

(*Continued*)

Table

Section	*Charted line capacity at the end of the Third Plan* (1965-66) *with steam traction except on Chingleput-Villupuram Section where electric traction is assumed*				*Utilisation as on* 1-4-66		
	Charted capacity	*Optg. requirements*	*Deptl. trains*	*B/S paths for regular service*	*Passenger*	*Goods*	*Total*
Udumalpet—Palani	14	2	1	11	5	3	8
Palani—Dindigul	15	2	1	12	6	3	9
Mayuram—Peralam	17	2	1	14	7	2	9
Peralam—Tiruvarur	17	2	1	14	7	2	9
Tiruvarur—Tirutturaipandi	15	2	1	12	5	2	7
Tirutturaipandi—Arantangi	11	2	1	8	3	1	4
Arantangi—Karaikkudi	11	2	1	8	3	1	4
Thanjavur—Nidamangalam	17	2	1	14	7	2	9
Nidamangalam—Tiruvarur	17	2	1	14	7	2	9
Salem—Vriddhachalam	12	2	1	9	3	1	4

56 (*Contd.*)

Requirements in 1970-71					*Anticipated shortfall in capacity in* 1970-71	*Requirements in* 1975-76					*Anticipated shortfall in capacity in* 1975-76	*Nature of traction assumed for working out requirements in* 1970-71 *and* 1975-76
Passenger	*Goods*			*Grand Total*		*Passenger*	*Goods*			*Grand Total*		
	As assessed	*Plus 20% to cover secondary movements*	*Total*				*As assessed*	*Plus 20% to cover secondary movements*	*Total*			
5	2.2	0.4	2.6	7.6	+3.4	5	2.7	0.5	3.2	8.2	+2.8	YG steam for goods and YP steam for passenger assumed.
5	2.0	0.4	2.4	7.4	+3.6	6	2.7	0.5	3.2	9.2	+2.8	
7	2.5	0.5	3.0	10.0	+4.0	7	3.6	0 7	4.3	11.3	+2.7	—do—
7	2.4	0.5	2.9	9.9	+4.1	7	3.4	0.7	4.1	11.1	+2.9	—do—
5	2.3	0.5	2.8	7.8	+4.2	5	3.0	0.6	3.6	8.6	+3.4	—do—
3	2.2	0.4	2.6	5.6	+2.4	3	3.0	0.6	3.6	6.6	+1.4	—do—
3	2.0	0.4	2.4	5.4	+2.6	3	2.4	0.5	2.9	5.9	+2.1	—do—
7	2.0	0.4	2.4	9.4	+4.6	7	2.7	0.5	3.2	10.2	+3.8	—do—
7	2.2	0.4	2.6	9.6	+4.4	7	3.0	0.6	3.6	10.6	+3.4	—do—
3	5.4	1.1	6.5	9.5	—0.5	3	12.0	2.4	14.4	17.4	—8.4	Diesel for goods YP for steam assumed.

(*Continued*)

Table

Section	*Charted line capacity at the end of the Third Plan* (1965-66) *with steam traction except on Chingleput-Villupuram Section where electric traction is assumed*				*Utilisation as on* 1-4-66		
	Charted capacity	*Optg. require-ments*	*Deptl. trains*	*B/S paths for regular service*	*Passenger*	*Goods*	*Total*
Vriddhachalam—Neyveli	17	3	1	13	3	2	5
Neyveli—Cuddalore	14	2	1	11	3	2	5
Katpadi—Villupuram	15	2	1	12	4	4	8
Tirunelveli—Ambasamudram	15	2	1	12	4	3	7
Ambasamudram—Tenkasi	15	2	1	12	4	3	7
Pollachi—Olavakkot	13	2	1	10	4	2	6
Branch Line Spurs (BG)							
Salem—Mettur Dam	11	2	1	8	2	1	3

56 (*Contd.*)

Requirements in 1970-71					*Anticipated shortfall in capacity in* 1970-71	*Requirements in* 1975-76					*Anticipated shortfall in capacity in* 1975-76	*Nature of traction assumed for working out requirements in* 1970-71 *and* 1975-76
Passenger	*Goods*			*Grand Total*		*Passenger*	*Goods*			*Grand Total*		
	As assessed	*Plus 20% to cover secondary movements*	*Total*				*As assessed*	*Plus 20% to cover secondary movements*	*Total*			
3	5.0	1.0	6.0	9.0	+4.0	3	11.0	2.2	13.2	16.2	—3.2	Diesel for goods YP for steam assumed.
3	2.0	0.4	2.4	5.4	+5.6	3	2.2	0.4	2.6	5.6	+5.4	
4	5.2	1.0	6.2	10.2	+1.8	5	3.0	0.6	3.6	8.6	+3.4	—do—
4	2.5	0.5	3.0	7.0	+5.0	4	3.0	0.6	3.6	7.6	+4.4	YG for goods and YP for steam assumed
4	2.4	0.5	2.9	6.9	+5.1	4	2.8	0.6	3.4	7.4	+4.6	
4	2.0	0.4	2.4	6.4	+3.6	4	2.7	0.5	3.2	7.2	+2.8	YG steam for goods and YP steam for passenger assumed
2	2.0	0.4	2.4	4.4	+3.6	2	3.5	0.7	4.2	6.2	+1.8	XD steam for goods and YB for passenger trains assumed

(Continued)

Table

Section	*Charted line capacity at the end of the Third Plan (1965-66) with steam traction except on Chingleput-Villupuram Section where electric traction is assumed*				*Utilisation as on 1-4-66*		
	Charted capacity	*Optg. require-ments*	*Deptl. trains*	*B/S paths for regular service*	*Passenger*	*Goods*	*Total*
Coimbatore—Mettupalaiyam	17	2	1	14	6	2	8
Branch Line Spurs (MG)							
Tiruvarur—Nagore	17	2	1	14	7	1	8
Villupuram—Pondicherry	18	3	1	14	3	1	4
Tirunelveli—Tiruchendur	14	2	1	11	5	1	6
Mayuram—Tranquebar	18	3	1	14	4	1	5
Peralam—Karaikkal	8	1	1	6	2	—	2

56 (*Contd.*)

Requirements in 1970-71					*Anticipated shortfall in capacity in* 1970-71	*Requirements in* 1975-76					*Anticipated shortfall in capacity in* 1975-76	*Nature of traction assumed for working out requirements in* 1970-71 *and* 1975-76
Passenger	*Goods*			*Grand Total*		*Passenger*	*Goods*			*Grand Total*		
	As assessed	*Plus 20% to cover secondary movements*	*Total*				*As assessed*	*Plus 20% to cover secondary movements*	*Total*			
6	2.0	0.4	2.4	8.4	+5.6	6	2.5	0.5	3.0	9.0	+5.0	XD steam for goods and YB for passenger trains assumed.
7	2.0	0.4	2.4	9.4	+4.6	7	2.0	0.4	2.4	9.4	+4.6	YG steam for goods and YP steam for passenger assumed
3	2.0	0.4	2.4	5.4	+8.6	3	1.0	0.2	1.2	4.2	+9.8	—do—
5	1.0	0.2	1.2	6.2	+4.8	5	1.0	0.2	1.2	6.2	+4.8	YL steam for goods ST steam for passenger assumed
4	1.0	0.2	1.2	5.2	+8.8	4	1.0	0.2	1.2	5.2	+8.8	YF steam for goods ST steam for passenger assumed
2	1.0	0.2	1.2	3.2	+2.8	2	1.0	0.2	1.2	3.2	+2.8	Will be cleared by mixed trains

(*Continued*)

Table

Section	*Charted line capacity at the end of the Third Plan* (1965-66) *with steam traction except on Chingleput-Villupuram Section where electric traction is assumed*				*Utilisation as on* 1-4-66		
	Charted capacity	*Optg. require-ments*	*Deptl. trains*	*B/S paths for regular service*	*Passenger*	*Goods*	*Total*
Tiruturaipundi—Vedaranyam	10	1	—	9	3	2	5
Vedaranyam—Point Calimere	10	1	—	9	3	2	5
Madurai—Bodinayakanur	9	1	1	7	2	1	3
Nidamangalam—Mannarguri	10	1	—	9	6	—	6

56 (*Contd.*)

Requirements in 1970-71					*Anticipated shortfall in capacity in* 1970-71	*Requirements in* 1975-76					*Anticipated shortfall in capacity in* 1975-76	*Nature of traction assumed for working out requirements in* 1970-71 *and* 1975-76
Passenger	*Goods*			*Grand Total*		*Passenger*	*Goods*			*Grand Total*		
	As assessed	*Plus 20% to cover secondary movements*	*Total*				*As assessed*	*Plus 20% to cover secondary movements*	*Total*			
3	2.0	0.4	2.4	5 4	+3.6	3	1.0	0.2	1.2	4.2	+4.8	YP steam for passenger YG steam for goods assumed.
3	--	--	--	3.0	+6.0	3	—	—	—	3.0	+6.0	—do—
2	1.0	0.2	1.2	3.2	+3.8	2	1.0	0.2	1.2	3.2	+3.8	—do—
6	1.0	0.2	1.2	7.2	+1.8	6	1 0	0 2	1.2	7.2	+1.8	F/ST steam for goods and YP steam for passenger assumed.

Table 57

Summary of the Additional Railway Sectional Capacity that will be Needed (1970-71 and 1975-76)

Name of railway section	*Capacity available on* 1-4-1966 *in terms of number of trains each way per day*	*Capacity expected to be needed in terms of number of trains each way per day*		*Anticipated shortfall in terms of number of trains each way on the basis of capacity expected to be available on* 31-3-1966	
		1970-71	1975-76	1970-71	1975-76
B. G. Main Line					
Jalarpet-Salem	16.0	19.6	24.8	−3.6	−8.8
Salem-Virapandy Road	21.0	20.3	26.6	+0.7	−5.6
Virapandy Road-Sankridrug	21.0	20.6	27.1	+0.4	−6.1
Sankridrug-Erode	21.0	20.4	27.1	+0.6	−6.1
Erode-Tiruppur	18.0	20 4	25.6	−2.4	−7.6
Tiruppur-Coimbatore	18.0	20.0	25.1	−2.0	−7.1
Coimbatore-Madukkarai	15.0	16.6	20.8	−1.6	−5.8
Madukkarai-Olavakkot	15.0	16.6	20.8	−1.6	−5.8
M. G. Main Line					
Tindivanam-Villupuram	22.0	21.9	30.8	+0.1	−8.8
Villupuram-Vriddhachalam	13 0	15.1	18.5	−2.1	−5.5
Vriddhachalam-Ariyalur	16.0	16.2	20.4	−0.2	−4.4
Ariyalur-Dalmiapuram	17.0	17.2	21.4	−0.2	−4.4
Dalmiapuram-Lalgudi	18.0	18.8	22.7	−0.8	−4.7
Lalgudi-Tiruchirapalli	20.0	23.8	27.7	−3.8	−7.7
Tiruchirapalli-Manaparai	15.0	16.3	20.0	−1.3	−5.0
Manaparai-Dindigul	14.0	15.3	20.0	−1.3	−6.0
Dindigul-Kodaikanal Road	16.0	17.0	20.3	−1.0	−4.3
Kodaikanal Road-Samayanallur	16.0	16.8	20.0	−0.8	−4.0
Samayanallur-Madurai	16.0	16.4	19.3	−0.4	−3.3
Madurai-Virudhunagar	20.0	20.4	24.2	−0.4	−4.2

Virudhunagar-Tulukkapatti[a]	14.0	10.9	13.8	+3.1	+0.2
Tulukkapatti-Satur[a]	14.0	10.5	13.3	+3.5	+0.7
Satur-Maniyachi[a]	14.0	10.5	13.3	+3.5	+0.7
Maniyachi-Tuticorin[b]	16.0	8.8	9.6	+7.2	+6.4
Maniyachi-Talaiyuthu[b]	18.0	10.4	12.0	+7.6	+6.0
Talaiyuthu-Tirunelveli[b]	18.0	11.0	11.5	+7.0	+6.5
Villupuram-Nellikuppam	21.0	19.3	21.9	+1.7	−0.9
Nellikuppam-Cuddalore	21.0	19.0	21.6	+2.0	−0.6
Cuddalore-Chidambaram	19.0	16.8	20.2	+2.2	−1.2
Chidambaram-Mayuram	19.0	16.7	20.2	+2.3	−1.2
Mayuram-Kumbakonam[b]	21.0	16.4	19.6	+4.6	+1.4
Thanjavur-Tiruchirapalli	20.0	18.4	20.2	+1.6	−0.2
Virudhunagar-Srivilliputur	10.0	10.8	13.7	−0.8	−3.7
Srivilliputur-S. N. Kovil	10.0	10.2	12.8	−0.2	−2.8
S. N. Kovil-Tenkasi	10.0	10.1	13.1	−0.1	−3.1
Tenkasi-Shencottah[b]	18.0	13.8	17.3	+4.2	+0.7
Kumbakenam-Papanasam[b]	21.0	16.4	19.0	+4.6	+2.0
Papanasam-Thanjavur[b]	21.0	16.4	19.0	+4.6	+2.0
B. G. Branch Line					
Erode-Karur	11.0	12.2	14.2	−1.2	−3.2
Karur-Kulitalai	12.0	11.6	13.2	+0.4	−1.2
Kulitalai-Tiruchirapalli	13.0	12.6	13.9	+0.4	−0.9
M. G. Branch Line					
Tiruchirapalli-Pudukkottai	12.0	12.2	14.2	−0.2	−2.2
Pudukkottai-Karaikuddi	12.0	12.2	13.4	−0.2	−1.4
Salem-Virddhachalam[c]	9.0	9.5	17.4	−0.5	−8.4
Virddhachalam-Neyveli[c]	13.0	9.0	16.2	+4.0	−3.2

a These sections have been included in this statement even though there is expected to be no shortfall in capacities in 1975-76 as the surplus capacity in that year is marginal.

b Though there is no shortfall in capacities on these sections, they have been included because of their being part of main line.

c The shortfall in capacity expected on these sections is on the assumption that a steel plant will be located in this area.

Table 58

Criteria of Highway Capacity

Description of road section	*Maximum capacity in terms of passenger car units per day*
Single lane road (12 ft. wide, surfaced road)	1,000
Two lane road (22 ft. to 24 ft. wide, surfaced road)	4,000
Four lane divided road each side having two lanes (22 ft. to 24 ft. surfaced roads on each)	
(a) where bullock-carts and other slow-moving animal-drawn vehicles are permitted	12,000
(b) where bullock-carts and other slow-moving animal-drawn vehicles are not permitted	16,000
(c) Same as (*b*) above, but where access is controlled and crossings are at grade	25,000

SOURCE :—Chief Consulting Engineer, Roads Wing, Ministry of Transport, Government of India.

Table 59

Passenger Car Equivalents for Different Types of Vehicles

Type of vehicle	*Passenger car equivalent*
Motor cars	1
Motor cycles, scooters and 3-wheelers	1
Station wagons and pick-up vans	1
Ordinary buses (4-wheelers)	3
Heavy buses (6-wheelers)—heavy single and double deck	3
Ordinary lorries (4-wheelers)—laden and unladen	3
Heavy lorries (6 or more wheelers)—laden and unladen	3
Tractors, tractor-trailer combinations, laden and unladen	3
Special vehicles	3
Bullock-carts—Pneumatic and iron tyred—laden and unladen, single and double	6
Cycles	1
Jatkas	6
Hand-drawn carts	6

NOTE:—Based on the passenger car equivalents furnished by the Chief Consulting Engineer, Roads Wing, Ministry of Transport, Government of India.

Table 60

Summary of Speed Tests on Certain Road Sections in the Region

Name of road and location of section	*Width of the pavement*	*Whether in built-in area or not*	*Average speed for the day of mechanised vehicles*	*Total traffic in PCUs for the day*	*Peak hour traffic in PCUs for any hour*	*Ratio of total traffic to peak hour traffic* $\frac{Col.\ 5}{Col.\ 6}$
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Poonamalle high road mile 7/3 to 8/1	20′	Built in	19.5	7,676.0	575.5	13.34
Poonamalle high road mile 8/1 to 8/7	20′	Open	27.1	6,712.5	498.5	13.47
Poolachi-Udumalpet mile 30/7 to 618—32/7-569′	22′	Open	29.8	2,983.0	344.0	8.67
Kodambakam-Sriperambadur mile 3/0 to 3/4	12′	Built in	11.7	9,835.0	838 0	11.74
Kodambakam-Sriperambadur mile 3/4 to 4/0	12′	Built in	15.3	5,984.0	449.5	13.31
Kodambakam-Sriperambadur mile 4/0 to 4/4	12′	Built in	12.9	4,052.5	277.5	14.60
Kodambakam-Sriperambadur mile 4/4 to 6/7	12′	Open	22.2	3,024.3	201.5	15.01
Pollachi-Vannanthurai mile 7/0 to 9/0+12′	12′	Open	24.6	2,158.0	351.0	6.15
Pollachi-Meenakarai mile 4/7 + 645′ to 6/7+638′	22-12′	Open	23.7	3,488.0	424.0	8.23
Pollachi-Charapuram mile 31/5–602′ to 32/5-573′	12′	Open	24.3	3,032.0	344.0	8.81
Pollachi-Palghat (Length of the section 10612′)	12′	Open	23.4	3,493.0	517.0	6.76

Table 61

Norms of Capacity Used in This Report for Roads of Different Widths of Carriageway

Description of road section	*Capacity in terms of passenger car units per day*
Single lane road usually with 12 ft. wide, black topped, carriageway	3,000
Two lane road usually with 22 ft. wide, black topped, carriageway	7,500

NOTE:— Based on data presented in Table 60.

Table 62

Summary of Anticipated Traffic Densities on Single Lane and Double Lane Roads (1975-76)

District	*Length of single lane roads with traffic density in PCUs*				*Length of double lane roads with traffic density in PCUs*			*Total*
	Upto 3,000	3,001 *to* 7,500	7,501 *to* 10,000	*Over* 10,000	*Upto* 7,500	7,501 *to* 10,000	*Over* 10,000	
South Arcot	355	604	44	81	200	79	120	1,483
Thanjavur	153	905	349	299	35	11	33	1,785
Tiruchirapalli	693	1029	126	121	131	74	131	2,305
Salem	678	729	126	238	216	21	168	2,176
Coimbatore	333	972	362	687	41	40	243	2,678
Madurai	386	585	127	211	24	20	189	1,542
Ramanathapuram	514	812	64	83	24	--	70	1,567
Tirunelveli	676	752	107	264	61	23	19	1,902
Kanyakumari	78	220	73	93	—	21	17	502
TOTAL	**3,866**	**6,608**	**1,378**	**2,077**	**732**	**289**	**990**	**15,940**

NOTE:—These figures do not include road lengths not covered by Census. Such lengths are generally of sections with very light traffic density.

Table 63

Normal Limits of Capacity Under Different Systems of Railway Operation

System of operation	*Limit of capacity in terms of number of trains each way daily*
Single line with standard signalling and with steam traction (all stations normally to have two signalled loops and block sections to be of fairly uniform length not exceeding 6 miles).	17
-do- -do- with diesel traction	19
-do- -do- with electric traction	21
Centralised traffic control on single line with steam traction	24
Centralised traffic control on single line with diesel traction	27
Centralised traffic control on single line with electric traction	30
Double line with steam traction	35
Double line with diesel traction	40
Double line with electric traction	45

NOTES:—(1) Provision of tokenless block working on single line will generally generate 10 per cent increase in capacity.

(2) Gradients on individual sections will affect the capacities given above. The figures given are for flat country.

Table 64

Tonnage of Cargo Handled at the Ports of the Region (1950-51 to 1963-64)

(In metric tonnes)

Year	Tuticorin		Cuddalore		Nagapattinam		Pondicherry		Total	
	Tonnage	Index	Tonnage	Index	Tonnage	Index	Tonnage	Index	Tonnage	Index
1950-51	521,375	100.00	183,205	100.00	8,111	100.00	48,000	100.00	760,691	100.00
1951-52	503,956	96.66	142,305	77.68	13,815	170.32	42,000	87.50	702,076	92.29
1952-53	525,664	100.82	218,348	119.18	18,869	232.64	25,000	52.08	787,881	103.57
1953-54	466,303	89.44	216,288	118.06	6,776	83.54	22,000	45.83	711,367	93.52
1954-55	483,251	92.69	219,549	119.84	20,964	258.47	19,511	40.65	743,275	97.71
1955-56	576,538	110.58	213,410	116.49	20,876	257.38	4,974	10.36	815,798	107.14
1956-57	595,768	114.27	185,228	101.10	12,796	157.76	10,240	21.33	804,032	105.70
1957-58	711,358	136.44	276,837	151.11	19,050	234.87	10,136	21.12	1,017,381	133.74
1958-59	799,207	153.29	383,737	209.46	17,882	219.22	4,150	8.65	1,204,976	158.41
1959-60	896,862	172.02	428,553	233.92	58,334	719.23	12,831	26.73	1,396,580	183.59
1960-61	974,767	186.96	435,776	237.86	40,451	498.73	4,561	9.50	1,455,555	191.35
1961-62	842,533	161.60	466,850	254.82	40,757	502.49	4,566	9.50	1,354,706	178.09
1962-63	1,025,173	196.63	467,809	255.35	57,619	710.38	3,345	6.97	1,553,945	204.28
1963-64	934,894	179.31	501,684	273.84	52,341	645.31	6,949	14.48	1,495,868	196.65

Table 65

Annual Rate of Growth of Traffic Handled at the Ports of the Region, 1950-51 to 1963-64

(Per cent)

Period	*Tuticorin*	*Cuddalore*	*Nagapattinam*	*All ports*
1950-51 to 1956-57	2.4	0.2	9.6	0.95
1956-57 to 1963-64	8.1	24.4	44.1	12.29
1950-51 to 1963-64	6.1	14.1	41.9	7.4

Table 66

Distribution of Traffic Among the Ports of the Region, (1950-51 to 1963-64 and 1970-71 and 1975-76[a])

(Per cent)

Year	*Tuticorin*	*Cuddalore*	*Nagapattinam*	*Pondicherry*	*Total*
1950-51	68.5	24.1	1.1	6.3	100
1951-52	71.8	20.2	2.0	6.0	100
1952-53	66.7	27.7	2.4	3.2	100
1953-54	65.5	30.4	1.0	3.1	100
1954-55	65.1	29.5	2.8	2.6	100
1955-56	70.7	26.2	2.5	0.6	100
1956-57	74.1	23.0	1.6	1.3	100
1957-58	69.9	27.2	1.9	1.0	100
1958-59	66.3	31.8	1.5	0.4	100
1959-60	64.2	30.7	4.2	0.9	100
1960-61	67.0	29.9	2.8	0.3	100
1961-62	62.2	34.5	3.0	0.3	100
1962-63	66.0	30.1	3.7	0.2	100
1963-64	62.5	33.5	3.5	0.5	100
1970-71	57.5	30.5	2.5	9.5	100
1975-76	73.3	21.1	3.5	2.1	100

a For 1970-71 and 1975-76 the figures are those predicted in Table 74.

