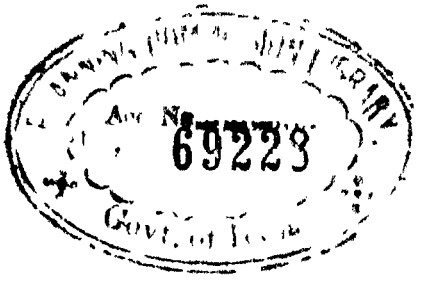
REPORT

ON

MASS TRANSPORTATION SYSTEM IN CALCUTTA



METROPOLITAN TRANSPORT TEAM
Committee On Plan Projects
Planning Commission

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CONTENTS

PREFACE

The Metropolitan Transport Team has been intimately concerned with devising long-term mass transit facilities for Calcutta to facilitate daily movement of people, goods and vehicles conveniently, cheaply and efficiently within and through the metropolitan city. In Calcutta, the existing mass transport facilities provided by suburban trains, buses and trams have been severely strained, particularly during the last decade owing to tremendous increase in population and industrial activity. The road system is inadequate to the current needs. Besides, severe street congestion has prevented any major improvements in the transit vehicles. It is, therefore, impossible to arrange dispersal of commuters along the road system.

2. The Study Team in its Interim Report had emphasised the need to devise some means of dispersal of the commuter traffic coming to Howrah and Sealdah from northern suburbs. Such a dispersal had to be along the perimeter of the Central Business District and within walking distance from most points of the Central area. The Team had, therefore, drawn up an alignment for providing an electrified suburban railway dispersal line and suggested preliminary engineering feasibility survey relating to two sections—one from Dum-Dum to Prinsep Ghat, and the second to serve the Salt Lake area where the State Government have plans to settle about a million people. The Survey Unit which was specially set up by the Eastern Railway to undertake the feasibility survey, has found the alignment feasible. A traffic and financial viability study of the Project was also undertaken which shows that a return of 4.5 per cent could be achieved by 1980-81. This is, however, based on the assumption that (i) land is available free for the Project (ii) interest charges during construction period are excluded; and (iii) there is slight increase in the existing fare structure. Taking into account the social benefits of the Project, the Team is of the opinion that this is an encouraging rate of return. It has, therefore, recommended Final Location Survey and preparation of project drawings and estimates for the proposed suburban dispersal line. It is expected that the Railways would be able to complete it during the course of next financial year. The Team envisages that the proposed dispersal line would be operated by the Railways and available for public use by the end of the fourth Plan.

3. The proposed facilities would not only benefit the commuters but also relieve the pressure on the city's over-congested roads and transport services which have almost reached the breaking point. A Project of this type naturally calls for co-ordinated efforts on the part of different agencies, particularly the State Government, local bodies, the Railways and the Port Commissioners. Its successful implementation would only be possible if the State Government could guarantee necessary acquisition of land. In fact construction could start on vacant land owned by the Government and public bodies from the middle of the first year. Besides, the value of land in the overall cost of the Project comes to Rs. 40 million which is a substantial amount. The Team is of the view that significant economy could be effected if the land owned by the State Government and local bodies, including the Salt Lake authority could be transferred to the Railways free or on a very nominal lease.