Table 67

Coastal Traffic Handled at the Ports of the Region (1960-61 to 1963-64)

(In metric tonnes)

Year	*Tuticorin*			*Cuddalore*			*Nagapattinam*			*Total*		
	Imports	*Exports*	*Total*	*Imports*	*Exports*	*Total*	*Imports*	*Exports*	*Total*	*Imports*	*Exports*	*Total*
1960-61	360,052	362,995	723,047	98,167	28,744	126,911	17,201	—	17,201	475,620	391,739	867,359
1961-62	308,447	268,385	576,832	179,841	39,443	219,284	9,640	—	9,640	497,928	307,828	805,756
1962-63	423,567	229,176	652,743	168,893	69,589	238,482	6,272	—	6,272	598,732	368,765	967,497
1963-64	427,726	240,306	668,032	201,230	34,218	235,448	7,751	—	7,751	636,707	274,524	911,231

Coastal Import/Export Traffic as Percentage of Coastal and Foreign Import/Export Traffic of Regional Ports

Year	*Imports*	*Exports*	*Total*
1960-61	84.1	44.0	59.6
1961-62	82.3	41.1	59.5
1962-63	78.2	46.8	62.3
1963-64	80.3	39.1	60.9

NOTE :—There is no coastal trade at Pondicherry Port.

Table 68

Foreign Traffic Handled at the Ports of the Region (1960-61 to 1963-64)

(In metric tonnes)

Year	*Tuticorin*			*Cuddalore*			*Nagapattinam*			*Pondicherry*			*Total*		
	Imports	*Exports*	*Total*	*Imports*	*Exports*	*Total*	*Imports*	*Exports*	*Total*	*Imports*	*Exports*	*Total*	*Imports*	*Exports*	*Total*
1960-61	60,743	190,776	251,519	18,246	290,619	308,865	9,716	13,535	23,251	1,300	3,261	4,561	90,005	498,191	588,196
1961-62	58,239	207,462	265,701	35,063	212,503	247,566	11,650	19,467	31,117	2,084	2,482	4,566	107,036	441,914	548,950
1962-63	78,123	224,298	302,430	48,764	180,563	229,327	38,380	12,967	51,347	1,223	2,122	3,345	166,499	429,950	586,449
1963-64	61,407	205,455	266,862	54,044	212,192	266,236	36,503	8,087	44,590	4,359	2,590	6,949	156,313	428,324	584,637

Foreign Import and Export Traffic as Percentage of Total (Coastal and Foreign) Import and Export Traffic of the Regional Ports

Year	*Imports*	*Exports*	*Total*
1960-61	15.9	56.0	40.4
1961-62	17.7	58.9	40.5
1962-63	21.8	53.2	37.7
1963-64	19.7	60.9	39.1

Table 69

Tonnage of Imports and Exports at the Ports of the Region (1950-51 to 1963-64)

Year	*Imports*	*Index*	*Exports*	*Index*	*Total*	*Index*
1950-51	449,571	100	311,120	100	760,691	100
1951-52	336,926	88.3	305,150	98.1	702,076	192.29
1952-53	498,262	110.7	289,619	93.1	787,881	103.57
1953-54	446,268	99.2	265,099	85.2	711,367	93.52
1954-55	379,933	84.5	363,342	116.7	743,275	97.71
1955-56	467,146	103.4	348,652	112.0	815,798	107.24
1956-57	473,121	105.1	330,911	106.3	804,032	105.74
1957-58	561,516	124.7	455,865	146.5	1,017,381	133.74
1958-59	522,524	116.1	682,452	219.3	1,204,976	158.41
1959-60	585,695	130.1	810,885	260.6	1,396,580	183.59
1960-61	565,625	125.8	889,930	286.0	1,455,555	191.35
1961-62	604,964	134.6	749,742	241.0	1,354,706	178.09
1962-63	765,230	170.2	788,715	253.5	1,553,945	204.28
1963-64	793,020	176.4	702,848	225.9	1,495,868	196.65

Table 70

Traffic Potential of Tuticorin Port (1970-71 and 1975-76)

Items of traffic	*Present level of traffic per year (Average over* 1961-62, 1962-63 *and* 1963-64)	*Anticipated traffic* (Tonnes)	
		1970-71	1975-76
Imports			
1. Coal	369,150[a]	605,600	698,600
2. Cotton	22,500	25,000	35,000
Exports			
3. Salt	205,500	365,500	505,500
4. Cement	73,350	—	—
5. Cotton waste	14,900	16,400	21,460
6. Cotton yarn	59,000	59,000	59,000
7. Cotton piece goods	6,000	6,000	6,000
8. Onions	40,900	40,900	40,900
9. Chillies	9,250	9,250	9,250
10. Palmyrah	7,500	7,500	7,500
11. Senna	6,500	6,500	6,500
12. Other cargos (imports and exports)	163,728	204,100	240,000
TOTAL	**978,278**	**1,345,750**	**1,629,710**
13. Diversion of traffic from Madras port	—	20,000	20,000
14. New traffic (Phosphatic rock imports)	—	—	121,000
GRAND TOTAL	**978,278**	**1,365,750**	**1,770,710**

a Including railway coal

Table 71

Rate of Growth of Traffic Registered or Anticipated at Tuticorn Port During Different Plan Periods

Plan	*Traffic at the beginning of the Plan period* (Tonnes)	*Increase during the Plan period* (Tonnes)	*Percentage increase*	*Annual rate of growth (Compound)*
First	521,375	55,163	10.58	2.0
Second	576,538	398,229	69.07	11.1
Third	974,767	390,983[a]	40.21[a]	3.4[a]
Fifth	1,365,750	404,960	29.65	5.4

a The figures relate to ten-year period—Third and Fourth Plans.

Table 72

Distribution of Traffic at Tuticorin Port Between (a) Imports and Exports, (b) Coastal and Foreign, and (c) Steamers and Sailing Vessels

Particulars	1963-64	1970-71	1975-76
Exports	445,761	686,000	846,900
	(47.68)	(50.23)	(47.82)
Imports	489,133	679,750	923,810
	(52.32)	(49.77)	(52.18)
TOTAL	**934,894**	**1,365,750**	**1,770,710**
	(100.00)	**(100.00)**	**(100.00)**
Coastal	668,032	899,100	1,099,060
	(71.46)	(65.83)	(62.07)
Foreign	266,862	466,650	671,650
	(28.54)	(34.17)	(37.93)
TOTAL	**934,894**	**1,365,750**	**1,770,710**
	(100.00)	**(100.00)**	**(100.00)**
Steamers	769,574	1,044,600	1,399,110
	(83.32)	(76.49)	(79.01)
Sailing vessels	165,320	321,150	371,600
	(17.68)	(23.51)	(20.99)
TOTAL	**934,894**	**1,365,750**	**1,770,710**
	(100.00)	**(100.00)**	**(100.00)**

NOTE:—Percentages of the total are within brackets.

Table 73

Traffic Potential of Cuddalore Port, 1970-71 and 1975-76

(Metric tonnes)

	1963-64 (*Actual*)	1970-71	1975-76
Iron ore	212,000	500,000	200,000
Coal	201.000	74,000	94,000
Magnesite	120	3,000	3,500
Other commodities	88,563	148,000	212,000
TOTAL	**501,683**	**725,000**	**509,500**

Table 74

Distribution of Traffic Among the Ports of the Region

Port	1963-64	1970-71	1975-76
Tuticorin	62.5	57.5	73.3
Cuddalore	33.5	30.5	21.1
Nagapattinam	3.5	2.5	3.5
Pondicherry	0.5	9.5	2.1

Table 75

Utilisation of Port Capacity in the Region in 1963-64

Port	*Port capacity*[b] (Million tonnes)	*Traffic* 1963-64 (Million tonnes)	*Percentage of traffic to capacity*
Tuticorin[a]	1.25	0.93	74.8
Cuddalore	0.65	0.50	72.2
Nagapattinam	0.10	0.05	52.3
Pondicherry	0.30	0.007	0.2

a In case of Tuticorin, the utilisation of capacity was higher in 1962-63, being 82·0 per cent.
b The figures of capacity are as given by the Port Authorities.

Table 76

Handling Capacity for Different Cargoes at Tuticorin Port in 1962-63 and as Required in 1970-71 and 1975-76

(Per day)

Item	*Present handling capacity*	*Required handling capacity*	
		1970-71	1975-76
Coal	1,800/2,000	2,000	2,250
Salt	2,000/2,500	2,550	2,000/2,500
Other cargo	1,000/1,500	2,550	1,900

NOTE :—The estimate of handling capacity per day is on the assumption that the number of working days in the port will be 300 per year. The handling capacity, of course, will have to be provided at the new deep sea port.

Table 77

Particulars of Irrigated Area in Pondicherry, and Karaikal Settlements (1961-62)

Particulars	*Hectares*
Area irrigated by canals	11,149
Area irrigated by tanks and wells	12,385
Area irrigated by other sources	475
Area irrigated more than once	10,444
GROSS AREA IRRIGATED	**34,453**

NOTE :—In Karaikal settlement canals are the only source of irrigation.
SOURCE :—*Techno-Economic Survey of Pondicherry*, NCAER, 1965, p. 95.

Table 78

Agricultural Production in Pondicherry State (1960-61)

Item	*Tonnes*
Paddy	54,171
Sugarcane	118,788
Ragi	3,291
Cumbu	1,186
Other cereals	423
Pulses	286
Cotton	444
Groundnut	4,611
Other crops	15,655

SOURCE : – *Techno-Economic Survey of Pondicherry*, NCAER, 1965, p. 97.

Table 79

Road Facilities in 1960-61 in Pondicherry State

Settlement/State	*Road length in kms per 100 sq. kms of area*		*Road length in kms per 1,000 of population*	
	Surfaced roads	*All roads*	*Surfaced roads*	*All roads*
Pondicherry	63.7	104.1	0.7	1.2
Karaikal	33.7	104.0	0.6	1.9
State[a]	53.5	101.0	0.7	1.3
Thanjavur	16.7	50.1	0.6	1.5
South Arcot	21.7	30.9	0.7	0.9
Madras State	23.1	34.0	0.7	1.3

a The State average is inclusive of Mahe and Yanam.

Table 80

Length of Roads Maintained by the Public Works Department in Pondicherry State

(In kilometres)

Items	*As on 31st March*			
	1956	1961	1962	1966[a]
Surfaced Roads				
Concrete	1.97	1.97	2.27	3.02
Asphalt	55.50	144.46	170.14	294.97
W. B. M.	110.51	108.87	80.05	99.48
TOTAL	**167.98**	**255.30**	**252.46**	**397.47**
Unsurfaced Roads				
Soled	—	127.18	142.30	102.77
Earthern	317.66	106.29	111.33	8.86
TOTAL	**317.66**	**233.47**	**253.63**	**111.63**
GRAND TOTAL	**485.64**	**488.77**	**506.09**	**509.10**

a Anticipated.

W.B.M.= Water bound macadam.

SOURCE :—*Hand Book of Statistics*, 1961-62, Bureau of Statistics, Pondicherry.

Table 81

Number of Motor Vehicles Registered in Pondicherry State

Type of vehicle	*As on December 31*		
	1956	1961	1962
Car	161	577	567
Lorry	28	130	141
Bus[a]	25	81	86
Jeep	2	34	44
Tractor	3	34	47
Scooter	—	58	69
Motor cycle	14	113	149
Others	8	79	100
TOTAL	**241**	**1,106**	**1,203**

a Figures taken from the reply given by State Transport Authority.

SOURCE :—*Hand Book of Statistics*, 1961-62, Bureau of Statistics, Pondicherry.

Table 82

Number of Passengers Booked by Railway at Stations in Pondicherry and Karaikal Settlements (1958-59 to 1962-63)

Year	*Stations in Pondicherry Settlement*		*Stations in Karaikal Settlement*	
	No.	*Index*	*No.*	*Index*
1958-59	287,674	100	212,187	100
1959-60	280,836	98	194,211	92
1960-61	313,029	109	210,154	99
1961-62	338,480	118	220,843	104
1962-63	273,042	95	157,296	74

Table 83

Details of Bus Traffic

Pondicherry						*Karaikal*					
City service		*Intra-State service*		*Inter-State service*		*City service*		*Intra-State service*		*Inter-State service*	
Route (Kms)	*Passenger* (Kms)	*Route* (Kms)	*Passenger* (Kms)	*Route* (Kms)	*Passenger* (Kms)	*Route* (Kms)	*Passenger* (Kms)	*Route* (Kms)	*Passenger* (Kms)	*Route* (Kms)	*Passenger* (Kms)
13.0	3,758	600	76,077	696	86,694	Nil	Nil	Nil	Nil	104	29,165

NOTES :—(1) In the case of overlapping routes, the route kilometres of each route have been taken separately.

(2) The passenger kilometres relate to the length of travel over the settlements including the enclaves.

Table 84

Composition of Railway Goods Traffic (1962-63)

(In tonnes)

Commodity	*Pondicherry Settlement*		*Karaikal Settlement*	
	Outward	*Inward*	*Outward*	*Inward*
Coal and coke	—	8,664.1	—	—
Cotton	1,724.6	4,750.7	—	4.5
Dyes and tans	0.4	3.6	—	8.9
Grains and pulses	243.2	10,681.5	9,939.1	550.2
Metals and manganese	433.4	5,957.7	50.4	347.3
Provisions	32.4	197.6	7.3	150.3
Oils	51.9	7,522.9	—	346.5
Oilseeds	13.1	46.1	2.7	99.1
Salt	960.0	7.6	—	44.1
Spices	1.0	104.6	1.6	51.7
Wood	108.7	2,977.5	18.0	344.0
Sugar	0.2	4.9	—	143.5
Hides, skin and leather	1.4	3.3	—	0.4
Groundnuts	—	—	—	2.7
Other commodities	2,765.6	19,515.7	171.8	13,594.4
TOTAL	**6,335.9**	**60,437.8**	**10,190.9**	**16,187.9**

Table 85

Trends in Railway Goods Traffic
(Index 1956-57 = 100)

(In tonnes)

Years	*Originating*				*Terminating*			
	Pondicherry Settlement	*Index*	*Karaikal Settlement*	*Index*	*Pondicherry Settlement*	*Index*	*Karaikal Settlement*	*Index*
1956-57	1,983.5	100	13,223.9	100	38,299.5	100	19,456.4	100
1957-58	3,642.0	184	12,678.5	96	63,388.6	166	20,630.1	106
1958-59	4,481.2	226	11,696.5	88	52,195.3	136	19,136.3	98
1959-60	3,914.1	197	11,976.4	91	61,926.6	162	15,043.1	77
1960-61	6,570.3	331	11,168.7	84	71,942.5	188	22,129.4	114
1961-62	5,935.7	299	6,813.8	52	47,570.1	124	19,153.0	98
1962-63	6,335.9	319	10,190.9	77	60,437.8	158	16,187.9	83

SOURCE :—*Goods Revenue Statistics*, Southern Railway.

Table 86

Projection of Agricultural Production in Pondicherry State (1970-71 and 1975-76)

('000 tonnes)

Commodity	1960-61 *(Actual)*	1970-71	*Annual rate of growth* (1960-61 to 1970-71) (Per cent)	1975-76	*Annual rate of growth* (1970-71 to 1975-76) (Per cent)	*Annual rate of growth* (1960-61 to 1975-76) (Per cent)
Paddy	54.1	90.8	5.5	114.1	4.1	5.0
Other cereals	4.5	5.1	1.3	5.5	1.5	1.3
Pulses	0.4	1.0	10.1	1.4	6.6	8.9
Sugarcane	114.4	262.1	8.6	350.0	6.0	7.7
Groundnuts	4.6	5.9	2.7	6.4	1.6	2.3

Table 87

Estimates of Production in the Principal Industries in Pondicherry State (1965-66, 1970-71 and 1975-76)

Industry	*Production in* 1960-61 *(Actual)*	*Estimated production in*		
		1965-66	1970-71	1975-76
Textile (Mill sector)	5.2	5.8	6.5	7.5
Cement	—	—	90.0	150.0
Sugar	9.7[a]	13.0	17.3	25.9
Paper and paper board	—	—	7.2	14.4
Yarn	6.4	8.1	9.8	10.8

a The figures refer to 1962-63.

Table 88

Anticipated Population, Income and Per Capita Income in Pondicherry State During the Period 1960-61 to 1975-76

Year	*Population* (In million)	*Income* (In lakhs)	*Per capita income* (In Rs.)
1960-61	0.4	1,219.5	330
1965-66	0.4	1,370.4	346
1970-71	0.4	2,170.4	522
1975-76	0.4	3,488·3	790

Table 89

Sectoral Contribution to the Income of Pondicherry State During 1960-61 to 1975-76

(Rs. lakhs)

Sectors	1960-61	1965-66	1970-71	1975-76
Agriculture	405.82	462.30	623.2	838.90
Industry	330.13	364.85	680.8	1,267.57
Others	483.51	543.20	866.4	1,381.84
TOTAL	**1,219.46**	**1,370.35**	**2,170.4**	**3,488.31**

Table 90

Annual Growth Rates of the Sectoral Income in Pondicherry State During 1960-61 to 1975-76

(Per cent)

Sectors	1960-61 to 1965-66	1965-66 to 1970-71	1970-71 to 1975-76
Agriculture	2.6	6.1	6.1
Industry	2.0	13.3	13.3
Others	2.4	9.8	9.8
TOTAL	**2.4**	**9.7**	**9.7**

Table 91

Anticipated Demand for Industrial Products and Raw Materials and Consumer Goods in Pondicherry and Karaikal Settlements (1970-71 and 1975-76)

('000 tonnes)

Commodity	1962-63	1970-71	1975-76
Coal	8.7	34.9	65.2
Petroleum products	8.4	15.0	27.0
Oilseeds	17.3	21.4	23.8.
Cotton	23.6	35.4	42.3
Fertilizers	7.5	12.0	15.0
Steel and pig iron	0.6	2.3	4.8
Cotton textiles	0.7	1.2	1.6
Cement	12.0	35.4	67.2
Sugar	1.4	2.5	3.2
Paper and paper board	0.8	1.6	2.1
Yarn	7.0	10.5	12.5
Vegetable oil	1.2	3.2	4.5

Table 92

Anticipated Goods Traffic in Pondicherry State and Karaikal Settlements (1970-71 and 1975-76)

('000 tonnes)

Commodity	1962-63			1970-71			1975-76		
	By rail	*By road*	*Total*	*By rail*	*By road*	*Total*	*By rail*	*By road*	*Total*
Coal	8.70	—	8.70	34.90	—	34.90	65.20	—	65.20
Iron ore	—	—	—	200.00	—	200.00	—	—	—
Petroleum products	8.40	—	8.40	15.00	—	15.00	27.00	—	27.00
Oilseeds	0.16	12.54	12.70	0.20	15.30	15.50	0.22	17.18	17.40
Cotton	6.50	17.10	23.60	9.74	25.66	35.40	11.63	30.67	42.30
Fertilizers	5.64	1.86	7.50	10.15	1.85	12.00	12.15	2.85	15.00
Steel and pig iron	0.53	0.07	0.60	1.94	0.36	2.30	4.06	0.74	4.80
Cotton textiles	1.57	2.93	4.50	1.19	4.11	5.30	1.30	4.60	5.90
Cement	9.03	2.97	12.00	39.57	15.03	54.60	53.43	29.37	82.80
Sugar	0.15	8.15	8.30	0.27	14.53	14.80	0.41	22.29	22.70
Paper and paper board	0.80	—	0.80	2.99	2.61	5.60	6.75	5.55	12.30
Yarn	0.21	0.39	0.60	0.16	0.54	0.70	0.37	1.33	1.70
Vegetable oil	0.21	0.99	1.20	0.13	3.07	3.20	0.17	4.33	4.50
Rice									
Other cereals	21.40	5.35	26.75	50.20	12.55	62.75	60.80	15.20	76.00
Pulses									
Other commodities	29.70	247.65	277.35	65.34	544.83	610.17	114.35	953.45	1,067.80
TOTAL	**93.00**	**300.00**	**393.00**	**431.78**	**640.44**	**1,072.22**	**357.84**	**1,087.56**	**1,445.40**

Table 93

Investments on Lorries, Buses and Workshops

(In lakhs of Rs.)