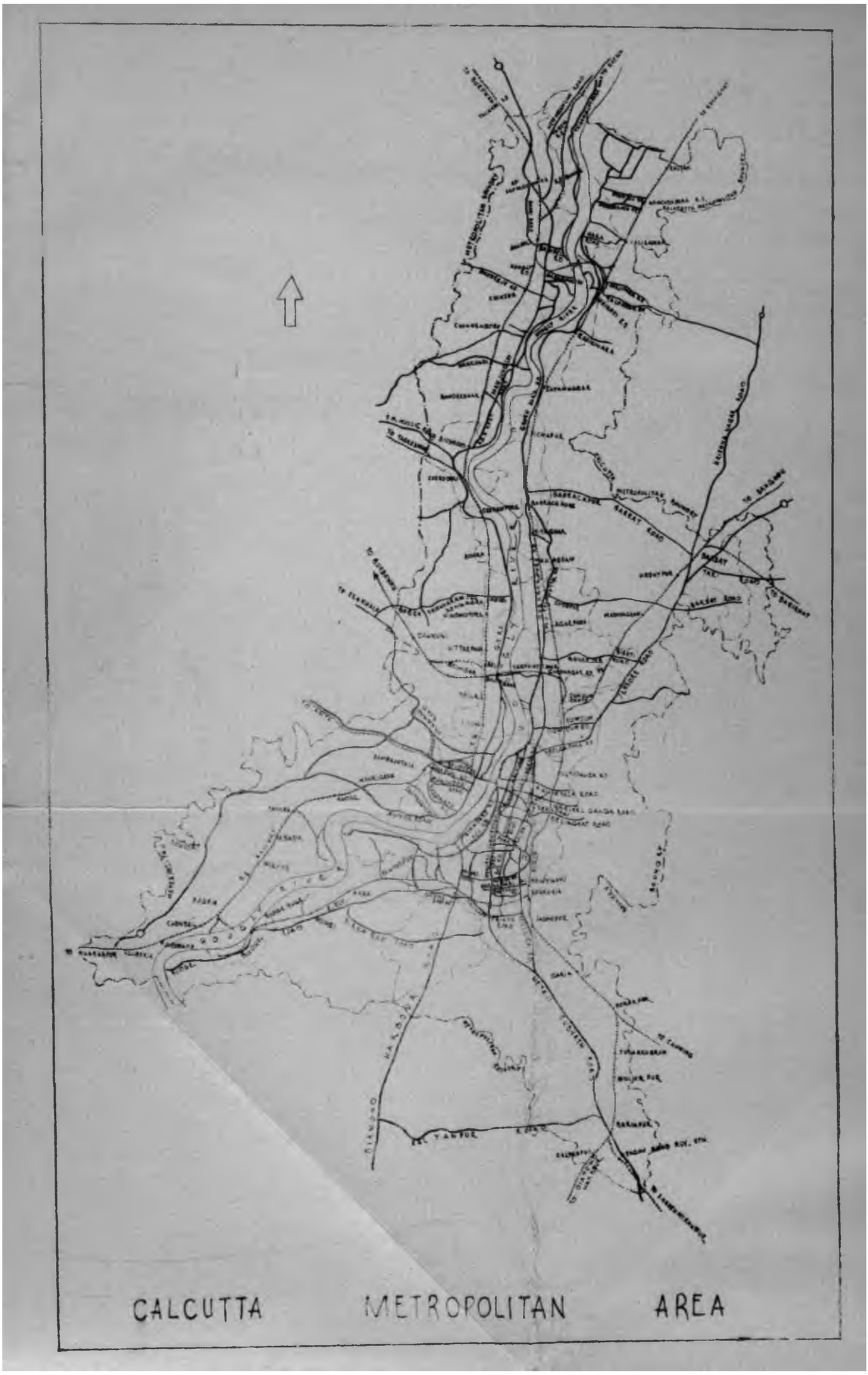
4. The Team has also recommended construction of Bally-Ballyghat link which would provide a direct suburban rail route into the C. B. D. via the Bally Bridge for Commuters from the north of Howrah.

5. The Team is convinced that the suburban dispersal line would have to be supplemented in the near future by a high capacity intra-urban rapid transit facility which could take the form of an underground system or an elevated system or a combination of both. It has, therefore, recommended techno-economic feasibility study for selecting the type of rapid transit system most suitable for the city. The object of this study is to compare the engineering, economic, operating and administrative benefits of the different types of rapid transit system. Although the services provided by the suburban dispersal line and the intra-urban rapid transit system are different, the Team would have to ensure that the two are closely integrated elements of the development plan of the metropolitan area. The Railways have agreed to undertake this study in collaboration with the Team and the West Bengal State Study Group. The Team contemplates that the Study would be completed in about 18 months' time.

6. The Team has also suggested an improvement programme for the existing suburban railway services, buses and trams to increase their capacity and efficiency of operation and to minimize further deterioration in services. An increase in mass transportation capacity would be possible with the implementation of schemes relating to road-way improvements, including the second Hooghly Bridge at Prinsep Ghat, approaches to Howrah and Sealdah Station areas and traffic operations improvement. The Team hopes that all possible efforts would be

made by the concerned authorities to implement the recommendations in this regard contained in the Report.

7. Finally, the Team would like to reiterate that the solution of transportation problems of Calcutta lies not exclusively on the ingenuity of providing additional capacity or employing better methods of moving passengers and goods. The demand for transportation would continue to outrun supply regardless of our efforts to provide more facilities at a very high cost particularly, in view of the fact that big push in population increase is yet to come. The projections of Calcutta Metropolitan District's population over 1961 indicate an increase of about 40 per cent by 1976, 76 per cent by 1986 and 108 per cent by 2001 A.D. The key to solution of long-term transportation problems is therefore, positive control over the demand for transportation by dispersal of population and economic activity and provision of infra-structure facilities in towns around the metropolis which could serve as counter-magnets. Besides, the Calcutta Metropolitan Planning Organisation should soon be made a statutory body and vested with adequate status and authority for the effective review and co-ordination of development programmes undertaken by various implementing agencies within the metropolitan area of Calcutta.