Period	*Investment on*		
	Buses	*Lorries*	*Workshop facilities*
1963-64 to 1970-71	28.3	50.2	5.2
1971-72 to 1975-76	42.2	45.3	5.8

Appendices

Appendix 1

Survey Team

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Appendix 2

Sectional Density of Railway Passenger Traffic in 1962-63, and as Anticipated in 1970-71 and 1975-76

Sl. No.	Railway section	Passenger kms per route km per day		
		1962-63	1970-71	1975-76
Main Lines				
1.	Chingleput-Villupuram	7368	10555	12025
2.	Villupuram-Vriddhachalam	3681	5346	6090
3.	Vriddhachalam-Lalgudi	4331	6289	7166
4	Lalgudi-Tiruchirapalli	5775	8379	9556
5.	Tiruchirapalli-Dindigul	4915	7138	8132
6.	Dindigul-Sholavandan	5832	8469	9649
7	Sholavandan-Madurai	6211	9020	10276
8.	Madurai-Virudhunagar	6753	9807	11173
9.	Virudhunagar-Maniyachi	3697	5369	6117
10.	Maniyachi-Tuticorin	1370	1484	1522
11.	Maniyachi-Tirunelveli	3143	4564	5200
12.	Virudhunagar-Tenkasi-Shencottah	2018	2931	3339
13.	Villupuram-Cuddalore	5689	8262	9412
14.	Cuddalore-Chidambaram	5189	7535	8585
15.	Chidambaram-Mayuram	5749	8349	9512
16.	Mayuram-Kumbakonam	5169	7506	8552
17.	Kumbakonam-Thanjavur	4361	6333	7215
18.	Thanjavur-Tiruchirapalli	6010	8728	9943
19.	Jalarpet-Salem	4672	6785	7730
20.	Salem-Erode	4616	6703	7637
21.	Erode-Podanur	5288	7679	8749
22.	Podanur-Olavakkot	4102	5957	6787
Branch Lines				
23.	Vriddhachalam-Cuddalore	471	599	630
24.	Vriddhachalam-Salem	863	1058	1112
25.	Mayuram-Tiruvarur	2742	3260	3426
26.	Tiruvarur-Nidamangalam	2871	3411	3585
27.	Nidamangalam-Thanjavur	3375	4002	4206
28.	Tiruvarur-Tiruturaipundi	1771	2122	2230
29.	T. T. Pundi-Arantangi	1377	1660	1745
30.	Arantangi-Karaikkudi	805	990	1040
31.	Tiruchirapalli-Karaikkudi	1517	1825	1918
32.	Karaikkudi-Manamadurai	1300	1570	1650
33.	Manamadurai-Ramanathapuram	2090	2496	2623

(Continued)

Appendix 2 (*Contd.*)

Sl. No.	*Railway section*	*Passenger kms per route km per day*		
		1962-63	1970-71	1975-76
34.	Ramanathapuram-Mandapam	1300	1570	1650
35.	Madurai-Manamadurai	2384	2840	2985
36.	Madurai-Bodinayakkanur	294	392	412
37.	Tenkasi-Tirunelveli	1559	1874	1970
38.	Dindigul-Palni	3000	3562	3744
39.	Palni-Pollachi	3700	4382	4605
40.	Pollachi-Podanur	2171	2591	2723
41.	Pollachi-Palghat	1170	1418	1490
42.	Tiruchirapalli-Kulitalai	4864	5746	6039
43.	Kulitalai-Karur	3957	4683	4922
44.	Karur-Erode	2908	3454	3630
45.	Villupuram-Tiruvannamalai	1324	1598	1679
46.	Villupuram-Pondicherry	1331	1441	1477
47.	Mayuram-Tranquebar	827	896	919
48.	Peralam-Karaikkal	427	462	474
49.	Tiruvarur-Nagore	2029	2197	2253
50.	Nidamangalam-Mannargudi	459	497	510
51.	T. T. Pundi-Point Calimere	754	817	838
52.	Salem-Mettur Dam	595	644	660
53.	Tirunelveli-Tiruchendur	1976	2140	2194
54.	Coimbatore-Mettupalaiyam	2521	2730	2799

Appendix 3

Goods Traffic Density on the Railway Sections of the Region in 1962-63, and as Anticipated in 1970-71, and 1975-76

(Net tonne-kms per route-km per day)

Sl. No.	Railway section	Distance (kms.)	1962-63			1970-71[a]			1975-76[a]		
			Up	Down	Total	Up[b]	Down[b]	Total	Up[b]	Down[b]	Total
Main Lines											
1.	Salem-Jalarpet	121	2,385	5,514	7,889	5,800	11,386	17,186	8,509	16,032	24,541
2.	Virapandy Road-Salem	10	2,385	5,514	7,899	5,376	10,941	16,317	8,307	15,576	23,883
3.	Sankridrug-Virapandy Road	29	2,385	5,514	7,899	5,379	11,240	16,619	8,313	16,135	24,448
4.	Erode-Sankridrug	20	2,385	5,514	7,899	4,987	11,177	16,164	7,850	16,045	23,895
5.	Tiruppur-Erode	51	2,328	3,445	5,773	3,829	8,934	12,763	6,187	13,470	19,657
6.	Coimbatore-Tiruppur	49	2,328	3,445	5,773	3,888	8,682	12,570	6,170	13,006	19,176
7.	Madukarai-Coimbatore	16	3,324	3,116	6,440	4,169	6,810	10,979	6,903	10,419	17,322
8.	Olavakkot-Madukarai	39	3,324	3,116	6,440	4,200	6,749	10,949	7,025	10,297	17,322
9.	Villupuram-Tindivanam	37	1,778	2,042	3,820	2,135	5,477	7,612	4,365	7,995	12,360
10.	Vriddhachalam-Villupuram	55	2,048	1,841	3,889	2,349	4,052	6,401	4,777	5,755	10,532
11.	Ariyalur-Vriddhachalam	54	2,048	1,841	3,889	1,712	4,159	5,871	3,472	6,477	9,949
12.	Dalmiapuram-Ariyalur	24	2,048	1,841	3,889	1,685	4,095	5,780	3,445	6,372	9,817
13.	Lalgudi-Dalmiapuram	19	2,048	1,841	3,889	801	3,925	4,726	1,278	5,956	7,234
14.	Tiruchirapalli-Lalgudi	26	2,048	1,841	3,889	778	3,928	4,706	1,157	5,964	7,121
15.	Manaparai-Tiruchirapalli	37	695	815	1,510	143	1,566	1,709	548	2,360	2,908
16.	Dindigul-Manaparai	56	695	815	1,510	189	1,550	1,739	660	2,334	2,994
17.	Kodaikanal Road-Dindigul	22	863	684	1,547	216	1,339	1,555	706	1,796	2,502
18.	Samyanallur-Kodaikanal Road	28	863	684	1,547	246	1,268	1,514	465	1,684	2,149
19.	Madurai-Samyanallur	12	863	684	1,547	241	1,010	1,251	458	1,418	1,876
20.	Virudhunagar-Madurai	43	2,551	1,623	4,174	884	61	945	1,644	95	1,739
21.	Tulukapatti-Virudhunagar	16	2,205	621	2,826	1,315	830	2,145	2,971	1,226	4,197
22.	Satur-Tulukapatti	11	2,205	621	2,826	1,009	797	1,806	2,490	1,167	3,657

23.	Maniyachi-Satur	58	2,205	621	2,826	1,030	667	1,697	2,528	965	3,493
24.	Tuticorin-Maniyachi	32	1,882	551	2,433	1,181	368	1,549	1,877	548	2,425
25.	Talaiyuthu-Maniyachi	23	510	749	1,259	242	663	905	1,287	1,012	2,299
26.	Tirunelveli-Talaiyuthu	6	510	749	1,259	371	1,339[c]	1,710	549	806[c]	1,355
27.	Nellikuppam-Villupuram	33	904	1,447	2,351	287	3,430[d]	3,717	343	3,533[d]	3,876
28.	Cuddalore-Nellikuppam	13	904	1,447	2,351	282	3,266[d]	3,548	330	3,367[d]	3,697
29.	Chidambaram-Cuddalore	39	677	920	1,597	186	1,709	1,895	205	2,886	3,091
30.	Mayuram-Chidambaram	37	677	920	1,597	184	1,630	1,814	212	2,828	3,040
31.	Kumbakonam-Mayuram	32	476	909	1,385	111	741	852	193	1,494	1,687
32.	Papanasam-Kumbakonam	14	476	909	1,385	227	597	824	404	1,267	1,671
33.	Thanjavur-Papanasam	24	476	909	1,385	229	532	761	410	1.165	1,575
34.	Tiruchirapalli-Thanjavur	50	713	1,192	1,905	533	785	1,318	1,035	1,513	2,548
35.	Srivilliputtur-Virudhunagar	42	361	802	1,163	2,111	1,775	3,886	3,434	2,624	6,058
36.	S. N. Kovil-Srivilliputtur	44	361	802	1,163	1,540	1,370	2,910	2,698	2,027	4,725
37.	Tenkasi-S. N. Kovil	37	361	802	1,163	1,592	1,323	2,915	2,792	1,954	4,746
38.	Shencottah-Tenkasi	8	361	802	1,163	2,115	2,154[c]	4,269	3,747	2,111[c]	5,858
Branch Lines											
39.	Erode-Karur	66	1,240	696	1,936	2,065	1,830	3,895	2,876	3,010	5,886
40.	Karur-Kulitalai	39	1,240	696	1,936	1,591	780	2,371	2,178	1,540	3,718
41.	Kulitalai-Tiruchirapalli	37	1,240	696	1,936	1,514	717	2,231	2,073	1,439	3,512
42.	Pudukkottai-Tiruchirapalli	53	1,362	1,868	3,230	1.219	2,663	3,882	2,492	3,983	6,475
43.	Karaikudi-Pudukkottai	36	1,362	1,868	3,230	1,395	2,430	3,825	2,821	3,497	6,318
44.	Manamadurai-Karaikudi	61	1,362	1,868	3,230	1,660	2,459	4,119	3,305	3,549	6,854
45.	Virudhunagar-Manamadurai	66	—	—	—	1,913	2,211	4,124	3,778	3,213	6,991
46.	Manamadurai-Madurai	49	1,527	1,849	3,376	13	35	48	23	56	79
47.	Ramanathapuram-Manamadurai	60	48	104	152	84	450	534	100	704	804
48.	Dhanushkodi-Ramanathapuram	69	48	104	152	88	64	152	111	88	199
49.	Pollachi-Coimbatore	46	85	61	146	204	199	403	283	251	534
50.	Udumalpet-Pollachi	30	556	442	998	489	252	741	926	723	1,649

(*Continued*)

Appendix 3 (*Contd.*)

(Net tonne-kms per route-km per day)

Sl. No.	Railway section	Distance (kms.)	1962-63			1970-71[a]			1975-76[a]		
			Up	*Down*	*Total*	*Up*[b]	*Down*[b]	*Total*	*Up*[b]	*Down*[b]	*Total*
51.	Palni-Udumalpet	33	556	442	998	273	405	678	652	664	1,316
52.	Dindigul-Palni	59	556	442	998	322	282	604	746	496	1,242
53.	Peralam-Mayuram	16	74	212	286	155	765	920	177	1,261	1,438
54.	Tiruvarur-Peralam	22	74	212	286	172	685	857	206	1,162	1,368
55.	Tiruturaipundi-Tiruvarur	27	230	104	334	648	358	1,006	909	578	1,487
56.	Arantangi-Tiruturaipundi	96	32	71	103	137	244	381	247	391	638
57.	Karaikudi-Arantangi	26	32	71	103	161	174	335	291	264	555
58.	Thanjavur-Nidamangalam	31	162	305	467	111	513	624	204	844	1,048
59.	Nidamangalam-Tiruvarur	24	162	305	467	90	599	689	155	948	1,103
60.	Vriddhachalam-Salem	139	109	287	396	2,683	133	2,816	6,766	235	7,001
61.	Vriddhachalam-Neyveli	20	214	246	460	225	3,757	3,982	407	9,343	9,750
62.	Neyveli-Cuddalore	38	214	246	460	72	242	314	365	367	732
63.	Villupuram-Katpadi	161	804	1,290	2,094	473	2,839[e]	3,312	656	1,608[e]	2,264
64.	Ambasamudram-Tirunelveli	35	425	253	678	575	1,080[c]	1,655	979	498[e]	1,477
65.	Tenkasi-Ambasamudram	38	425	253	678	526	875[c]	1,401	908	271[c]	1,179
66.	Pollachi-Olavakkot	58	368	233	601	244	376	620	567	664	1,231
Branch Line Spurs											
67.	Salem-Mettur Dam	41	233	56	289	375	11	386	893	19	912
68.	Mettupalaiyam-Coimbatore	36	122	543	665	81	567	648	128	861	989
69.	Tiruvarur-Nagore	31	N.A	N.A	N.A	180	53	233	316	103	419
70.	Pondicherry-Villupuram	38	35	190	225	21	666[e]	687	27	108[e]	135
71.	Tiruchendur-Tirunelveli	62	119	36	155	Neg.	54	54	Neg.	91	91
72.	Tranquebar-Mayuram	30	24	10	34	10	50	60	24	58	82
73.	Karaikal-Peralam	24	N.A	N.A	N.A	Neg.	59	59	Neg.	100	100

74.	Vedaranhiyam-Tiruturaipundi	35	122	10	132	514	1	515	667	2	669
75.	Point Calimere-Vedaranhiyam	11	122	10	132	Neg.	Neg.	Neg.	Neg.	2	2
76.	Bodi-Madurai	90	33	11	44	11	35	46	18	67	85
77.	Mannargudi-Nidamangalam	13	N.A	N.A	N.A	31	113	144	64	188	252

a Excludes railway coal.

b Up and Down direction correspond to Southern Railway Time Table.

c The drop in 1975-76 over 1970-71 is due to discontinuance of cement movements to Kerala in that year.

d The lower rate of increase in 1975-76 over 1970-71 as compared to other sections is due to decrease in iron ore exports from Cuddalore Port.

e The drop in 1975-76 over 1970-71 is due to discontinuance of iron ore exports from Pondicherry Port and less volume of exports from Cuddalore Port.

Neg. indicates negligible.

Appendix 4

Present and Anticipated Densities of Traffic on Sections of Roads of Different Categories in the Years 1963-64, 1970-71 and 1975-76

NOTE

THE FIGURES OF anticipated road traffic density over different sections in the years 1970-71 and 1975-76 in terms of "Passenger Car Units" furnished in this appendix have been obtained by adding together

(i) the equivalent P.C.Us. for the Council's estimates of goods traffic in lorries and passenger traffic in buses in those years, and

(ii) the P.C.Us. in respect of all other items of traffic such as private cars, bullock-carts, cycles, etc., based on the PWD Census figures for 1963-64 multiplied by suitable conversion factors worked out by the Council to allow for the anticipated increases in traffic.

There are concrete reasons to believe that in the case of certain sections the 1963-64 figures of road traffic census are out of tune.[1] This may be due to abnormal local conditions during the period of Census, errors in enumeration, etc.

There is also another point of importance. As earlier stated, our figures of anticipated traffic densities have been built in part on PWD Census figures. But in many cases the census points have not been located close enough to each other to warrant the assumption that the figures of any particular census point represent fairly truly the traffic over the full length of the 'Section' in which it is located. Many 'Sections' with a single census point located in them are over 10 miles long and it is questionable if the traffic densities over such 'Sections' are reasonably uniform to warrant the application to the whole 'section' of the figures pertaining to the point of census. The error resulting from such action can be very substantial, particularly when the census point is located at one end of the section and near a town and not near the middle of the section.

On account of both these reasons, the anticipated traffic density figures given in this appendix have to be examined in the light of the experience of the local officers, and where our recommendations are not in keeping with their experience fresh census of road traffic should be taken at a larger

1 Example: Palayamkottai-Tiruchendur Road (Tuticorin Division), Census point mile 26/1.

The figures for buses and lorries given for this point in the summary sheet of the Census taken in Sept. 1963 are 13,752 and 24,216 P.C.Us. per day. These mean 2 buses and 3 lorries *per* minute in each direction. Having regard to the location of the point of Census, these figures are prima-facie unacceptable. A large number of motor-cycles and station wagons are also shown, working up the nearly three per minute. Also, the figures under these three columns are dimensionally many many times the corresponding figures at the other two check points on the same road.

These remarks apply to some extent to the number of bullock-carts also.

It is significant further that a rough comparison with the Census figures with those of the year 1960-61 yields the following results:—

The passenger car units, up and down taken together work out in 1963-64 Census to 59,186 against only 2,735 in 1960-61.

number of observation points not more than four miles apart from each other.

Detailed statements are available giving the several components that have gone into the estimated traffic in P.C.Us. anticipated by us over each section, to permit necessary corrections being made quickly based on the results of fresh census.

Present and Anticipated Density of Traffic on Sections of Road of Different Categories in the Region, 1963-64, 1970-71 and 1975-76

(In passenger car units per day)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
District : Salem						
Division: Krishnagiri						
Varanasi-Cape Comorin Rd.	174/0-185/7	174/7	3,000	2,361	3,815	5,133
-do-	185/7-188/5	185/7	3,000	1,909	3,167	4,218
—do—	187/3-188/5	187/4	3,000	4,833	6,134	8,414
Varanasi (Old Trunk Rd.)	187/0-188/5	188/5	3,000	2,005	4,587	5,952
—do—	188/5-192/4	188/5	3,000	3,540	4,736	6,432
—do—	192/4-203/0	192/4	3,000	3,962	4,867	6,470
—do—	219/1-228/0	219/6	7,500	5,858	9,255	13,191
—do—	228/0-230/0	228/1	7,500	22,350	30,558	39,637
—do—	228/0-230/0	228/8	7,500	27,968	31,808	41,430
Thoppur Mettur Bhavani Rd.	216/0-226/0	215/8	3,000	5,915	7,036	8,962
—do—	226/0-234/1	226/5	3,000	4,226	2,570	3,981
Omalur-Sankaridrug Rd.	0/0- 12/0	0/8	7,500	5,867	6,975	9,419
Omalur-Macheri Rd.	0/0- 10/1	1/1	3,000	2,980	4,304	6,020
Suramangalam-Taramangalam Rd.	10/5- 14/7	14/7	3,000	4,666	6,347	8,233
Taramangalam-Jalakantapuram Rd.	0/0- 3/0	0/2	3,000	1,908	3,103	4,378
Macheri-Solapadi Rd.	0/0- 3/0	0/1	3,000	4,503	5,506	6,701
Hosur-Adamankotta Rd.	0/0- 18/0	0/8	3,000	1,693	2,628	3,679
—do—	28/0- 54/4	54/4	3,000	1,262	2,188	3,157
Dharmapuri-Tiruppattur Rd.	0/6- 13/1	0/6	3,000	1,982	2,983	4,744
—do—	13/2- 26/8	24/2	3,000	1,878	2,926	4,094
Dharmapuri-Morappur Rd.	0/0- 8/6	1/0	3,000	1,712	2,627	3,725
Morappur-Marandahally	11/7- 18/6	18/7	3,000	1,419	2,243	3,210
Dharmapuri-Hogainakkal Rd.	0/0- 10/0	0/3	3,000	3,884	4,813	6,493
Salem Tiruppattur Rd.	47/4- 63/0	53/6	3,000	2,243	2,678	3,503
Harur-Morappur Rd.	0/0- 17/8	0/5	3,000	2,155	2,957	3,979
Bargur-Tiruppattur Rd.	0/0- 4/7	0/1	3,000	1,334	3,254	4,015
Dowlatabad-Cuddalore Rd.	0/0- 37/2	0/3	3,000	2,408	4,259	5,854
—do—		29/1	3,000	2,656	5,012	7,017
—do—		39/1	3,000	1,435	2,393	3,220

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Kaveripattinam-Kakkangarai Rd.		0/3	3,000	3,306	4,831	6,282
Hosur-Denkanikota Rd.	0/0- 6/0	2/4	3,000	2,885	3,548	4,417
Hosur-Thalli Rd.	0/0- 8/0	2/4	3,000	2,282	3,193	4,185
Denkanikotta-Kelamangalam Rd.	0/0- 8/0	7/6	3,000	1,948	2,619	3,340
Rayacottah-Athipalli Rd.	0/0- 14/0	13/5	3,000	1,948	2,909	3,711
—do—	14/0- 21/1	21/0	3,000	3,445	4,992	6,335
—do—	21/1- 24/7	22/3	3,000	2,159	3,225	4,174
Kaveripattinam-Banagamuttu Rd.	0/0- 5/0	0/4	3,000	2,502	3,426	4,123
Kaveripattinam-Palacode Rd.	0/0- 6/0	0/3	3,000	3,215	4,509	5,627
Pochampalli-Kallavi Rd.		0/1	3,000	2,029	3,567	4,869
Thogarapalli-Pochampalli Rd.	0/1- 9/6	9/6	3,000	2,033	3,368	4,483
Kaveripattinam-Pochampalli Rd.	0/0- 12/0	11/8	3,000	3,990	5,602	6,915
Chinnatiruppathi Rd.		0/1	3,000	2,818	4,469	5,851
Tholassampatti Rd.		0/1	3,000	1,647	2,811	3,804
Mettur-Kolathur Rd.	1/5- 7/1	1/5	3,000	1,436	2,438	3,303
Jalakandapuram-Nangavelli Rd.	0/0- 4/5	0/1	3,000	5,736	7,025	8,228
District : Salem						
Division: Salem						
Salem-Cochin Road	231/0-236/0	231/4	7,500	12,605	18,208	25,011
—do—	236/0-242/0	241/6	7,500	13,904	16,905	20,936
—do—	251/6-253/2	251/6	7,500	4,677	5,692	8,153
—do—	253/2-261/0	253/2	7,500	6,797	8,808	11,846
—do—	261/0-265/4	265/4	7,500	10,453	13,274	16,756
—do—	265/4-266/1	265/4	7,500	5,177	8,175	10,130
Tiruchirapalli-Salem Road	52/0- 57/0	53/3	7,500	4,505	8,898	12,009
—do—	57/0- 66/0	60/1	7,500	4,007	7,863	10,775
—do—	66/0- 71/0	68/2	7,500	3,488	8,017	10,794
—do—	71/0- 81/3	71/1	7,500	5,802	9,110	12,151
—do— (within mpl. limit)	81/3- 82/7	81/8	7,500	5,866	9,826	12,357
Namakkal-Velur Road	0/0- 11/0	0/4	3,000	4,494	8,387	11,701
—do—	11/0- 15/3	14/1		3,755	5,845	7,808
State Highways						
Salem-Cuddalore Road	2/2- 5/2	2/3	7,500	14,955	18,314	22,928
—do—	32/0- 45/6	32/7	7,500	7,017	10,503	13,506

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Salem Jn. Bye Pass Rd.	0/0- 3/4	0/4	3,000	11,377	18,945	25,812
—do—	0/0- 3/4	1/6	3,000	5,893	12,505	17,030
Salem-New Bye Pass Rd.	0/0- 3/1	1/6	3,000	11,488	19,622	28,873
Collector's Bungalow-Adimanam	0/0- 5/1	5/1	3,000	2,151	4,288	6,218
Tiruchirapalli-Salem Rd.	44/0- 52/0	51/8	3,000	2,609	4,523	6,207
Major District Roads						
Kokkampalaiyam-Chennappampatty Road	0/0- 3/4	3/0	3,000	4,604	7,461	9,892
Suramangalam-Taramangalam Rd.	3/4- 10/4	5/4	3,000	4,074	6,699	8,976
Kokkampalaiyam-Attayampatti Rd.	0/0- 3/2	3/0	3,000	3,881	4,948	5,710
Attayampatti-Masakkalipatti Rd.	0/0- 2/0	0/4	3,000	6,939	9,529	11,586
—do—	2/0- 7/0	2/6	3,000	5,287	7,388	9,102
Tiruchengode-Anyanoor Rd.	0/0- 14/0	0/6	3,000	8,860	12,036	15,067
—do—	14/0- 20/0	18/3	3,000	2,682	4,437	5,329
Arisipalayam-Cherrying Cross Rd.	0/0- 2/0	2/0	3,000	9,291	18,315	26,348
Pallapatti-Suramanglam Rd.	0/0- 3/2	3/2	3,000	4,857	8,035	10,704
Salem-Tiruppattur Rd.	0/0- 15/0	6/3	3,000	3,427	4,340	5,626
Valappadi-Thimanakkarpatty Rd.	0/0- 6/4	0/2	3,000	4,315	5,492	6,418
Rasipuram-Attur Rd.	0/0- 9/0	2/0	3,000	7,800	10,074	13,133
—do—	0/0- 9/0	3/0	3,000	11,403	15,908	20,249
—do—	0/0- 9/0	4/0	3,000	3,925	6,625	9,119
—do—	9/0- 16/0	14/8	3,000	2,199	3,166	3,908
Attur-Veeraganur Rd.	0/0- 4/3	0/4	3,000	9,667	13,718	17,092
—do—	4/3- 16/6	1/8	3,000	1,867	2,697	3,380
Thidavur-Thanmampatty Rd.	0/0- 15/2	3/1	3,000	3,316	5,025	6,394
—do—	0/0- 15/2	14/8	3,000	2,213	3,684	4,986
Mallikarai-Thammampatty Rd.	0/0- 12/3	9/6	3,000	4,791	7,149	9,867
Rasipuram-Adalur Rd.	0/0- 2/2	0/2	3,000	8,681	14,476	19,471
Rasipuram-Tiruchengode Rd.	2/2- 6/0	2/4	7,500	5,837	9,087	12,032
Rasipuram-Tiruchengode Rd.	6/0- 18/4	13/1	3,000	3,734	4,831	6,383
Namakkal-Rasipuram Rd.	16/0- 21/2	18/5	3,000	4,596	7,391	10,537
—do—	4/0- 16/0	3/7	3,000	3,939	6,386	8,716
Tiruchengode-Paramathi Rd.	0/0- 6/0	0/5	3,000	7,924	12,612	15,320
—do—	6/0- 18/2	18/2	3,000	2,840	5,024	7,122
Namfindapuram-Nadukombai Rd.	0/0- 5/0	2/0	3,000	5,775	8,018	9,729
Nainamalai-Sendamangalam Rd.	0/0- 5/0	0/0	3,000	5,280	8,297	10,769
Namakkal-Thuraiyur Rd.	0/0- 3/0	0/2	3,000	2,044	3,163	4,096

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Namakkal-Thuraiyur Rd.	3/0- 16/2	10/2	3,000	4,671	9,196	12,552
Namakkal-Mohamur Rd.	0/0- 1/6	0/3	3,000	3,581	10,881	15,649
Jadayampalayam-Velur Rd.	0/0- 9/3	0/2	3,000	2,891	4,037	5,020
Velur-Mohanur Rd.	0/0- 10/1	0/1	3,000	5,778	8,946	11,767
Pandamangalam-Velur Rd.	9/3- 12/3	12/3	3,000	5,899	9,026	12,109
Tiruchengode-Namakkal Rd.	0/0- 14/0	0/6	3,000	7,956	10,842	13,877
—do—	14/0- 22/4	21/8	7,500	8,542	13,586	18,386
Edapady-MacDonald's Choultry Rd.	0/0- 5/0	1/1	3,000	3,996	5,371	6,696
—do—	5/0- 11/1	3/6	3,000	3,185	4,705	6,252
Omalur-Sankaridrug Rd.	12/0- 17/0	14/3	3,000	3,173	3,375	4,072
Sankaridrug-Tiruchengode Rd.	0/0- 1/6	0/2	3,000	3,785	6,285	8,314
—do—	1/7- 3/4	1/7	3,000	5,459	7,036	8,620
Edapady-Jalakandapuram Rd.	0/0- 8/4	2/1	3,000	2,348	3,157	3,857
Kanarapalayam-Edapady Rd.	0/0- 8/0	3/7	3,000	4,125	5,688	7,092
—do—	8/0- 16/0	10/5	3,000	3,783	5,280	6,603
Other District Roads						
Ayodhyapattinam-Belur Rd.	0/0- 12/0	0/1	3,000	6,434	9,187	11,467
Valapady-Belur Rd.		0/1	3,000	3,700	4,912	5,965
Salem-Veeranam Rd.		0/6	3,000	5,708	8,965	11,661
Pallipalayam-Kumarapalayam Rd.	9/6- 18/2	12/2	3,000	10,265	12,491	14,679
Other District Roads (*Govt.*)						
Attur Bye Pass Road	0/0- 1/1	0/1	7,500	10,012	17,918	24,919
District: South Arcot						
Division: Villupuram						
Madras-Tiruchirapalli-Dindigul Rd.	64/0- 74/4	74/4	7,500	3,635	6,723	9,027
—do—	89/0- 97/0	90/8	7,500	15,932	21,218	27,147
—do—	97/0- 98/0	97/8	7,500	10,238	13,424	17,438
—do—	98/0-100/0	98/8	7,500	6,449	8,021	10,967
—do—	100/0-110/0	107/1	7,500	3,555	6,547	9,315
—do—	110/0-120/0	119/5	7,500	4,911	5,712	7,653
—do—	120/0-130/0	122/6	7,500	3,883	6,593	8,933
—do—	120/0-130/0	121/6	7,500	5,113	9,278	13,421
Cuddalore-Chittoor Rd.	30/0- 40/0	32/1	3,000	2,846	3,495	4,673
—do—	40/0- 52/6	44/6	3,000	3,630	3,934	5,063
—do—	40/0- 52/6	47/6	3,000	1,855	2,884	4,026
Ulundurpet-Salem Rd.	36/0- 46/3	43/3	3,000	4,382	7,249	10,241

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Markanam-Tindivanam-Gingee-Tiruvannamalai Rd.	10/0- 20/2	20/1	3,000	2,504	2,810	3,667
—do—	20/2- 24/0	21/5	3,000	9,660	11,478	14,976
—do—	24/0- 30/0	24/1	3,000	2,097	2,518	3,583
—do—	40/0- 50/7	44/2	3,000	1,561	2,294	3,520
Vikravandi Lower Anicut Rd.	92/5-104/5	93/2	3,000	1,909	2,856	3,702
Marthandi-Tindivanam Rd.	7/3- 15/0	11/6	3,000	973	2,510	3,622
—do—	15/0- 24/6	24/0	3,000	1,868	3,847	5,367
Markanam-Pondicherry Rd.	11/4- 18/2	17/8	3,000	2,533	3,889	5,435
Mailam-Pondicherry Rd.	89/0-101/4	98/3	3,000	3,979	5,394	7,052
Tindivanam-Vellimedupettai Rd.	3/7- 15/0	27/6	3,000	1,511	2,291	3,364
Villupuram-Gingee Road	3/7- 15/0	3/7	3,000	2,767	2,727	3,471
—do—	15/0- 22/6	22/8	3,000	4,536	7,682	10,640
Villupuram-Pondicherry Rd.	15/3- 25/3	18/8	3,000	2,188	2,465	3,347
	15/3- 25/3	24/1	3,000	9,922	12,679	16,307
	15/3- 25/3	24/6	3,000	7,715	9.103	11,107
—do—	15/3- 25/3	25/3	3,000	6,108	5,402	7,057
Villupuram-Tiruvannamalai Rd.	26/0- 46/5	26/0	3,000	7,227	8,150	9,505
—do—	26/0- 46/5	28/6	3,000	2,869	3,488	4,605
Pennathur-Chetput Rd.	4/5- 16/5	6/2	3,000	3,359	3,907	4,411
Gingee-Chetput Rd.	30/0- 38/0	31/6	3,000	3,571	5,052	6,370
Vriddhachalam-Ulundurpet Rd.	10/0- 13/3	13/3	3,000	1,511	2,227	3,210
Tirukoilur-Tyagadurgaur Rd.	0/0- 8/6	0/6	3,000	3,591	4,726	5,866
—do—	5/0- 10/0	8/8	3,000	2,329	3,331	4,256
Tirukoilur-Sankarapuram Rd.	0/0- 5/0	0/1	3,000	1,899	2,801	3,843
Tirukoilur-Asanur Rd.	8/8- 19/0	8/8	3,000	2,893	4,122	5,408
Ulundurpet-T. V. Nallur Rd.	13/4- 18/4	25/1	3,000	2,471	3,409	4,150
Pappanapattu-Valudavur Rd.	0/0- 10/0	0/7	3,000	3,109	4,236	5,194
Avalurpet-Tiruvannamalai Rd.	9/5- 11/5	9/6	3,000	3,992	6,127	7,782
Vallatly-Melmalayanur Rd.	0/0- 4/0	0/1	3,000	2,878	4,258	5,360
District : South Arcot						
Division: Cuddalore						
Madras-Tiruchirapalli-Dindigul Rd.	112/0-139/0	137/7	7,500	5,140	7,252	8,124
—do—	139/0-150/0	149/4	7,500	3,464	6,112	6,953
Cuddalore-Chittoor Road	0/0- 4/7	0/1	7,500	5,395	7,419	9,934
—do—	4/7- 6/7	4/7	7,500	5,491	6,713	8,772
—do—	6/7- 8/8	6/7	7,500	12,985	14,219	16,984
—do—	8/8- 9/4	8/8	7,500	11,728	13,992	15,867

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Cuddalore-Chittoor Rd.	9/4- 15/5	9/4	7,500	13,707	15,102	19,185
—do—	15/5- 24/0	15/5	7,500	11,516	14,477	18,596
Ulundurpet-Salem Road	46/4- 54/0	50/8	3,000	10,281	12,679	14,963
—do—	54/0- 57/0	56/4	3,000	10,175	12,740	15,028
—do—	57/0- 59/0	58/4	3,000	8,348	9,792	11,757
—do—	59/0- 66/0	64/3	3,000	5,584	6,547	8,194
—do—	66/0- 74/0	70/1	3,000	1,773	2,381	3,280
Pondicherry-Cuddalore Road	113/0-117/8	117/8	3,000	8,082	10,328	13,289
Vikravandi Lower-Anicut Road	109/1-109/4	109/1	3,000	7,183	9,989	12,470
—do—	109/4-110/2	109/4	3,000	9,951	13,365	15,945
Vikkalovandi-Lower Anicut Rd.	124/4-133/4	132/0	3,000	2,717	4,148	5,383
—do—	133/5-138/0	135/2	3,000	1,945	3,317	4,525
—do—	138/0-142/0	138/7	3,000	1,523	2,584	3,514
Cuddalore-Chidambaram Rd.	0/0- 0/7	0/1	7,500	13,694	17,671	23,108
—do—	0/7- 3/7	0/7	7,500	8,570	8,977	11,021
Cuddalore-Tirukoilur Anicut Rd.	1/7- 3/8	3/8	7,500	5,190	6,741	8,067
—do—	16/3- 21/0	16/3	7,500	5,782	8,852	11,553
Cuddalore-Pallaivellianur Rd.	4/6- 7/4	7/4	3,000	2,061	2,916	3,672
Cuddalore-Vriddhachalam Salem Rd	37/3- 50/0	38/4	3,000	8,568	10,007	12,449
—do—	50/0- 61/0	50/8	3,000	3,098	3,637	4,786
Vakkalpatti Road	4/3- 5/5	5/5	3,000	2,833	4,141	4,768
Arungunam Road	0/1- 0/3	0/1	7,500	12,160	17,231	21,965
Sitharasur Road	0/1- 3/0	0/1	3,000	11,145	12,927	16,563
Melpattam Bakkam-Seranavur Rd.	0/0- 1/4	0/1	3,000	10,419	12,133	15,175
Kuttanchavadi-Kathucuddalore Rd.		0/1	7,500	5,133	6,683	7,768
Vriddhachalam-Porto Novo Rd.	0/5- 12/0	0/5	3,000	5,471	5,906	6,866
—do—	12/0- 28/0	22/5	3,000	3,767	4,981	6,802
—do—	28/0- 35/0	28/3	3,000	4,082	5,360	6,412
Vriddhachalam-Tholur Rd.	0/0- 3/8	3/8	3,000	2,214	2,842	3,371
—do—	3/8- 19/0	19/0	3,000	3,032	3,248	4,041
Neyveli-Valayamadevi Rd.	0/0- 5/3	0/1	3,000	6,093	6,150	7,468
Chidambaram-Sirkazhi Rd.	26/0- 31/2	26/8	3,000	10,358	14,679	18,917
Chidambaram-Mannargudi Rd.	0/0- 8/2	8/2	3,000	3,802	4,665	5,370
—do—	8/0- 15/6	13/6	3,000	3,005	5,265	7,163
Mannargudi-Amapuliyur Rd.	11/4- 15/6	12/3	3,000	2,959	4,416	5,572
Kumartchi-Puliankudi Rd.	14/5- 19/1	8/2	3,000	3,369	4,298	4,956
Viranam Tank Bund Rd.	0/5- 9/5	9/5	3,000	1,386	2,451	3,360
Keerapalayam-Settiatope Rd.	3/4- 11/2	3/4	3,000	4,277	6,641	9,138

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Kallakurchi-Sankarapuram Rd.	0/0- 4/0	6/2	3,000	1,771	2,657	3,388
Kallakurchi-Kachirapalayam Rd.	0/0- 3/6	0/4	3,000	3,654	4,923	5,892
Kallakurchi-Koothakudi Rd.	0/0- 15/4	5/2	3,000	3,259	4,515	5,406
Tirukoilur-Tyagadwigam Rd.	10/0- 19/6	19/6	3,000	3,161	4,165	4,945
Tirukoilur-Sankarapuram Rd.	10/0- 22/0	10/7	3,000	5,820	7,772	9,363
District : Tirunelveli						
Division: Tuticorin						
Varanasi-Cape Commorin Rd.		358/3	7,500	9,917	9,525	12,551
—do—		358/8	7,500	10,907	10,037	13,728
—do—		362/6	3,000	3,815	4,568	6,884
Palayamkottai-Tuticorin Rd.		19/6	3,000	1,633	3,101	4,066
—do—		24/6	3,000	7,262	6,690	8,002
Tenkasi-Madurai Road		19/1	3,000	12,631	9,168	10,672
Tirunelveli-Rajapalaiyam		33/3	3,000	8,054	5,708	6,518
—do—		33/5	3,000	9,816	2,602	3,251
—do—		40/5	3,000	5,052	2,778	3,276
Palayamkottai-Tiruchendur		15/2	3,000	4,329	5,896	7,382
—do—		26/1	3,000	59,186	28,964	35,764
Srivaikuntam-Pudukottai Rd.	0/0- 4/0	0/1	3,000	2,559	2,971	3,553
Tuticorin-Tiruchendur Rd.		1/5	3,000	3,696	2,574	3,589
—do—		17/3	3,000	10,449	10,652	12,732
—do—		25/1	3,000	3,102	4,302	5,578
Tiruchendur-Kulasekharapatnam Rd.		0/1	3,000	2,352	3,251	4,084
Sankaranainarkovil-Chinthamani Rd.		0/1	3,000	6,811	7,976	10,680
Kovilpatti-Bye-Pass Road		0/1	3,000	5,651	7,304	8,834
Palayanikottai-Nagalpuram Road (Aruppukottai)		16/1	3,000	2,114	2,750	3,168
—do—		31/1	3,000	1,686	3,013	4,287
—do—		51/4	3,000	2,594	3,746	4,422
Ettayapuram-Vilathikulam Rd.		0/1	3,000	3,298	4,596	5,624
Tuticorin-Ettyapuram Road		4/3	3,000	3,225	5,732	8,111
—do—		10/0	3,000	2,476	4,892	7,027
—do—		10/1	3,000	1,613	2,989	4,285
—do—		26/2	3,000	4,891	7,406	9,757
Sankaranainarkovil-Nalatinpudur Road		0/1	3,000	3,794	4,808	5,999
—do—		11/0	3,000	4,082	5,417	6,562
—do—		21/1	3,000	2,343	3,718	5,025

NOTE: Capacity figures are not given for road sections of over 24 feet carriageway.

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Paravakudi-Kovilpatti Rd.		9/0	3,000	4,267	6,816	9,008
Sankaranainarkovil-Tiruvengadam Rd.		11/0	3,000	3,782	4,959	6,066
Ettayapuram-Aruppukottai Rd.		0/3	3,000	3,637	4,511	5,117
Paramankurichi-Udangudi		0/1	3,000	2,098	2,619	3,168
Paramankurichi-Tiruchendur		0/1	3,000	1,970	2,694	3,360
Tuticorin-Tharavaikulam		0/1	3,000	1,735	2,876	3,894
Pudukottai-Ottapidaram Rd.		0/1	3,000	1,650	2,612	3,380
Mengnanapuram-Kavamoli-Thalayanai Sastamkoil Rd.		5/3	3,000	2,199	2,850	3,438
—do—		13/0	3,000	2,226	3,128	3,862
Karumbur-Eral Road		0/1	3,000	2,177	2,889	3,378
Pannamparai-Mengnanapuram Rd.		5/2	3,000	2,333	3,202	3,937
District : Tirunelveli						
Division: Tirunelveli (South)						
B. C. C. Road	381/0-393/4	392/5	7,500	6,152	9,566	14,057
—do—	393/4-395/0	393/4	7,500	3,701	5,905	9,275
—do—	395/0-406/0	396/4	3,000	7,315	8,302	11,959
Tirunelveli-Shencottah Rd.		4/1	3,000	6,861	8,816	11,084
Tirunelveli-Pottalpudur Rd.		3/2	3,000	4,953	7,232	8,557
Veerakaralampudur-Summuganalur Road		0/1	3,000	1,865	2,641	3,367
Tirunelveli-Rajapalaiyam Rd.		0/6	3,000	6,401	8,448	10,861
Gangaikondan-Kurichi Road		384/6	3,000	1,839	2,696	3,244
Alagianpandiyapuran-Ukkirankottai		13/3	3,000	4,281	6,114	7,742
Theneerkulam-Branch Road		392/5 of BCC Rd.	3,000	1,840	2,653	3,515
Palayamkottai Bus Stand-Thatchanallur Road		0/1	3,000	1,914	3,393	4,526
Palayamkottai-Tiruthur Road		0/1	3,000	2,024	3,510	3,975
Palayamkottai-Nagalapuram Road		1/1	3,000	3,693	5,953	6,039
—do—		8/6	3,000	3,588	5,037	6,228
Palayamkottai-Tiruchendur Road		2/5	3,000	2,747	3,142	4,171
Palayamkottai-Ambasamudram Road		23/7	3,000	9,706	13,996	18,269
Kokkirakulam-Nanguneri Road		4/5	3,000	2,319	3,772	4,770
Ambasamudram-Tenkasi Road		1/2	3,000	10,738	14,685	19,634
Ambasamudram-Papanasam		1/2	3,000	8,538	14,708	19,689
Ambasamudram-Alangulam Road		4/7	3,000	5,305	8,529	11,111