CALCUTTA METROPOLITAN AREA

INTRODUCTION

The Calcutta Metropolitan District is the largest urban concentration in the country with a population of more than 7.5 million and an area of 1,255 sq. kms. according to 1966 estimates. By 2001 A. D. its population is expected to touch the 14 million mark. During the decade 1951—61, about 30 per cent of the population growth within the C. M. D. was due to continuous inflow of migrants from its hinterland and other distant parts of the country, mainly in search of employment. The average density in Calcutta is 159 persons per developed acre, and 294 persons per residential acre, whereas in northern Calcutta it is about 590 persons per acre. In certain wards, however, it varies from 700 to 1000 per residential acre.

The characteristic growth of Calcutta as a major industrial city is due to the extensive suburban expansion along the river with uncontrolled land use. There has been a rapid growth in the fringe areas and in the municipalities immediately bordering the city, particularly on the northern side of the Corporation area. The Metropolitan area comprising 2 Municipal Corporations, 33 Municipalities and 37 non-municipal urban areas, has grown into a linear north-south urbanised sprawl along both the banks of the river Hooghly. The two linear cities—Howrah and Calcutta—on either banks of the river, are linked by only 3 bridges over a stretch of 80 kms. This has led to the development of independent road system on the east and the west banks of the river and is also responsible for the strong north-south orientation of the major streets and highways.

Central Business District—The centre of business activity in Calcutta is in the vicinity of Dalhousie Square and the Burra Bazar area. The industrial city of Howrah is on the west bank of the Hooghly. The residential area extends to the north-east and the south of the central area. The docks, warehouses and railway tracks of the Port Commissioners' are along the east bank of the Hooghly extending from the Howrah Bridge to the Kidderpore area on the south. Major industrial development is located along the Grand Trunk Road in Howrah and in the Kidderpore area in Calcutta as well as along the eastern fringe of the city.

Traffic Pattern—According to a study made by the C.M.P.O. in 1964, there are two principal traffic corridors—one along the

north-south axis and the other along the east-west. The passenger flow is tidal. It is directed towards the Central Business area in the morning and gets reversed during the evening. The study revealed that the morning peak (9 to 11) was more pronounced than the evening peak (4 to 6). The volume of traffic entering the Central Business area was about 85,000 and that of out-bound passengers nearly 77,000 per hour. The peak flow of passengers per hour from the south on the Chowringhee Road alone was more than 18,000; from the north about 22,000; from the east (mainly Sealdah station) about 22,000 and from the west (across Howrah Bridge) about 20,000. Thus the principal traffic corridors carried about 77,000 persons per hour, the remaining 8,000 persons being carried by other routes.

Transit passenger volume counts were also made by the C. M. P. O. in 1964 at several screen lines to assess the magnitude and variation of the existing transit passenger flow The maximum volume of 314,172 transit passengers was recorded at Howrah bridge. The next highest load points occurred along Jawaharlal Nehru Road—277,524 transit passengers were observed on Jawaharlal Nehru Road near S. N. Banerjee Road and 250,976 at Chowringhee near Acharya Jagdish Chandra Bose Road. Other maximum load points occur in the east-west corridor leading to Sealdah station. The principal transit services to Sealdah station are located on Mahatma Gandhi Road, B. B. Ganguli Street and Dharamtala Street; a total combined volume of 324,580 transit passengers was recorded on these streets in the vicinity of Sealdah station. Maximum transit movements occur in the central area of Calcutta. This area is roughly delineated by the east-west screen lines along Kolutala Street, Surya Sen Street and S. N. Banerjee Road together with the north-south screen lines along Acharya Jagdish Chandra Bose Road and Strand Road A daily total of 1,455,562 transit passengers was recorded which included 770,891 by trams and 684,671 by buses.

A study of morning peak hour transit passenger volume counts into the central area revealed that the heaviest volume was the east-bound movement over the Howrah Bridge. On an average day, more than 500,000 persons moved over the Howrah Bridge—207,200 people by buses and 113,800 by trams. The number of pedestrians alone was 125,000. During the peak hours the movement was about 10.3 per cent of the daily total. A large number of fast vehicles crossing the river have short trips which terminate in zones near the Howrah Bridge approaches.

Inadequate Transport Facilities—The tremendous growth in population and industrial activities have severely strained the

existing mass transportation services which are provided by suburban trains, buses and trams. The Railways alone carry about 700,000 suburban passengers daily whereas the bus and tram systems serve about 2.5 million passengers daily under conditions of gross overcrowding. A two-car unit tram with a seating capacity of 75 carries about 200 passengers and a single deck bus with 45 seats about 125 passengers. The operating speed of trams on important routes is 11 to 16 kms. per hour while the average operating speed of buses is about 14 kms. per hour.