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Cheranmahadevi-Kalakad Road		0/5	3,000	2,974	3,218	3,926
Quilon-Shencottah Road		59/2	7,500	6,529	7,400	12,117
—do—		58/4	7,500	4,920	6,850	9,182
Shencottah-Samboonadagari Rd.		3/6	3,000	5,125	6,951	8,316
—do—		10/7	3,000	4,811	6,736	8,206
Sivarampettai-Pambuli Shencottah Road		6/4	3,000	2,640	3,642	4,472
Tenkasi-Madurai Road		2/2	3,000	4,155	5,118	6,484
—do—		2/3	3,000	3,820	4,679	6,217
Ambasamudram-Tenkasi Road		32/6	3,000	2,342	2,931	3,587
Kadayanallur-Vallasai Road		10/1	3,000	3,899	5,675	5,873
Adiyuthur-Surandai Road		0/1	3,000	2,123	3,076	4,094
Pavoor-Vellegal-Surandai Rd.		28/1	3,000	3,391	4,653	5,628
Tenkasi-Courtallam-Shencottah Road		0/2	3,000	4,873	6,375	7,956
Kasimayarpuram-Kuthukkal-Vellai		0/1	3,000	1,439	2,359	3,164
B. C. C. Road		422/7	3,000	3,532	6,583	9,273
—do—		428/3	3,000	3,780	6,666	7,368
B. C. Road		431/0	3,000	2,739	4,415	6,067
Grand Southern Trunk Road		431/0	3,000	2,576	3,937	5,414
B. C. C. Road		440/3	3,000	2,041	3,064	4,045
Vallioor-Eruvadi Road		0/1	3,000	1,379	2,471	4,300
Vallioor-Ittamoli Road		1/1	3,000	1,473	2,421	3,341
Thisayanvilai-Udangudi Road		17/5	3,000	2,013	2,545	3,307
Nanguneri-Udangudi Road		17/5	3,000	2,702	3,689	4,765
B. C. C. Road		413/6	3,000	3,167	6,014	8,592
Cheranmahadevi-Kalakad Road		13/1	3,000	3,112	3,494	4,241
Cheranmahadevi-Panagudi Road		18/7	3,000	3,047	4,460	5,586
Nanguneri-Kalakad Road		13/1	3,000	2,466	4,472	5,303
Nanguneri-Eruvadi Therukungudy Rd.		18/7	3,000	2,649	4,237	5,240
Vijayananarayanam-Reddiarpatti Rd.		11/4	3,000	1,864	3,468	4,902
District : Tiruchirapalli						
Division : Tiruchirapalli						
Great Southern Trunk Road	164/5-175/0	172/0	7,500	4,887	6,772	8,311
—do—	175/0-192/4	189/1	7,500	8,579	9,500	11,896
—do—	192/4-193/2	192/5	7,500	8,111	11,328	14,817
—do—	193/2-194/7	194/1	7,500	14,635	15,253	20,455
—do—	195/2-199/6	195/4	7,500	13,366	17,441	24,943
—do—	—do—	197/2	7,500	23,041	26,589	35,396

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Great Southern Trunk Rd.	199/6-214/0	199/6	7,500	4,974	6,767	7,770
Tiruchirapalli-Coimbatore Rd.	0/0- 7/6	0/1	3,000	7,000	8,547	10,812
—do—	7/7- 16/0	11/2	3,000	7,965	9,978	12,057
Tiruchirapalli-Salem Rd.	4/4- 26/7	4/8	7,500	6,541	7,958	9,792
—do—	—do—	23/8	7,500	5,360	7,246	9,126
—do—	26/7- 28/1	28/1	7,500	4,227	6,883	8,217
—do—	32/4- 42/0	32/4	3,000	1,724	4,363	5,273
Thanjavur-Tiruchirapalli Rd.	28/1- 34/5	34/1	7,500	35,036	37,503	49,073
—do—	—do—	34/5	7,500	18,292	21,698	27,230
Tiruchirapalli-Chidambaram Rd.	4/4- 28/0	4/4	7,500	6,837	7,407	9,185
—do—	—do—	11/8	7,500	10,849	15,525	20,152
—do—	52/0- 57/0	57/1	3,000	2,488	4,197	5,620
—do—	57/0- 57/5	57/1	3,000	3,642	5,881	7,756
—do—	57/5- 60/0	57/5	3,000	3,738	5,571	7,217
—do—	60/0- 64/5	64/5	3,000	4,132	6,037	7,556
Tiruchirapalli-Viralimalai Madurai Rd	198/6-210/0	201/0	7,500	5,228	7,770	11,136
Pudukkottai-Tiruchirapalli Rd.	25/4- 31/7	31/7	7,500	10,435	17,384	23,447
Tiruchirapalli-Thanjavur-Thammanpatti Rd.	5/6- 20/0	5/6	3,000	6,251	7,645	9,807
—do—	27/0- 29/4	29/4	3,000	2,361	3,883	5,320
—do—	29/4- 38/0	29/4	3,000	1,766	2,782	3,757
—do—	38/0- 47/1	38/8	3,000	1,701	2,423	3,206
Musiri-Thanjavur Road	34/4- 45/0	35/0	3,000	4,942	6,185	8,086
—do—	45/0- 51/4	45/7	3,000	1,544	2,433	3,493
Thanjavur-Perambalur Rd.	52/6- 59/3	53/4	3,000	2,728	3,600	4,728
—do—	59/7- 72/4	72/4	3,000	3,571	3,456	4,577
Vellur-Anicut-Lower Anicut Road	142/0-150/0	150/0	3,000	4,184	6,008	7,538
—do—	150/0-154/2	150/0	3,000	4,172	6,108	6,750
Jayakondocholapuram-Vriddhachalam Road	11/0- 17/0	11/3	3,000	2,407	3,332	4,096
—do—	17/0- 19/8	19/8	3,000	2,438	3,688	4,505
—do—	19/8- 25/6	19/8	3,000	2,545	3,776	5,540
Thoraimangalam-Bungalow Rd.	0/0- 0/7	0/3	3,000	2,857	4,106	6,182
Perambalur-Attur Rd.	0/0- 16/2	0/5	3,000	4,256	5,324	7,703
Tiruchirapalli-Kulimani-Jeeyapuram Road	0/0- 8/0	0/1	3,000	12,109	16,078	16,591
Jayakondocholapuram-Sendurai Rd.	0/0- 15/7	0/0	3,000	2,362	2,967	3,732

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Namakkal-Thathiengarpet-Eragudy Rd.	16/2- 21/1	21/1	3,000	1,608	2,373	3,105
Allitharai-Thogaimalai Rd.	3/2- 9/0	3/2	3,000	5,378	6,217	6,583
Pullambadi-Sirugalappur Padalur Road	0/0- 15/2	6/2	3,000	2,673	5,805	7,615
Andimadam-Srimushnam Rd.	0/0- 3/0	0/1	3,000	2,646	3,695	4,527
Jayankondacholapuram-Madanathoor Rd.	0/0- 11/0	11/0	3,000	2,625	3,936	5,157
Puvalur-Siruganur Rd.	0/0- 9/0	1/6	3,000	4,331	5,744	6,933
Puvalur-Tiruppattur Rd.	9/0- 15/6	14/6	3,000	3,653	4,491	5,174
Musiri-Thathiengarpet-Murukur-Eragudy Rd.	0/0- 6/5	0/0	3,000	2,800	4,156	5,263
—do—	12/2- 19/4	19/4	3,000	1,872	2,598	3,189
—do—	19/4- 25/0	19/4	3,000	2,057	2,809	3,442
Seeplaputtur-Kathuputtur-Namakkal Road	0/0- 2/0	1/8	3,000	1,955	2,651	3,203
—do—	2/0- 6/5	2/3	3,000	2,498	3,225	3,843
Musiri-Pulivalam Road	0/0- 15/0	0/2	3,000	2,968	4,063	4,958
Manachanallur-Edumalai Road	0/0- 10/0	0/4	3,000	2,252	3,204	3,951
Permangalam-Keelavadi Rd.	0/0- 12/4	9/1	3,000	2,333	3,316	4,064
Manachanallur-Samayapuram Rd.	0/0- 2/3	0/1	3,000	4,192	6,129	7,779
Manachanallur-Tirupangili Rd.		0/4	3,000	2,157	2,970	3,581
Irungulur-Sengenthi Rd.	0/0- 9/0	0/0	3,000	1,412	2,310	3,081
Samayapuram-Maruthur Rd.		0/0	3,000	4,390	6,703	8,684
Siruthaiyur-Sankaraiyur Rd.	0/0- 5/0	0/0	3,000	9,821	15,113	19,718
Pullambadi-Barudamangalam Rd.		0/0	3,000	2,779	3,898	4,698
Alathon-Chettikulam Rd.	0/0- 8/5	0/1	3,000	2,278	3,316	4,302
Bommanapadi-Senjeri Rd.	0/0- 7/3	7/3	3,000	3,797	4,090	4,958
Ariyalur Street Road	0/1- 0/4	0/1	3,000	3,942	6,072	6,704
Ariyalur-Kallankurichi Rd.	0/4- 3/4	0/5	3,000	9,177	11,335	10,997
Ariyalur-Vilangudi Rd.	0/1- 7/2	0/5	3,000	5,657	7,566	9,166
Ponmalaipatty Road	0/0- 1/6	0/1	3,000	1,710	2,725	3,723
Sengaliandepuram-Senthannipuram Rd.	0/0- 0/7	0/1	3,000	4.793	5,969	9,218
Perur-Pandamangalam Rd.	2/8- 8/4	2/8	3,000	4,196	6,112	8,205
Thiruverambur-Old Vennor Rd.	0/0- 2/6	0/1	3,000	2,709	4,512	5,870
Kilakalkandar-Kottai Road	0/0- 2/6	0/1	3,000	2,283	3,807	5,048
Kajamalai-Maiyur Rd.	0/0- 2/3	0/1	3,000	1,834	2.989	4,060

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Ratchampettai-Edayathimangalam Rd.	0/0- 4/2	8/1	3,000	3,082	4,371	6,080
Madurai Nagar-Tirumangalam Road	0/3- 4/5	0/1	3,000	2,757	4,322	4,705
Puvalur-Alangudi Rd.	0/0- 7/2	0/1	3,000	4,027	5,277	6,789
Pudur-Uthamnalur-Vellanur Road		5/5	3,000	3,589	5,206	5,867
Kattuputhur-Unniyur Rd.	0/0- 3/6	0/0	3,000	1,829	2,604	3,159
District : Tiruchirapalli						
Division: Pudukkottai						
Karur-Aravakurichi Road	16/2- 22/5	16/2	3,000	1,484	2,825	3,750
Karur-Aravakurichi-Dindigul Road	0/0- 16/2	16/2	3,000	4,588	5,492	6,616
—do—	16/2- 18/5	18/1	3,000	3,242	5,821	7,940
—do—	18/5- 28/0	22/5	3,000	3,328	4,284	5,502
Karur-Pugalur Road	0/0- 6/0	0/3	7,500	6,339	8,290	10,680
—do—	6/0- 7/7	7/7	7,500	13,594	15,086	18,565
—do—	7/7- 10/0	7/7	3,000	23,236	25,238	30,601
—do—	10/0- 11/2	11/2	3,000	15,388	15,486	17,607
Tiruchirapalli-Coimbatore Rd.	16/0- 28/0	21/4	7,500	4,232	8,150	12,224
—do—	28/0- 46/7	21/4	7,500	4,569	8,526	11,616
—do—	46/7- 47/7	46/7	7,500	6,906	8,755	10,923
—do—	47/7- 49/4	49/2	7,500	4,363	6,694	8,363
—do—	49/4- 55/0	49/2	3,000	2,902	5,545	7,071
—do—	55/0- 60/0	52/4	3,000	4,545	5,366	7,128
—do—	60/0- 69/2	65/1	3,000	2,435	2,844	3,869
Pudukkottai-Thanjavur Rd.	0/0- 0/4	0/4	7,500	6,575	10,186	14,171
—do—	1/4- 5/4	5/4	3,000	2,392	2,863	3,806
—do—	5/4- 11/4	11/4	3,000	2,557	2,915	3,777
—do—	11/4- 14/1	14/1	3,000	2,858	3,259	4,059
Pudukkottai-Madurai Rd.	0/5- 8/0	6/3	3,000	2,178	3,788	6,029
—do—	8/1- 13/0	12/5	3,000	1,689	3,201	5,098
—do—	13/1- 20/8	12/8	3,000	1,351	2,838	3,725
Pudukkottai-Arantangi Road	0/3- 3/1	0/3	7,500	5,954	9,026	12,002
—do—	3/1- 10/2	3/1	3,000	4,765	6,459	7,887
—do—	10/2- 12/3	10/2	3,000	1,688	2,615	3,529
Pudukkottai-Pattukkottai Rd.	3/1- 11/1	3/1	3,000	2,189	3,421	5,329
—do—	11/1- 12/3	11/1	3,000	2,085	3,308	4,827
—do—	12/2- 22/5	12/3	3,000	3.221	5,032	7,072

NOTE: Capacity figures for road sections of over 24 feet width are not given.

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Pudukkottai-Pattukkottai Rd.	22/5- 25/7	22/5	3,000	3,534	6,839	7,937
Pudukkottai-Tiruchirapalli Rd.	0/4- 5/8	0/4	7,500	3,938	8,785	11,753
—do—	14/4- 25/4	14/4	3,000	5,309	6,521	7,272
Alangudi-Anarangal Rd.	12/2- 21/3	12/3	3,000	5,445	8,081	10,222
Tirumayam-Nemathanpatti Road	12/7- 16/5	12/8	3,000	940	1,893	3,201
Pudukkottai-Nedumargudi Road	17/1- 24/1	17/2	3,000	2,977	4,033	4,598
Namanasamudram-Ponnamaravathy Road	6/2- 25/4	21/2	3,000	1,305	2,173	3,131
Pudukkottai-South Kalathur Road	10/4- 25/4	10/4	3,000	3,293	5,215	6,781
—do—	25/4- 26/0	25/4	3,000	2,953	4,256	5,265
—do—	26/0- 30/7	26/0	3,000	2,832	3,899	4,768
Viralimalai-Manaparai Road	0/0- 6/4	0/0	3,000	2,654	1,840	4,895
Tiruchirapalli-Viralimalai Madurai	220/0-234/8	234/8	3,000	2,759	6,600	7,266
—do—	234/8-239/4	234/8	3,000	3,272	6,739	7,186
Kovilpatti-Manaparai Road	0/0- 7/5	7/5	3,000	3,402	5,963	8,230
—do—	0/0- 7/5	7/5	3,000	2,520	4,491	6,222
Manaparai-Thuvaraukurichi Road	0/0- 17/0	0/0	3,000	4,155	7,246	10,204
—do—	17/0	17/0	3,000	5,032	7,986	10,846
Karur-Vangal Rd.	0/0- 7/1	1/6	3,000	4,870	8,483	11,815
Mylampatti-Uppidamangalam Road	0/1- 17/6	17/6	3,000	3,803	5,419	6,554
Aravakurichi-Palni Rd.	0/0- 3/3	3/3	3,000	1,892	2,466	3,209
Paramathy-Nyyal Rd.	0/0- 6/4	6/4	3,000	2,311	3,020	3,643
Erode-Karur Road	27/0- 34/0	27/2	3,000	3,156	4,603	5,840
—do—	34/0- 38/3	38/3	3,000	2,461	4,213	5,737
Karur-Dharapuram Rd.	5/0- 13/0	5/0	3,000	3,454	3,197	6,031
—do—	13/0- 21/3	17/6	3,000	1,169	2,167	3,138
Aravakurichi-Dharapuram Road	0/2- 2/0	18/1	3,000	4,222	6,823	9,121
Pallapatti-Manaparai Road	0/0- 2/7	2/5	3,000	2,118	3,261	4,229
Valanadu-Kalingapatti Rd.	0/0- 8/7	0/0	3,000	1,514	2,483	3,304
Karur-Nerur Road	1/6- 6/5	1/6	3,000	2,708	3,571	4,444
Nerur-Dhalavapalayam Rd.	0/0- 4/0	0/1	3,000	1,912	2,817	3,546
Nerur-Renganathampettai Rd.	0/0- 1/7	6/1	3,000	2,108	3,415	4,522
Pudukkottai-Embal Road	1/4- 10/7	1/4	3,000	2,876	4,946	6,851
—do—	10/7- 11/3	11/3	3,000	2,317	3;643	4,910
—do—	11/3- 17/2	17/2	3,000	3,321	3,966	4,630
Alangudi-Arimalam Road	6/4- 9/6	9/6	3,000	1,878	2,952	4,050
—do—	0/0- 6/4	0/1	3,000	2,023	3,304	4,437
Pudukkottai-Manaparai Rd.	2/4- 7/0	2/4	3,000	1,220	2,123	3,119

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Pudukkottai-Manaparai Rd.	12/4- 27/4	27/4	3,000	2,210	3,444	4,637
—do—	27/4- 32/0	27/5	3,000	1,793	2,693	3,520
Pudukkottai-Embal Road	0/0- 17/3	17/3	3,000	4,491	5,732	6,789
Annavasal-Kolathur Road	0/0- 8/3	10/4	3,000	2,765	4,320	5,583
Manipallam Road	1/2- 12/2	12/2	3,000	1,985	3,030	3,895
Nadavalam-Pudukkottai Rd.	5/4- 12/3	12/3	3,000	1,817	2,672	3,350
—do—	12/3- 20/6	12/3	3,000	2,701	3,698	4,482
Keeranur-Adanakkottai Rd.	0/0- 8/3	0/3	3,000	2,856	4,648	5,381
—do—	0/3- 8/1	8/1	3,000	2,556	3,778	4,766
—do—	8/1- 9/1	9/1	3,000	3,345	4,460	5,298
—do—	9/1- 14/0	14/1	3,000	2,403	3,197	3,817
Karambakudi-Ragunathpuram Road	25/7- 34/4	25/7	3,000	4,125	5,867	7,330
Adanakkottai-Alangudi Road	7/2- 11/4	11/4	3,000	4,528	6,237	7,530
District : Coimbatore						
Division : Coimbatore						
Madras Calicut Rd.	293/6-303/1	297/1	7,500	7,471	9,863	13,112
—do—	303/1-309/3	303/2	7,500	10,509	15,362	21,202
—do—	309/3-317/0	312/4	7,500	8,626	11,154	14,995
—do—	317/0-321/2	318/6	7,500	6,208	8,460	11,739
—do—	321/2-326/6	326/6	3,000	26,773	36,491	50,302
Tiruchirapalli-Coimbatore Rd.	96/0- 96/0	93/2	3,000	3,571	4,063	5,361
—do—	90/0-103/2	103/2	3,000	4,170	4,994	6,676
—do—	103/2-109/0	104/6	3,000	6,573	7,944	10,764
—do—	109/0-112/0	112/0	7,500	7,213	8,150	10,734
—do—	112/0-116/0	115/6	7,500	10,257	16,246	22,076
—do—	116/0-121/1	120/2	7,500	14,093	22,851	31,333
	121/1-124/5	122/5	7,500	18,773	24,670	33,941
—do—	124/5-127/5	126/7	7,500	38,334	50,985	71,582
Coimbatore-Mettupalaiyam Road	0/4- 3/3	2/3	7,500	19,956	24,826	33,346
—do—	3/3- 9/0	3/6	7,500	22,809	27,267	31,022
—do—	3/3- 9/3	7/0	7,500	8,718	11,835	16,224
—do—	9/3- 16/6	11/4	3,000	8,719	12,681	17,671
—do—	16/6- 22/6	22/3	7,500	17,058	19,113	25,668
Coimbatore-Satyamangalam Rd.	1/1- 5/3	1/5	7,500	15,006	23,069	34,302
—do—	5/3- 12/7	4/5	7,500	27,082	30,695	37,676
—do—	5/3- 12/7	12/3	3,000	4,911	5,921	6,907
—do—	12/7- 24/5	16/2	7,500	6,377	7,945	9,066

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Coimbatore-Dindigul Rd.	1/6- 5/6	3/4	7,500	7,612	8,946	11,542
—do—	9/6- 19/6	13/3	3,000	7,075	9,118	11,400
—do—	19/6- 26/7	24/6	7,500	19,305	24,999	33,749
—do—	26/3- 37/2	27/2	7,500	5,305	6,448	8,024
—do—	37/2- 41/7	39/5	7,500	5,230	6,496	8,117
—do—	41/7- 51/6	42/3	7,500	6,843	9,265	11,604
—do—	41/7- 51/6	43/3	7,500	10,692	12,813	16,295
Coimbatore-Tadagam Rd.	1/0- 4/0	2/1	7,500	11,172	21,854	31,230
—do—	4/0- 9/6	7/0	3,000	1,603	2,586	3,471
Coimbatore-Madampatti Rd.	0/0- 4/5	0/1	3,000	5,733	9,230	12,278
—do—	4/5- 8/2	5/8	3,000	3,172	4,863	6,330
Coimbatore-Siruvani Rd.	1/4- 5/3	1/4	7,500	9,653	15,848	19,593
—do—	9/0- 18/5	12/4	3,000	6,453	9,382	11,961
4/2 of Coimbatore-Siruvani Rd. to 333/6 of Madras Calicut Rd.	0/0- 4/1	0/1	3,000	9,443	12,216	14,837
Podanur-Junction Rd.	0/0- 1/5	0/2	3,000	4,109	8,093	11,380
Podanur-Chettipalayam Rd.	1/6- 7/0	2/0	3,000	5,107	8,863	11,789
Ramanathapuram-Podanur Rd.	1/3- 3/3	1/4	3,000	5,465	8,744	11,613
Ettimadai-Cochin Frontier Road	0/8- 5/0	0/1	3,000	2,605	5,334	7,321
Palladam-Cochin Frontier Road	16/6- 23/0	19/4	3,000	4,513	6,761	8,295
Podanur-Vellalur Rd.	0/0- 3/0	0/1	3,000	6,238	8,388	10,302
Ambarampalayam-Sethamadai Rd.	0/0- 10/0	4/2	7,500	7,635	11,759	14,163
Anaimalai-Pulankinar Rd.	10/0- 20/0	19/5	3,000	1,808	2,939	3,895
Road from 34/2 of Pollachi-Vanaturai Road to 4/2 of Anaimalai-Pulankinar Rd.	0/0- 2/4	1/3	3,000	8,496	11,741	14,450
0/4 of Pollachi-Meenkarai Rd. 0/0-0/6 to 0/0-0/6 Meenakshipuram		0/2	3,000	3,418	4,497	5,288
Anaimalai Road	0/0- 10/0	7/2	3,000	2,128	4,401	6,715
Udumalpet-Chinnar Rd.	0/0- 1/3	0/2	7,500	6,582	10,812	14,814
—do—	1/3- 18/0	6/2	3,000	1,729	2,744	3,581
Udumalpet-Tirumurthi Hills Rd.	4/3- 11/7	7/5	3,000	2,570	3,976	5,212
Dhalli-Kumaralingam Rd.	0/0- 10/4	6/7	3,000	1,803	2,687	3,668
Udumalpet-Kumaralingam Rd.	0/0- 11/6	8/8	3,000	3,843	5,784	6,268
Udumalpet-Dharapuram Rd.	0/4- 12/4	4/6	3,000	5,306	7,572	9,782
Dhalli-Pulankinar Rd.	0/0- 3/6	1/4	3,000	1,488	2,309	8,000
Udumalpet-Tiruppur Rd.	0/0- 0/7	0/2	3,000	4,785	6,425	8,264
—do—	14/2- 23/0	15/0	3,000	4,145	4,345	5,149

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Udumalpet-Tiruppur Rd.	23/0- 25/0	23/0	3,000	3,888	3,442	4,148
—do—	25/0- 35/0	25/3	3,000	4,154	3,904	5,110
—do—	35/0- 37/0	35/2	3,000	5,428	5,655	6,848
—do—	37/0- 38/2	38/1	7,500	9,354	9,952	11,815
Dharapuram-Pollachi Rd.	28/0- 33/6	36/6	3,000	4,253	5,004	5,986
Pollachi-Meenakarai Rd.	0/0- 4/5	1/5	3,000	8,882	11,375	13,217
—do—	4/5- 13/6	5/2	3,000	5,385	6,878	8,818
Pollachi-Vannanthurai Rd.	29/5- 37/0	34/3	3,000	4,906	7,514	9,893
—do—		29/5	3,000	6,893	9,741	12,044
Dharapuram-Tiruppur Rd.	16/0- 29/4	25/4	3,000	2,175	3,443	4,599
—do—	16/0- 20/4	18/2	3,000	1,786	2,498	3,223
Kattampatti-Koduvoi Rd.		12/2	3,000	3,895	5,095	5,999
—do—		18/6	3,000	2,812	3,967	4,764
Palladam-Dharapuram Rd.	0/8- 11/4	6/4	3,000	4,946	6,719	8,407
Sulur Railway Feeder Rd.	0/0- 3/4	0/6	3,000	4,843	6,602	7,880
Tiruppur-Padiyur Rd.	1/2- 9/0	3/4	3,000	3,045	4,860	5,864
Tiruppur-Kunnathur Rd.	0/0- 7/4	0/3	7,500	5,377	6,283	8,828
—do—	7/4- 11/7	7/5	3,000	6,194	7,997	9,681
Sulur-Somanur Rd.	0/0- 6/0	5/8	3,000	7,373	9,442	11,842
Sulur-Sallakarachel Rd.	0/0- 2/7	0/2	3,000	6,160	8,264	9,622
—do—	2/7- 3/2	3/2	3,000	1,740	2,596	3,358
Palladam-Mangalam Rd.	0/0- 8/0	0/5	3,000	2,603	3,986	4,774
Tiruppur-Somanur Rd.	1/4- 11/6	5/4	3,000	2,061	1,789	4,246
Pollachi-Palladam Rd.	0/0- 12/0	8/6	3,000	12,841	13,892	16,891
—do—	12/0- 29/2	27/2	3,000	10,358	11,643	14,481
Pollachi By-pass Rd.	0/0- 1/5	1/1	7,500	8,736	12,838	16,625
Pollachi-Palghat Rd.	0/0- 9/7	1/3	7,500	8,584	12,752	16,642
Tiruppur-Mettupalaiyam Rd.	0/0- 9/4	1/0	3,000	6,246	6,237	10,346
—do—	9/4- 20/4	14/4	3,000	2,709	4,945	6,684
—do—	20/5- 26/0	21/1	3,000	9,275	12,717	15,290
Satyamangalam-Mettupalaiyam Rd.	12/3- 19/0	15/4	3,000	1,698	2,327	3,229
—do—	19/0- 27/0	26/5	3,000	4,775	6,580	10,195
Cheyur-Erode-Satyamangalam Rd.	0/0- 8/0	0/5	3,000	2,900	4,323	5,588
Avanashi-Pullampatti Rd.	0/0- 8/0	0/8	3,000	3,839	7,919	10,507
—do—	8/0- 11/0	8/1	3,000	1,765	3,786	4,733
Kotagiri-Mettupalaiyam Rd.	10/2- 19/4	19/1	3,000	7,133	8,773	10,610
Kamanaichkenpalaiyam-Annur Rd.	0/0- 7/0	4/4	3,000	3,130	4,443	5,630
—do—	7/0- 12/0	7/8	3,000	8,920	11,919	14,115

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Kamanaichkenpalaiyam-Annur Rd.	12/0- 24/6	12/4	3,000	7,128	9,568	11,532
Andipalayam-Attampalaiyam	0/0- 4/5	1/0	3,000	2,141	2,795	3,331
Cheyur-Kunnathur Rd.	0/0- 12/2	10/4	3,000	2,275	2,957	3,518
Tippampatti-Chellappampalai	0/0- 6/5	—	3,000	2,039	2,898	3,885
Negamam-Erisinampatti	5/0- 9/6	9/6	3,000	1,775	2,548	3,182
Kovilapalayam-Negamam Rd.	0/0- 5/0	0/1	3,000	3,445	4,690	5,712
Road from 18/5 of Pollachi Palladam to Malayadi-Palaiyam Rd.		18/5	3,000	2,287	2,850	3,280
Kinathu Kadavoo-Kattampatti Rd.	5/0- 10/0	6/0	3,000	6,417	8,882	10,970
Kamanaichkenpalaiyam-Negamam Chettipalaiyam Road	4/0- 11/4	5/6	3,000	6,131	8,195	9,877
Vadachilloor-Negamam Rd.	0/0- 6/6	5/6	3,000	6,544	5,858	7,220
Madras-Calicut Road	326/6-330/6	328/6	7,500	71,188	114,565	154,898
—do—	330/6-334/4	331/1	7,500	12,320	21,659	29,916
—do—	334/4-343/1	340/0	7,500	4,801	8,197	11,361
Coimbatore-Dindigul	41/7- 51/6	51/1	7,500	6,071	8,731	11,091
Tiruppur-Mettupalaiyam Rd.	21/6- 32/7	32/3	3,000	6,012	9,131	11,982
District : Coimbatore						
Division : Erode						
Salem-Cochin Road	266/1-270/0	266/7	7,500	6,877	9,957	13,900
—do—	280/0-286/0	280/3	7,500	16,054	17,488	21,993
—do—	286/0-292/0	286/4	7,500	8,767	8,237	10,582
Coimbatore-Satyamangalam Chamarajanagar Road	29/0- 38/5	29/4	3,000	7,184	10,700	14,003
—do—	38/5- 43/0	42/1	3,000	2,316	2,954	3,654
Tiruchirapalli-Coimbatore Rd.	69/2- 81/0	73/3	3,000	10,639	17,971	24,744
—do—	81/0- 84/4	84/3	3,000	4,382	6,564	8,824
—do—	84/4- 90/0	84/5	3,000	6,283	8,542	10,854
Erode-Satyamangalam Road	0/0- 7/0	2/1	3,000	13,646	19,956	27,152
—do—	7/0- 14/0	7/1	3,000	4,351	7,060	9,568
—do—	14/0- 17/4	14/6	3,000	6,948	10,502	13,766
—do—	17/4- 33/0	24/3	3,000	10,631	13,063	16,781
—do—	33/0- 39/1	37/8	3,000	2,512	3,651	4,655
Erode-Muthur Road	0/0- 2/2	1/1	3,000	6,374	9,538	12,730
—do—	2/2- 12/0	3/3	3,000	4,845	6,667	8,516
—do—	12/0- 17/0	15/7	3,000	5,373	7,623	9,208
—do—	17/0- 22/0	17/5	3,000	6,535	8,963	10,936

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Erode-Karur Road	2/2- 12/0	6/8	3,000	3,240	4,668	5,905
—do—	12/0- 22/0	19/6	3,000	3,264	5,731	7,906
—do—	22/0- 27/0	24/5	3,000	4,412	6,641	8,720
Erode-Kangayam Road	0/0- 3/1	1/3	3,000	8,250	10,782	14,197
—do—	3/1- 17/0	1/1	3,000	3,127	4,480	5,973
—do—	17/0- 27/5	27/3	3,000	2,357	4,006	5,462
Erode-Bhavani Road	1/3- 7/1	2/6	3,000	6,524	10,490	14,225
Perundurai-Maccanamcombai Road	0/0- 9/0	0/1	3,000	3,240	5,111	6,666
—do—	9/0- 17/0	13/1	3,000	10,447	13,823	16,319
—do—	17/0- 24/2	19/7	3,000	2,416	3,376	4,243
Erode-Perundurai Rd.	1/2- 11/7	11/5	3,000	7,014	11,040	15,790
Chennimalai-Uttukuli Rd.	0/0- 3/0	0/1	3,000	6,382	9,967	12,921
—do—	3/0- 11/3	9/6	3,000	2,811	3,938	4,891
Perundurai-Kunnathur Rd.	0/0- 9/0	0/1	3,000	27,195	38,295	37,200
—do—	9/0- 12/1	12/2	3,000	12,825	17,413	20,876
Perundurai-Kangayam Rd. and	0/0- 2/0 8/0- 12/0	0/1	3,000	6,651	10,539	14,060
—do—	12/0- 20/1	19/7	3,000	6,954	9,216	11,272
Erakine Road	0/0- 0/5	0/1	7,500	31,371	45,724	58,527
Brough Road	0/0- 0/7	0/1	7,500	22,831	33,339	42,899
Chennimalai-Arachalur Kodumundi Rd.	0/0- 8/4	0/5	3,000	5,775	10,342	14,307
Erode-Chennimalai Rd.	1/5- 14/1	8/8	3,000	4,277	6,909	9,002
Archalur-Kodumundi Rd.	0/0- 7/0	5/3	3,000	3,779	5,423	6,960
—do—	7/0- 17/1	14/7	3,000	2,995	4,589	6,012
Thoppur-Mettur-Bhavani Rd.	234/0-240/0	239/6	3,000	4,336	7,657	10,652
—do—	240/0-247/5	241/4	3,000	5,570	9,147	12,407
—do—	247/5-253/2	252/6	3,000	8,774	15,594	21,674
Bhavani-Kavindapadi Rd.	0/0- 8/3	0/1	3,000	5,041	7,628	9,876
Mettur-Bhavani Rd. to Velli Tirupur	0/0- 5/0	0/1	3,000	3,609	5,217	6,532
—do—	5/0- 11/3	8/4	3,000	4,098	5,457	6,492
Bhavani-Chelliappampalayam Rd.	0/0- 9/0	0/7	3,000	6,999	10,760	14,445
—do—	9/0- 19/0	11/8	3,000	10,131	13,798	16,939
—do—	9/0- 19/0	16/1	3,000	4,305	6,116	6,803
Andiyur-Atlani Rd.	0/0- 5/6	0/3	3,000	5,869	9,539	12,610
Andiyur-Ammapettai Rd.	0/0- 10/7	2/8	3,000	5,229	7,635	9,624
Kollegal-Chelliappampalayam Rd.	34/0- 59/6	46/7	3,000	374	645	3,391
Gobichettipalayam-Savandapur Rd.	0/0- 7/7	0/7	3,000	13,233	19,162	24,128

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Road Branching from 32/1 of Erode-Satyamangalam Rd. to Kodumundi Road	0/0- 1/2	0/1	3,000	1,769	2,604	3,288
Gobichattipalayam-Dharapuram Road	0/0- 10/4	0/4	3,000	7,216	11,552	15,358
—do—	10/4- 20/0	18/3	3,000	4,706	6,389	7,851
—do—	20/0- 25/0	24/4	3,000	4,002	6,077	7,838
—do—	25/0- 36/0	35/3	3,000	5,135	8,285	10,817
—do—	36/0- 41/0	36/1	3,000	5,840	7,083	8,588
—do—	41/0- 52/5	47/7	3,000	2,422	2,865	3,567
Cheyur to Erode Satyamangalam Rd.	8/0- 15/6	10/6	3,000	3,027	4,819	6,268
—do—	16/1- 18/7	18/5	3,000	4,067	5,850	7,318
Avanashi-Pullampatti Rd	11/0- 13/2	13/2	3,000	5,310	8,930	12,272
Satyamangalam-Atlani-Bhavani Rd.	4/1- 9/0	8/3	3,000	5,095	7,569	9,925
—do—	9/0- 18/0	11/4	3,000	5,470	7,946	10,272
—do—	18/0- 24/0	19/2	3,000	10,637	14,098	17,059
—do—	24/0- 32/0	29/6	3,000	7,734	11,370	14,479
Satyamangalam-Mettupalaiyam Rd.	6/0- 12/0	8/3	3,000	3,099	4,421	5,779
Udumalpet-Chinna-Dharapuram Road	12/4- 22/5	21/8	3,000	7,384	5,822	7,140
—do—	22/5- 25/5	23/6	3,000	10,645	12,793	15,803
—do—	25/5- 33/0	25/5	3,000	6,807	9,982	12,719
—do—	38/0- 46/6	38/2	3,000	1,555	2,965	4,135
Dharapuram-Tiruppur Rd.	0/0- 1/4	1/4	7,500	4,084	6,407	8,731
—do—	1/4- 4/0	3/8	3,000	1,905	2,992	4,168
—do—	4/0- 16/0	15/6	3,000	2,539	3,727	4,771
Dharapuram-Palni Road	1/1- 10/7	3/6	3,000	2,548	3,317	4,337
Dharapuram-Dindigul Rd.	0/0- 6/0	0/1	3,000	2,742	4,350	5,860
Palladam-Dharapuram Rd.	11/4- 19/2	16/7	3,000	3,250	4,649	5,955
Dharapuram-Pollachi Rd.	0/3- 12/0	0/6	3,000	2,388	3,396	4,312
Muthur-Vellakoil Rd.	0/0- 7/2	7/2	3,000	8,326	13,965	18,860
Kangayam-Kodumudi Rd.	12/0- 17/0	12/2	3,000	4,406	6,613	8,655
—do—	17/0- 23/0	21/4	3,000	3,393	5,144	6,835
Tiruppur-Vilayamangalam Road	3/5- 16/1	9/1	3,000	6,802	8,958	10,721
—do—	3/5- 16/1	15/8	3,000	2,105	3,171	4,056
Tiruppur-Unnathur Rd. via Perumanether	11/7- 13/5	13/3	3,000	12,337	17,570	21,858
Tiruppur-Padiyur Road	9/3- 10/4	10/5	3,000	2,091	3,249	4,235
Uttukuli R. S.-Uttukuli (M)	0/0- 1/4	1/2	3,000	4,617	6,474	8,031

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Vellodu-Arachalur Rd.	0/0- 5/3	3/6	3,000	2,289	3,524	4,584
Perundurai-Kavindapadi Rd. via Kanjikovil Rd.	0/0- 10/7	10/7	3,000	5,487	7,857	9,586
Erode-Thangaiyur Rd.	0/0- 8/1	5/1	3,000	1,960	3,522	4,882
Kavindapadi-Perundalaiyur Rd.	0/0- 1/6	0/1	3,000	5,505	8,558	11,045
Kavindapadi-Getticheyur Road via Siruvalur	0/0- 5/6	0/3	3,000	4,239	6,162	7,969
—do—	5/6- 12/6	10/0	3,000	4,481	6,420	7,983
Karattadipalayam-Bungelouipudur Road	0/0- 4/1	4/1	3,000	4,778	7,100	9,012
Hariappampalayam-Pullampatti Road	0/0- 6/5	11/3	3,000	3,011	4,578	5,926
Pullampatti-Nambiyur Road	6/5- 12/4	12/2	3,000	4,606	7,079	9,102
Modur Reserve Forest Rd.	14/0- 16/2	16/3	3,000	2,944	4,421	5,821
Malayampalayam-Thammerapolayam Road	0/0- 6/5	5/3	3,000	2,602	4,046	5,300
Unjalur R. S.-15/1 Erode-Kangayam Rd. and	0/0- 1/6 and 4/0- 8/2	7/8	3,000	5,863	7,926	9,553
Dharapuram-Pulavadi Road	0/0- 16/2	11/3	3,000	2,766	3,668	4,356
Udiyur-Kundadam Rd.	0/0- 6/5	2/3	3,000	1,721	2,475	3,105
Kangayam-Kodumudi Road	1/1- 12/0	11/8	3,000	5,957	8,451	10,531
District : Madurai						
Division: Madurai						
G. S. T. Road	288/0-295/4	295/1	7,500	4,910	9,483	14,234
—do—	295/4-299/5	297/6	7,500	30,484	36,263	46,572
—do—	299/6-301/3	299/6	7,500	30,274	35,973	48,369
—do—	301/4-308/6	303/3	7,500	11,000	15,058	20,492
—do—	308/6-312/0	311/8	3,000	12,627	17,125	21,283
—do—	312/0-318/0	312/7	3,000	6,199	8,191	10,710
Tenkasi-Madurai Rd.	72/0- 83/2	312/7 of G.S.T. Rd.	3,000	3,911	7,296	8,816
Kodaikanal Rd.	0/0- 7/4	314/2 of G. S. T. Rd.	3,000	2,377	2,870	3,231
G. S. T. Road	318/0-324/7	321/3	3,000	4,057	4,609	6,950
Madurai-Theni Rd.		2/2	3,000	2,563	2,802	3,779
Madurai-Tiruppattur Rd.		6/1	7,500	8,781	10,697	14,757
—do—		17/8	7,500	6,579	11,575	16,937
—do—	17/8- 19/2	19/2	7,500	6,260	9,566	13,761

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Madurai-Natham Rd.	1/3- 2/2	1/3		36,056	45,589	65,143
—do—	13/5- 23/4	23/4	3,000	4,928	8,261	11,752
Madurai-Palamodu Rd.		3/7	3,000	2,984	3,884	4,950
Madurai-Poovarthi Rd.		2/2	3,000	3,781	6,823	9,010
—do—		10/5	3,000	2,546	3,965	4,710
Madurai-Alagarkoil Rd.		3/1	3,000	5,677	9,031	13,338
Madurai-Theni Rd.	0/0- 0/4	1/7	7,500	12,219	13,557	18,870
—do—	0/4- 9/0	3/0	7,500	13,130	10,402	14,533
—do—	9/0- 21/0	10/7	3,000	5,346	5,479	6,953
Batalagundu-Peraiyar Rd.	15/4- 22/6	24/1	3,000	2,939	3,317	4,000
		of M. T. Rd.				
Ammayanaickenpatti-Periakulam Rd.		26/5	3,000	2,637	4,229	5,568
Veerapandi-Koduvilarpatti Rd.		13/6	3,000	2,199	2,761	3,340
		of P. K. Rd.				
Periyakulam-Kumili Rd.	20/0- 22/2	23/2	3,000	28,187	37,341	46,186
—do—	23/2- 26/7	26/7	3,000	3,325	4,334	5,921
—do—	26/7- 27/7	27/7	3,000	3,340	4,744	6,157
—do—	27/7- 43/1	33/2	3,000	4,592	6,226	7,221
—do—	43/0- 47/3	43/1	3,000	2,305	2,938	4,186
0/6 of Bodinayakkanur-Karangan Rd.		0/6	3,000	2,799	4,897	6,658
Bodinayakkanur-Thevaram Rd.	7/2- 8/0	8/0	3,000	2,759	4,404	6,098
Periyakulam-Kumili Rd.	27/7- 32/2	33/8	3,000	7,296	8,574	10,829
Palaya-Thevaram Rd.	0/0- 7/5	33/8	3,000	2,931	4,456	6,188
Madurai-Theni Rd.	40/0- 65/0	24/1	3,000	3,338	3,188	3,834
Madurai-Melakkal Rd.	2/4- 10/5	2/4	3,000	5,127	8,859	12,127
Madurai-Aruppukottai Rd.	0/8- 12/2	0/8	7,500	15,822	19,834	24,209
Mangalarava-Elumalai Rd.	0/0- 14/0	27/5	3,000	2,189	2,707	3,126
		of B. P. Rd.				
Madurai-Theni Rd.	3/0- 9/0	3/0	3,000	12,670	10,053	13,931
Periakulam-Kumili Rd.	18/0- 32/0	11/2	3,000	7,056	7,787	9,133
Alanpatty-Sedapatty Rd.	0/0- 11/4	8/2	3,000	2,425	2,840	3,105
Batlagundu-Peraiyur Rd.	22/6- 31/6	4/5	3,000	2,657	4,148	4,880
		of K. S. Rd.				
Metur-Sivaganga Rd.		0/1	3,000	6,261	9,813	13,385
Metur-Alagarkoil Rd.		0/5	3,000	3,484	6,046	8,359
Tiruchirapalli-Melur Rd.	239/6-246/4	244/4	3,000	2,294	5,367	8,539
Madurai-Theni Road	66/0- 75/0	46/8	3,000	5,507	5,293	6,004
Dindigul-Vattanam Rd.		32/2	3,000	3,709	7,267	10,317

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
periyakulam-Kumili Rd.	33/3	33/3	3,000	6,402	8,115	10,491
Periyakulam-Devadanapatti Rd.	1/3- 8/0	5/4	3,000	1,246	2,257	4,024
—do—		5/4	3,000	802	1,760	3,309
Kallandiri-Pannaikadu Rd.		5/1	3,000	3,454	4,821	5,594
—do—		5/3	3,000	3,476	4,650	5,518
Kolachanenthal-Tiruvadur Rd.		2/2	3,000	4,955	7,629	9,825
Samayanallur-Thenur Rd.		0/1	3,000	6,686	11,789	14,597
Sellur-Kulamangalam Rd.		0/1	3,000	2,796	4,657	6,215
Vaigai-Bye Pass Rd. N.H. 7		1/2	7,500	7,291	9,265	12,383
—do—		1/4	7,500	4,725	6,327	7,992
Periyakulam-Devadanapatti Rd.	5/8- 12/1	5/8	3,000	7,311	9,212	11,637
Periyakulam-Kumili Rd.		33/3	3,000	1,700	2,489	3,817
District : Madurai						
Division : Dindigul						
G. S. T. Rd.	248/2-253/0	248/1	7,500	4,377	6,495	8,724
Dindigul-Aravakurichi Road	0/3- 6/0	0/3	3,000	11,872	15,847	19,511
—do—	6/0- 12/6	11/8	3,000	1,671	2,766	3,789
Vadamadurai-Oddanchatram Rd.	13/0- 19/0	13/5	3,000	1,794	2,730	3,898
Dindigul-Karur Rd.	0/0- 12/7	12/7	3,000	1,696	2,461	3,469
—do—	24/2- 34/2	28/7	3,000	2,433	3,204	3,994
G. S. T. Rd.	253/0-258/0	257/3	7,500	4,362	6,983	9,397
—do—	258/0-288/0	259/4	7,500	6,498	9,263	11,805
—do—	—do—	259/6	7,500	7,904	12,811	17,713
Dindigul-Aravakurichi Rd.	12/6- 19/0	12/1	3,000	3,127	5,584	7,613
Dindigul-Palni Rd.	0/6- 15/0	0/7	3,000	9,402	9,570	11,396
—do—	15/0- 16/4	15/2	3,000	11,689	12,506	15,649
Dindigul-Batlagundu Rd.	0/7- 5/0	0/7	3,000	3,762	5,870	8,457
—do—	5/0- 9/0	8/7	3,000	2,861	4,867	7,457
—do—	9/0- 13/0	8/8	3,000	2,830	4,610	6,903
Mettur-Palakkanuthu Rd.	0/0- 5/0	4/8	3,000	2,208	2,592	3,499
—do—	5/0- 20/0	5/1	3,000	2,470	2,971	3,915
Dindigul-Vattanam Rd.	2/1- 9/0	3/5	3,000	2,238	3,420	4,528
—do—	9/0- 17/0	9/5	3,000	2,839	4,196	5,303
Dindigul-Karur Rd.	1/5- 6/0	1/5	3,000	2,580	4,099	5,795
G. S. T. Rd.	268/0-288/0	267/7	7,500	5,340	10,658	14,651
—do—	268/0-278/0	273/5	7,500	4,853	10,858	14,806
—do—	268/0-288/0	276/7	7,500	6,552	11,686	15,119

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Ammayanayakanur-Periyakulam Road	9/0- 8/0	2/3	3,000	2,246	2,074	3,133
Tirumangalam-Pallapatti Road	10/2- 16/0	12/5	3,000	3,346	3,992	4,651
Melakkal-Perani Rd.	10/8- 24/0	15/3	3,000	3,336	5,732	8,196
Sulukkuvarpatti-Pallapatti Road	0/0- 3/1	3/1	3,000	2,040	3,041	4,108
Madurai-Palamedu Rd.	8/0- 15/2	11/1	3,000	4,836	8,058	10,053
Palni Dharapuram East Rd.	0/3- 11/2	8/8	3,000	2,657	4,163	5,388
Palni-Dharapuram West Rd.	0/3- 14/2	0/6	3,000	2,725	4,167	5,162
Talaiyuthu-Kallimandayam	0/0- 10/3	0/1	3,000	2,382	4,128	3,678
Tadieombu-Pallapatti Rd.	0/0- 15/7	14/5	3,000	2,170	2,980	3,810
Kallimandayam-Idayakottai Rd.	0/0- 12/0	12/3	3,000	2,020	2,697	3,408
Dindigul-Palni Rd.	16/5- 25/0	18/6	3,000	11,069	13,784	17,807
—do –	25/0- 35/0	35/2	7,500	6,545	7,684	10,421
Palni-Udumalpet Rd.	1/2- 8/0	2/3	3,000	2,555	3,675	5,168
—do—	8/0- 13/0	8/1	3,000	3,092	3,873	5,448
Oddanchatram-Dharapuram Rd.	0/0- 16/0	0/1	3,000	12,196	16,846	21,094
Vadamadurai-Oddanchatram Rd.	19/0- 26/6	22/3	3,000	2,671	3,660	4,608
Palni-Kolumani Rd.	0/0- 8/2	0/1	3,000	2,573	3,909	5,054
Dindigul-Batlagundu Rd.	13/0- 20/6	20/5	3,000	1,986	1,899	3,188
Ammayanayakanur-Periyakulam Rd	8/0- 16/0	15/8	3,000	5,349	6,134	8,720
District : Ramanathapuram						
Division: Satur						
Varanasi-Cape Comorin Rd.	324/7-336/8	327/8	7,500	5,685	8,322	10,886
—do —	324/7-337/0	328/5	7,500	10,651	16,774	22,406
—do—	345/0-356/1	345/8	3,000	3,784	3,630	4,809
—do—	345/0-356/1	350/2	3,000	4,001	4,807	6,475
Tenkasi-Madurai Rd.	33/1- 44/0	43/1	7,500	10,234	16,576	23,171
—do—	44/0- 55/0	50/3	7,500	19,950	26,922	35,981
Satur-Sivakasi Rd.	0/0- 10/0	0/1	3,000	2,796	4,466	6,055
Sivakasi-Virudhunagar Rd.	0/0- 7/0	2/4	3,000	3,507	5,268	6,891
Sivakasi-Kalugumalai Rd.	0/0- 4/0	3/4	3,000	1,529	2,403	3,209
—do—	4/0- 13/1	11/4	3,000	2,519	3,616	4,527
Virudhunagar-Alagapuri Rd.	0/0- 5/0	0/1	3,000	2,289	3,390	4,351
Satur-Srivilliputtur Rd.	16/0- 22/1	17/5	3,000	5,031	7,303	9,437
Krishnankoil-Kummapatti Rd.	0/0- 6/0	0/1	3,000	2,336	3,314	4,122
Watrap-Maharajapuram-Alagapuri Road	0/0- 10/7	3/1	3,000	4,124	5,540	6,635

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Sankaranainarkovil-Rajapalaiyam Rd.	46/7- 53/3	53/1	3,000	12,364	18,145	24,291
Rajapalaiyam-Keelarajakularaman Road	0/0- 5/0	0/1	3,000	12,658	21,069	28,685
—do—	5/0- 10/4	5/8	3,000	4,471	6,634	8,380
Rajapalaiyam-Ayyanarkoil Rd.	0/0- 8/0	0/1	3,000	15,845	30,291	42,990
Madurai-Aruppukottai Rd.	27/0- 30/2	29/3	7,500	7,985	12,226	15,882
Aruppukottai-Pandalgudi Rd.	30/5- 37/0	30/5	7,500	6,887	9,657	12,098
Aruppukottai-Tiruchuli Rd.	10/6- 13/0	11/2	3,000	5,273	8,180	10,686
Aruppukottai-Sayalgudi Rd.	0/0- 7/0	2/6	3,000	4,083	5,656	7,048
Satur-Dalavoipuram Rd.	0/0- 1/7	0/1	3,000	9,658	14,003	17,849
Srivilliputtur-Mamsapuram Rd.	0/0- 3/4	0/3	3,000	8,961	13,801	17,754
District : Ramanathapuram						
Division : Sivaganga						
Madurai-Tondi Road	44/0- 46/0	45/6	3,000	2,453	3,676	4,864
—do—	52/0- 58/0	57/1	3,000	2,238	3,104	3,842
—do—	58/0- 62/0	58/8	3,000	4,472	6,005	7,437
Sirugani-Devakottai	0/0- 5/0	0/1	3,000	2,194	3,045	4,058
—do—	5/0- 9/6	9/6	3,000	2,052	2,928	3,923
Devakottai-Devipattinam Rd.	0/3- 6/0	0/3	3,000	3,088	4,128	5,195
—do—	6/0- 16/0	11/7	3,000	2,453	3,524	4,590
—do—	16/0- 22/2	22/1	3,000	2,116	3,017	3,907
—do—	22/2- 28/0	22/3	3,000	2,605	3,696	4,712
Tiruvadanai-Oriyur Rd.	0/0- 12/3	0/1	3,000	2,198	3,039	3,683
Tondi-Tirupalakudi Rd.	0/0- 16/0	0/1	3,000	4,353	5,653	6,665
Devakottai-Devipattinam Rd. R. S. Mangalan	0/0- 1/1	0/1	3,000	2,738	3,736	4,721
Madurai-Devakottai Rd.	55/5- 60/2	60/2	3,000	3,152	4,306	5,618
Ararayal (A. Pudur-Devakottai)	0/6- 6/1 of MDV-Devakottai Rd.	60/2	3,000	1,965	2,724	3,301
Vattənam Road	0/0- 0/3 of MDV-Devakottai Rd.	60/2	3,000	3,496	5,161	5,859
—do—	0/3- 0/6	0/4	3,000	3,287	4,874	7,231
R. S. Mangalam-Ilayangudi Rd.	0/0- 7/0	0/1	3,000	3,089	4,137	4,910
Ramanathapuram-Devipattinam Rd.	0/0- 9/6	0/5	3,000	7,001	8,210	9,805
—do—	—do—	1/3	3,000	3,092	4,056	5,054

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Ramanathapuram Devipattinam Rd.	0/0- 9/6	8/6	3,000	2,626	3,142	3,995
Ramanathapuram-Kilakarai Rd.	0/0- 10/3	0/3	3,000	4,715	5,721	6,907
do	0/0- 10/3	5/3	3,000	1,989	2,463	3,405
Ramanathapuram Railway Feeder Rd.	0/5- 0/8	0/5	3,000	11,865	16,139	19,606
Ramanathapuram-Nainarkoil Rd.	0/0- 5/0	0/5	3,000	7,433	9,602	11,267
Devipattinam-Tirupalakudi	0/0- 4/4	9/4	3,000	2,652	3,741	4,618
	(of R. M. D. Devipattinam Rd)					
Tirupuvanam-Pulvoikarai	0/0- 4/8	0/0	3,000	1,331	2,289	3,106
Manamadurai-Tholichathanallur	0/0- 5/0	0/0	3,000	3,017	4,864	6,269
Madurai-Tondi Rd.	26/0- 31/2	26/7	7,500	6,195	7,962	10,632
Manamadurai-Tholichathanallur Road	5/0- 9/0	9/0	3,000	2,522	3,866	4,408
Tiruppachetty-Narikudi Rd.	0/0- 5/0	2/0	3,000	2,767	3,539	4,078
Thanjakkoor to meet Tirupuvanam-Pulvoikkarai	0/0- 10/0	0/0	3,000	2,690	3,422	3,930
Melur Poovandhi Tirupuvanam Road	14/0- 16/0	16/0	3,000	2,171	3,321	4,386
Manamadurai-Tirupattur-Pudukottai Frontier Road	0/0- 1/0	0/0	3,000	2,718	3,970	5,443
—do—	1/0- 10/0	0/2	3,000	4,901	6,806	8,965
—do—	10/0- 16/0	10/4	3,000	3,832	4,742	5,940
—do—	—do—	11/6	3,000	1,913	3,160	4,661
—do—	28/0- 34/0	31/8	3,000	2,348	3,443	4,981
—do—	—do—	31/8	3,000	2,000	3,339	4,770
—do—	—do—	33/6	3,000	1,358	2,994	4,090
—do—	34/0- 39/5	38/3	3,000	1,290	2,706	3,607
Nattarasankottai Natarajapuram	1/0- 6/0	4/2	3,000	1,993	2,671	3,182
Sivaganga-Ilayangudi	0/5- 13/0	0/5	3,000	1,994	2,796	3,554
Kallal-Madagupatti	11/0- 16/0	13/2	3,000	1,700	2,718	3,530
Okkur-Kilapungudi	0/3- 15/3	12/7	3,000	2,143	2,651	4,179
Nettur-Sivaganga Road	7/5- 16/2	16/2	3,000	1,866	3,369	5,031
Madurai-Dhanushkodi	6/5- 11/4	11/4	3,000	8,116	10,557	13,101
—do—	11/5- 19/0	11/5	3,000	3,785	5,935	8,091
—do—	28/5- 34/0	28/5	3,000	2,686	4,009	5,151
—do—	34/0- 40/0	36/6	3,000	3,029	4,237	5,930
—do—	45/3- 48/0	46/7	7,500	4,464	6,468	9,066
—do—		47/7	3,000	2,010	2,929	4,290
—do—	53/0- 59/0	54/5	3,000	2,800	3,206	4,290

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Madurai-Dhanushkodi	59/0- 65/0	63/7	3,000	2,105	2,981	4,112
—do—	65/0- 99/4	69/3	3,000	2,597	3,119	4,118
—do—		72/2	3,000	3,262	4,160	5,179
—do—		77/5	3,000	2,106	2,449	3,027
—do—		85/0	3,000	2,866	3,211	3,960
—do—	28/0- 39/0	38/7	3,000	2,617	1,173	5,903
—do—	39/0- 42/0	39/4	3,000	3,136	4,373	6,491
—do—	39/0- 42/0	41/5	3,000	1,625	2,600	3,789
—do—	42/0- 49/0	48/6	3,000	1,921	2,681	3,854
—do—	49/0- 55/5	52/1	3,000	7,508	10,081	13,209
Dindigul-Tiruppattur	35/0- 47/0	40/7	3,000	3,557	5,127	6,753
—do—	47/0- 51/1	51/1	3,000	2,934	5,424	7,697
Kummangudi Bridge to Kummangudi Road		7/3	3,000	1,397	2,579	3,637
Managiri-Kallal Rd.		2/5	3,000	1,580	2,395	3,147
Karaikkudi-Kanadukathan	2/0- 5/0	3/5	3,000	3,116	5,392	7,789
—do—		4/3	3,000	2,220	3,335	4,943
—do—	5/0- 11/5	10/3	3,000	1,566	2,462	3,569
—do—		10/6	3,000	3,137	4,935	6,907
Kunnakkudi-Kanadukathal Rd.	10/0- 14/6	12/6	3,000	1,412	2,364	3,259
—do—		14/6	3,000	1,909	2,998	3,965
Managiri-Karaikkudi Rd.	0/0- 2/7	1/5	3,000	4,931	8,596	11,873
Koilur-Kunnakkudi Rd.	0/0- 4/2	1/5 (of Managiri-Kunnakudi)	3,000	2,417	4,150	5,168
Kottaiyur-Arantangi Rd.	0/0- 4/0	0/1	3,000	1,309	2,201	3,287
C. V. Mangalam-Piranmalai Rd.	0/0- 5/3	40/7 of DDL-TPK Rd.	3,000	2,095	3,191	4,081
Pudur-Ulagampatti Road		0/5	3,000	944	1,792	2,515
Tiruppattur-Kandramanickam	0/0- 5/3	0/1	3,000	1,542	2,769	3,982
—do—		5/3	3,000	1,455	2,416	3,240
Kanadukathan-Kothamangalam	0/0- 2/6	2/4	3,000	3,503	5,087	6,466
Nemathanpatti-Konapet		0/1	3,000	2,528	4,050	5,399
Kottaiyur-Diversion Rd.	3/5- 4/7	3/5	3,000	2,141	3,674	5,039
Paramakkudi-Madukulattur Rd.	0/0- 6/0	0/1	3,000	3,743	5,069	6,422
Emaneswaram-Nainarkoil Rd.	0/0- 7/5	0/1	3,000	2,333	3,498	4,463
Ilayangudi-Paramakkudi	20/0- 26/2	25/2	3,000	5,535	7,408	9,319
Kamuthi-Sayalkudi Rd.		63/5	3,000	2,508	3,326	3,994
—do—		46/8	3,000	3,615	4,935	5,981

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Aruppukottai-Sayalkudi Rd.		22/4	3,000	3,846	5,292	6,554
Paramakkudi-Mudukulattur Rd.	6/0- 15/7	14/4	3,000	3,985	5,046	6,010
—do—		15/5	3,000	3,153	4,520	5,683
Partibanur-Abiramamkamuthi Road		23/7	3,000	3,334	4,515	5,694
—do—		24/1	3,000	1,744	2,592	3,404
Kamuthi-Mandapasalai Rd.		0/1	3,000	2,257	3,227	4,128
Perunali-Vilathikulam Rd.		0/8	3,000	2,844	3,771	4,443
Kamuthi-Mandalamanickam Road		23/8	3,000	2,054	3,101	4,147
	of Abiramam Kamuthi Rd.					
District : Thanjavur						
Division : Thanjavur						
Thanjavur-Nagappattinam	0/0- 4/3	4/2	7,500	6,569	8,470	10,167
—do—	4/3- 10/7	12/6	3,000	2,744	3,920	5,274
Thanjavur-Thiruvaiyaru	0/0- 3/2	3/2	7,500	10,752	12,504	16,530
Thanjavur-Gandharvakottai Rd.	0/3- 9/4	6/4	3,000	3,263	3,704	4,622
—do—	4/5- 18/0	16/6	3,000	3,786	4,045	5,111
Lower Anicut-Thanjavur	156/2-167/4	158/1	3,000	7,669	9,710	12,308
—do—	167/4-170/4	168/1	7,500	4,474	6,506	8,528
—do—		169/8	7,500	9,921	15,300	20,730
—do—	175/0-181/0	175/7	3,000	3,516	5,691	8,268
—do—	181/0- 19/0	183/7	3,000	7,321	10,984	14,780
—do—		190/5	3,000	8,829	12,413	21,851
Thanjavur-Vadugur	4/3- 13/0	4/3	3,000	3,901	6,033	7,836
Thanjavur-Pattukkottai	1/0- 8/0	4/0	3,000	3,785	4,929	6,543
—do—	8/0- 15/0	14/0	3,000	5,274	5,294	6,588
—do—	23/4- 30/0	27/0	3,000	1,589	2,082	3,418
Pattukkottai-Muthupet	30/0- 26/6	34/3	3,000	2,851	3,446	4,352
Arantangi	0/0- 8/0	0/8	3,000	3,556	4,819	6,236
—do—	8/0- 21/7	3/7	3,000	1,761	2,302	3,155
—do—	22/0- 29/0	28/6	3,000	3,669	5,112	6,893
Pattukkottai-Arantangi	22/0- 29/0	28/4	3,000	2,316	3,229	4,184
—do—	22/0- 29/0	29/0	3,000	3,263	4,560	6,142
—do—	12/4- 21/0	15/4	3,000	2,505	2,632	3,469
—do—	12/4- 21/0	20/2	3,000	2,640	3,165	4,026
Arantangi-Pudupatti	0/0- 4/6	0/1	3,000	2,160	3,118	4,122
Arantangi-Mimisal	0/0- 22/0	0/5	3,000	3,535	5,372	7,028
Arantangi-Katumavadi	0/0- 8/0	0/2	3,000	3,278	4,836	6,067

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Arantangi-Katumavadi		7/8	3,000	3,106	4,320	5,214
Katumavadi-Mimisal Rd.	27/3- 38/0	27/3	3,000	1,708	2,521	3,200
Eruchi-Erupkulakottai		4/0	3,000	1,571	2,451	3,221
Kumbakonam-Mannargudi Road	0/2- 2/0	0/2	3,000	9,552	6,565	13,993
—do—	2/0- 5/7	2/3	3,000	3,527	3,500	4,417
Kumbakonam-Mannargudi	5/8- 14/7	6/2	3,000	4,650	7,845	10,611
—do—	—do—	14/7	3,000	2,515	3,306	4,447
—do—	33/0- 46/5	36/0	3,000	3,577	5,570	7,374
Pattukkottai-Adirampattinam	29/2- 36/4	32/2	3,000	4,913	7,113	9,010
Grand Anicut-Kaveripattinam	0/0- 10/0	9/4	3,000	5,955	7,824	9,305
—do—	10/0- 23/8	12/1	3,000	3,198	4,321	5,365
—do—	24/0- 36/8	26/8	3,000	2,452	3,948	5,417
—do—	37/0- 40/0	39/3	3,000	5,493	9,301	13,008
—do	40/0- 47/0	46/6	3,000	4,619	6,094	7,339
—do—	47/0- 50/0	49/1	3,000	5,194	7,955	10,874
Thogur-Ammapet	0/0- 10/0	8/8	3,000	3,708	4,824	7,022
—do—	10/0- 26/6	18/8	3,000	2,080	3,823	4,826
—do—	20/7- 26/3	26/3	3,000	1,850	2,937	3,379
Tirukattupalli-Sengippatti	0/0- 5/3	0/5	3,000	5,948	8,451	10,779
—do—	5/3- 9/5	9/5	3,000	1,959	2,670	3,313
Old Vannanhead-Grand Anicut	0/8- 5/7	5/3	3,000	3,919	5,427	6,605
Sengippatti-Pattukkottai	0/0- 7/0	0/3	3,000	2,942	3,821	4,718
—do—	7/0- 14/0	11/1	3,000	3,253	4,620	6,023
—do—	7/0- 14/0	11/2	3,000	3,024	4,277	4,572
—do—	14/0- 32/7	22/1	3,000	1,730	2,530	3,447
Kodavasal-Valangaman	15/0- 20/0	19/6	3,000	3,489	5,841	8,002
—do—	—do—	24/2	3,000	2,700	4,043	5,339
Salhamangalam-Papanasam	0/2- 10/2	6/3	3,000	4,374	6,299	7,881
Grand Anicut-Milattur	0/0- 5/4	0/1	3,000	2,684	4,252	5,580
—do—	—do—	5/4	3,000	2,441	3,496	4,358
Ammapet Railway Approach Road	0/0- 1/3	0/8	3,000	4,024	6,439	8,432
Ayyampet Railway Approach Road	0/0- 1/0	0/7	3,000	7,415	10,286	12,521
Kumbakonam-Sirkazhi	0/6- 2/0	0/7	3,000	12,899	16,822	23,369
—do—	2/0- 4/1	2/1	3,000	7,171	2,277	11,087
—do—	4/2- 11/2	9/1	3,000	8,673	9,900	13,201
Kumbakonam-Karaikkal	1/2- 5/0	1/2	3,000	3,932	5,863	8,072
—do—	5/0- 10/5	8/2	3,000	8,542	12,475	16,440
Kumbakonam-Kodavasal	2/2- 10/4	2/4	3,000	7,511	8,397	9,249

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Aduturai-Tirundakudi	6/5- 8/2	6/5	3,000	8,755	12,928	16,619
Punthottam-Nachiyarkoil	12/7- 15/7	13/6	3,000	6,420	8,106	9,009
Tirupanandal-Aduturai	0/0- 6/5	5/7	3,000	6,918	8,927	12,397
Kumbakonam-Coleroon Bank Road	0/0- 5/4	0/4	3,000	5,004	7,352	7,879
Vaithisvarankovil-Lower Anicut	12/5- 19/7	15/1	3,000	5,018	7,761	10,298
Kuttalam-Pandanallur	4/0- 6/4	6/1	3,000	4,232	6,797	9,872
Vallam-Orattanad	0/0- 7/0	1/7	3,000	2,439	3,528	4,470
—do—	7/0- 13/4	13/4	3,000	1,945	2,887	3,752
Thanjavur-Vallam	1/0- 6/8	6/8	3,000	962	2,716	3,570
Peravurni-Sethabavachatram	0/0- 6/3	0/2	3,000	4,267	6,405	8,129
Peravurni Aranam Rd.	0/0- 8/5	7/2	3,000	6,347	9,926	13,131
Thanjavur-Budalur	2/0- 7/0	2/1	3,000	4,455	6,081	7,553
—do—	7/0- 13/6	11/5	3,000	2,840	3,785	4,664
Thanjavur-Nanjikottai Rd.	1/2- 7/4	2/1	3,000	2,853	4,031	4,953
District : Thanjavur						
Division: Nagappattinam						
Thanjavur-Nagappattinam Rd.	19/0- 24/0	19/3	3,000	3,007	4,106	5,346
—do—	19/0- 24/0	19/8	3,000	5,073	6,657	7,445
—do—	32/4- 34/0	32/4	3,000	2,250	3,433	4,699
—do—		37/2	3,000	10,303	13,195	16,963
—do—		44/7	3,000	3,714	5,182	7,077
—do—		47/1	3,000	8,025	11,379	13,915
—do—	47/2- 52/1	51/1	3,000	10,281	11,424	14,180
—do—		51/7	3,000	4,705	5,428	8,224
Mannargudi-Tiruturaipundi Road		1/2	3,000	3,847	5,158	6,551
—do—	11/0- 18/0	16/7	3,000	3,690	4,097	5,214
Kumbakonam-Sirkazhi Rd.	11/6- 20/3	15/6	3,000	2,617	4,395	7,053
—do—	11/6- 20/3	17/1	3,000	4,711	6,011	8,312
—do—	20/3- 23/3	22/3	3,000	6,419	9,117	12,090
—do—	20/3- 23/3	23/1	7,500	4,146	5,673	8,093
—do	29/4- 42/3	29/4	7,500	4,808	6,215	8,648
Kumbakonam-Sirkazhi Rd.	29/4- 42/3	33/6	7,500	5,176	7,214	10,014
—do—	29/4- 43/3	42/3	7,500	9,967	11,061	14,906
Tiruturaipundi-Vedaranniyam Road	15/0- 24/4	18/1	3,000	11,298	13,946	14,643
—do—	15/0- 24/4	20/4	3,000	4,708	5,338	6,622
—do—	24/4- 30/0	24/3	3,000	5,585	6,058	7,381
—do—	30/8- 35/0	32/3	3,000	5,406	6,332	7,655

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Tirutturaipundi-Vedaranniyam Rd.	38/0- 39/3	39/3	3,000	15,255	18,706	21,432
Vedaranniyam-Kodavasal Rd.	0/0- 7/0	0/2	3,000	7,410	9,964	12,013
Mayuram-Muttupet Rd.	0/3- 9/0	0/6	3,000	4,719	8,179	10,292
—do—	0/3- 9/0	9/1	3,000	2,579	2,781	3,667
—do—		10/5	3,000	4,081	5,523	6,809
—do—		12/8	3,000	2,302	3,535	4,574
—do—		21/7	3,000	5,686	8,294	10,456
—do—		28/6	3,000	4,420	6,673	8,769
—do—		32/2	3,000	5,064	7,359	9,307
—do—		36/4	3,000	2,459	4,049	5,472
—do—	35/0- 43/0	42/5	3,000	4,958	7,219	9,316
—do—	43/0- 51/0	44/3	3,000	6,135	8,708	10,696
—do—	43/0- 51/0	50/6	3,000	6,181	9,333	12,021
—do—	51/0- 59/0	58/6	3,000	2,476	4,045	5,378
Thanjavur-Pattukkottai-Muttupet Road	39/6- 41/7	41/7	3,000	4,905	7,353	9,731
Tranquebar-Mayuram Rd.	0/1- 16/0	4/5	3,000	3,100	4,400	5,749
—do—	0/1- 16/0	6/8	3,000	4,332	6,117	8,175
—do—	0/1- 16/0	4/7	3,000	4,987	6,840	8,860
—do—	16/0- 18/4	17/6	3,000	5,480	7,455	9,719
Nagore-Nannilam-Nachiyarkoil Road	15/6- 20/0	15/1	3,000	6,130	7,442	9,240
—do—	15/0- 22/0	17/4	3,000	5,577	7,010	8,774
—do—	20/0- 25/0	20/4	3,000	5,102	6,215	7,740
Mannargudi-Tiruvarur Rd.		1/6	3,000	7,116	9,663	12,402
—do—		7/2	3,000	2,544	3,701	5,038
—do—		14/6	3,000	4,356	5,855	7,486
Nagore to Karaikkal Rd.		4/5	3,000	11,025	14,549	17,735
Tranquebar-Karaikkal Rd.	0/0- 2/1	0/7	3,000	3,954	5,709	7,239
Nagappattiam-Velanganni Rd.	0/7- 6/7	0/7	3,000	6,087	6,864	8,462
—do—	0/7- 6/7	6/1	3,000	5,210	5,717	7,400
Velanganni-Tirutturaipundi Road	6/7- 17/0	10/1	3,000	4,517	5,295	6,700
—do—	6/7- 17/0	12/1	3,000	4,391	5,212	6,967
—do—	6/7- 17/0	15/7	3,000	4,090	4,467	5,775
—do—	6/7- 17/0	17/0	3,000	15,231	18,697	21,393
—do—	17/0- 25/0	24/1	3,000	6,525	7,890	9,683
Kumbakonam-Karaikkal Rd.	12/5- 25/0	12/6	3,000	7,690	12,458	16,782
—do—	12/5- 25/0	20/7	3,000	2,579	3,786	4,805
Kivalur-Kachanam	0/0- 2/8	0/0	3,000	2,970	4,797	6,494

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Kivalur-Kachanam	2/8- 12/6	2/8	3,000	5,625	8,677	11,592
—do—	2/8- 12/6	12/6	3,000	2,222	3,511	4,646
Kumbakonam-Kodavasal-Koradacheri Road	10/6- 15/0	11/5	3,000	6,162	8,782	11,225
—do—	10/6- 15/0	12/2	3,000	6,365	9,362	12,063
—do—		18/4	3,000	2,162	3,322	4,622
Kumbakonam-Koradacheri-Lakshmangudi Road		22/8	3,000	1,688	2,963	4,252
—do—		24/2	3,000	5,039	6,589	8,616
—do—		28/6	3,000	3,627	5,129	6,606
Tiruvarur-Kodavasal-Valangamam Rd.	10/0- 15/0	12/8	3,000	7,170	8,269	10,405
—do—	0/0- 10/7	0/7	3,000	14,375	17,588	21,522
Kuttalam-Pandanallur Rd.		1/1	3,000	5,255	7,697	10,187
Tittai-Tirumalrayanpattinam Rd.	0/0- 2/1	0/0	3,000	2,832	3,857	4,720
Vaithisvarankovil Tirupamangal Road	0/0- 12/1	0/0	3,000	6,000	7,996	9,665
—do—	0/0- 12/2	4/5	3,000	6,665	9,121	11,444
Sirkazhi-Tirumalaivasal Road		0/4	3,000	6,126	8,962	11,544
Sirkazhi-Panakattamgudi	0/0- 6/1	0/4	3,000	12,486	15,928	18,842
Grand Anicut-Kaveripattinam Road	56/3- 61/2	56/3	3,000	6,385	8,329	9,918
Andipandal-Nannilam Rd.		26/4	3,000	5,670	8,294	10,508
Neenamanallur-Sanganttu Road	4/0- 8/6	8/6	3,000	3,695	5,657	7,380
Mayuram-Pattawarthi Rd.	0/0- 7/2	0/2	3,000	3,568	6,170	8,427
—do—	0/0- 7/2	7/2	3,000	5,052	7,185	9,006
Mavoor-Sathiakudi Rd.		0/1	3,000	3,501	4,666	5,600
Mavoor-Mavoor Rly. Station Road	0/0- 1/6	0/1	3,000	4,251	6,187	7,896
Kuttalam-Komal Rd.	0/0- 6/2	0/1	3,000	3,781	6,212	8,344
Mavoor-Vettor Rd.	0/0- 7/6	0/1	3,000	13,770	16,899	19,303
Akkur-Sirkazhi Road	7/0- 15/6	6/0	3,000	4,680	6,430	8,202
—do—	15/0- 17/4	17/4	3,000	4,973	7,298	9,686
Punthottam-Nachiyarkoil Road		0/1	3,000	1,849	2,756	3,469
Kottur Railway Feeder Road		0/1	3,000	5,080	7,134	8,794
Koradacheri Rly. Feeder Road	0/0- 6/2	0/1	3,000	2,427	3,456	4,273
Tirumathikkunnam Rly Feeder Road	0/0- 1/5	1/5	3,000	2,970	3,763	4,339
Nagappattinam-Nagore Rd.	0/0- 4/5	1/2	3,000	13,214	14,347	16,943
Alangudi-Talainayar Rd.		17/1	3,000	14,978	18,659	21,149
Kumbakonam-Mannargudi Madukkur Road		22/1	3,000	2,074	3,495	5,437

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Kumbakonam-Mannargudi-Madukkur Rd.		23/7	3,000	3,876	5,986	8,182
Thanjavur-Mannargudi (Via) Vaduvar Road		22/6	3,000	2,793	4,386	5,615
Mannargudi-Pudukkottai Rd. (Via) Vadaseri		3/6	3,000	1,517	2,280	3,248
Kottur-Meenamanallur Rd.	0/0- 4/0	0/1	3,000	1,676	2,463	3,119
Papanad-Madukkur Rd.		16/2	3,000	2,618	3,503	4,157
Sattanathapuram-Tirumangalam Road		4/4	3,000	3,302	4,876	6,293
Tiruvarur-Alivalam-Vadaguchery Road		0/6	3,000	2,991	4,312	5,410
Mannargudi-Muthupet Rd.	0/0- 2/4	1/2	3,000	3,568	5,100	6,314
—do—	18/6- 21/2	21/2	3,000	3,674	5,578	7,153
Karunganni-Kolappadu Rd.		7/4	3,000	1,624	2,676	3,660
Grand Anicut-Kaveripattinam Rd.		17/5	3,000	3,060	4,508	5,245
Tranquebar-Mangannallur Rd.	0/0- 6/4	0/7	3,000	3,650	5,576	7,570
Sathakudi-Tirukkuvalai Easanur Road		6/7	3,000	2,866	4,420	5,677
Anandandavapuram Village Rd.		0/1	3,000	2,636	4,101	5,547
Konerirajupuram Village Rd.	0/0- 2/1	0/1	3,000	4,650	6,628	9,163
Kadalangudi-Kodavasal Rd.		4/2	3,000	3,767	4,917	5,758
Velanganni Church Rd.	0/0- 1/1	0/1	3,000	3,361	5,149	6,613
Brahmins Burning Ghat-Vijayapuram Regulator Road	0/0- 0/8	0/1	3,000	5,602	7,825	9,940
District : Kanyakumari						
Division : Nagercoil						
Varanasi-Bangalore-Cape Comorin Road	440/5-445/2	441/1	3,000	1,716	2,592	3,679
—do—		445/2	3,000	2,881	3,906	4,904
Salem-Cochin-Cape Comorin Road	19/6- 54/4	22/6	7,500	9,464	10,846	15,166
—do—		23/4	7,500	10,075	11,369	15,728
—do—		24/2	7,500	12,200	13,865	18,243
—do—		27/6	7,500	4,679	6,580	9,847
—do—		29/7	7,500	5,846	7,682	11,240
—do—		30/4	7,500	6,058	7,521	10,496
—do—		32/6	7,500	8,239	10,786	12,850
—do—		32/7	7,500	8,956	12,212	16,355
—do—		36/7	7,500	9,044	9,389	12,037
—do—		39/6	7,500	8,894	9,212	12,051
—do—		41/7	7,500	60,308	61,618	64,887

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Salem-Cochin-Cape Comorin Rd.		42/8	7,500	39,291	46,640	52,777
—do—		45/5	7,500	7,222	8,645	10,906
Koviloor-Kulasekharam Road	24/1- 32/2	32/2	3,000	2,544	4,393	6,001
Kulasekharam-Shorlacode Road	0/0- 6/3	0/0	3,000	5,261	8,352	11,135
Thuckalay-Thadikarankonam Road	10/5- 12/6	10/6	3,000	1,856	2,853	3,712
Balamore Road	5/6- 10/6	5/5	3,000	2,752	4,356	6,013
Anjugramam Road	0/0- 6/3	6/3	3,000	1,605	2,508	3,371
Kottar- Manakudy Road	0/0- 6/6	0/1	3,000	4,249	6,129	7,744
Nagercoil-Aramboly Road	42/0- 53/3	44/7	7,500	4,371	5,936	8,680
Thamarakulam Road	0/0- 3/7	0/0	3,000	1,977	2,907	3,624
Balamore Road	0/0- 5/6	0/6	3,000	18,667	28,770	37,751
—do—	10/6 23/4	10/6	3,000	1,687	2,885	3,982
Nagercoil-Rajakamangalam-Colachel Road	0/0- 14/3	0/1	3,000	7,824	11,154	14,685
—do—		8/6	3,000	4,247	6,096	8,147
—do—		9/3	3,000	5,673	7,773	10,047
—do—		14/4	3,000	4,422	6,844	9,428
Colachel-Parasseri Road	5/0- 14/2	5/0	7,500	6,292	10,419	14,453
—do—		5/6	7,500	3,492	5,714	7,606
—do—		8/1	7,500	4,380	7,126	9,481
—do—		8/4	7,500	5,864	9,682	12,998
—do—		8/5	7,500	7,339	11,920	15,879
—do—		9/5	7,500	7,196	11,417	14,938
—do—		9/6	7,500	7,151	11,006	14,294
—do—		13/1	7,500	5,765	9,331	12,373
—do—		13/5	7,500	5,844	9,677	12,966
—do—		13/7	7,500	4,823	8,203	11,220
Santhapuram Road	0/0- 7/5	0/1	3,000	13,729	20,382	26,506
—do—		5/6	3,000	2,712	4,265	5,613
—do—		6/7	3,000	2,675	4,165	5,482
—do—		7/6	3,000	4,152	6,543	8,677
Monday Market Puthukada Road	0/0- 11/2	0/0	3,000	8,611	12,923	16,556
—do—		2/7	3,000	4,493	7,286	9,720
—do—		5/1	3,000	6,504	10,968	14,927
—do—		11/2	3,000	4,797	8,133	11,003
Eraniel Rajakamangalam Road	0/0- 7/4	0/0	3,000	3,119	4,732	6,232
—do—		3/8	3,000	3,483	4,947	6,313
—do—		5/6	3,000	2,305	3,018	3,946

(*Continued*)

Appendix 4 (*Contd.*)

Road section		*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Thuckalay-Thadikarankonam Road	0/0- 5/3	0/0	3,000	6,274	10,453	14,241
—do—		5/3	3,000	3,943	5,907	7,562
Parassala-Panichamood Road	1/5- 3/1	1/5	3,000	10,258	14,764	18,551
Kuzhithura-Alenchola Road	0/0- 8/0	0/0	3,000	6,745	10,307	13,413
Kuzhithurai-Tharagapattanam Road	0/0- 7/2	0/0	3,000	5,574	8,751	12,981
—do—		4/3	3,000	6,303	9,865	13,506
Martandum-Pechiparai Road	0/0- 13/3	0/0	3,000	7,839	13,062	17,804
—do—		3/1	3,000	3,893	6,682	9,148
—do—		7/1	3,000	3,399	6,043	8,392
—do—		7/3	3,000	3,545	6,356	8,879
—do—		7/7	3,000	3,276	5,810	8,107
Martandum-Panichamood Road	1/5- 3/1	1/5	3,000	4,988	7,355	9,775
Martandum-Karinkal Road	0/0- 4/3	0/1	3,000	11,782	16,988	22,626
Eraniel-Thuckalay Road	0/0- 2/4	0/0	3,000	4,156	6,538	8,634
—do—		2/4	3,000	6,717	11,477	15,125
Meycode-Kulasekharam Road	0/0- 4/4	0/0	3,000	4,063	6,135	8,174
—do—		4/4	3,000	2,086	3,795	5,353
Eraniel Muttom Road	0/0- 4/4	0/0	3,000	3,187	4,960	6,519
—do—		4/5	3,000	4,759	7,281	9,473
Kottar-Dharmapuram Road		0/6	3,000	3,269	5,151	6,777
Eathenkattumadam Road	0/0- 7/4	0/1	3,000	2,184	3,122	3,928
Marungoor Road	0/0- 3/1	3/1	3,000	3,005	4,784	6,104
Eraviputhur-Colachel Road	0/0- 8/4	2/8	3,000	4,878	7,035	9,386
—do—		8/5	3,000	4,668	8,275	11,177
Mulagamudu-Colachel Road	0/0- 6/7	0/0	3,000	1,700	2,632	3,580
—do—		3/7	3,000	3,647	5,713	7,500
—do—		6/8	3,000	3,695	6,894	7,853
Monday Market-Thiruvattar Road	0/0- 6/6	0/0	3,000	5,136	8,245	11,000
—do—		2/6	3,000	3,195	5,451	7,438
—do—		4/3	3,000	3,039	5,246	7,168
—do—		5/6	3,000	3,662	6,228	8,508
—do—		6/7	3,000	3,681	6,444	9,315
Top road connecting Monday Market Thiruvattar Road and Martandum Pechiparai Road	0/0- 2/3	2/4	3,000	2,201	3,694	4,970
Meycode-Elanthayambalam Road	0/0- 4/2	0/0	3,000	2,338	3,815	5,101
—do—		2/3	3,000	3,019	5,105	6,938
Midalam Road	0/0- 2/6	0/0	3,000	2,612	5,330	6,109

(*Continued*)

Appendix 4 (*Contd.*)

Road section			*Census point*	*Capacity* (1963-64)	*Actual density* (1963-64)	*Anticipated density* (1970-71)	*Anticipated density* (1975-76)
Parassala-Kolluncode Road	0/8-	5/4	0/8	3,000	3,631	5,501	7,151
Thevala-Thazhakuddy Road	0/0-	3/4	3/4	3,000	2,599	3,515	4,266
Erachakulam-Kalliyankod Road			0/3	3,000	3,285	4,328	5,139
Beach Road	0/0-	3/7	0/6	3,000	2,396	3,546	4,541
Thuckalay-Thiruvithancode Road	0/0-	1/5	1/0	3,000	1,746	2,949	4,019
Monday Market-Colachel via Niyoor	0/0-	4/0	0/0	3,000	3,633	5,361	6,841
Friday Market-Thurunainarkurichi Road	0/0-	1/5	0/0	3,000	2,839	4,323	5,622
Padmanabhapuram-Mekkamandapam Road	0/0-	3/0	3/0	3,000	3,030	5,298	7,307
Manjad Road	0/4-	4/8	1/8	3,000	2,495	4,113	5,601
Manjad-Ganapathiyan Kadavu Road	0/0-	1/4	0/1	3,000	1,852	2,991	4,014
Kuzhithira-Nambali Road	0/0-	4/1	0/1	3,000	1,919	2,957	3,888
Karingal-Kurumbanai Road	0/0-	3/4	0/0	3,000	2,814	5,132	7,292
Payanam Road	0/0-	1/3	0/1	3,000	3,948	6,526	8,815
Karinkal-Pattanam Road	0/0-	5/2	0/1	3,000	4,183	6,468	9,113

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