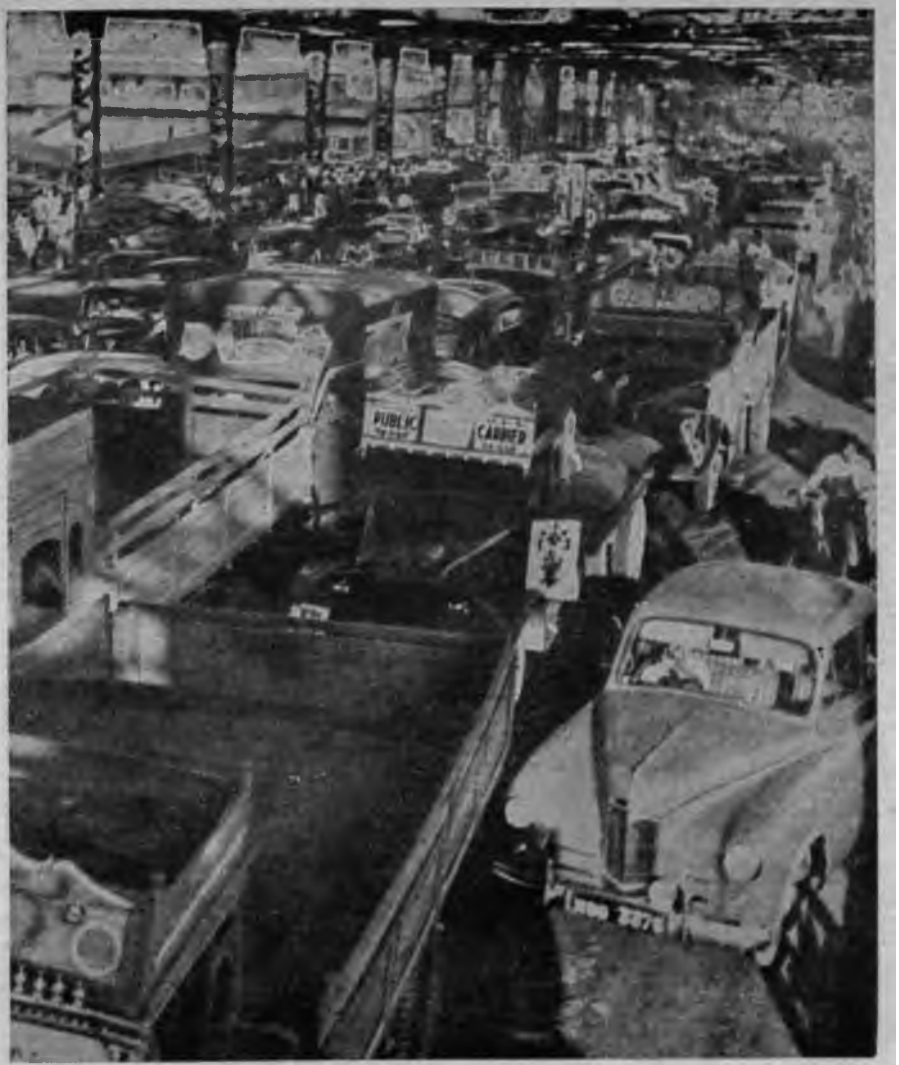
Existing Road System—The road system is basically inadequate to the current needs. The two main roads of great importance to Calcutta and Howrah are the Barrackpore Trunk Road running northwards from Calcutta on the east, and the Grand Trunk Road also running north-wards from Howrah on the west. These are the main feeders to Calcutta's north-south main street system. It is only the two trunk roads and the railway lines that provide means of travel from the outskirts of the city and from the limits of the metropolitan area to Calcutta and Howrah. The north-south main streets are served by the east-west feeder roads of the grid, but neither the main trunk roads nor the main streets or cross-feeder roads, are of adequate widths or standards. Severe street congestion prevents improved service and limits the number of surface transit vehicles that can be effectively put into operation. While the position in regard to road and street improvements in the Calcutta Metropolitan District have remained static undoubtedly due to difficulties in carrying them out, the daily traffic into Calcutta has grown up by leaps and bunds.

Chapter I

SUBURBAN DISPERSAL RAILWAY LINE

There are 12 rail alignments of suburban services of the Eastern and South-Eastern Railways entering the CMD. These extend as far as Burdwan, Krishnagar city and Bongaon on the north and Kharagpur on the west, Diamond Harbour and Port Canning on the South. A large percentage of the suburban commuter traffic is oriented towards central Calcutta and practically all this traffic is funnelled through either Howrah or Sealdah stations which are the principal suburban terminals serving the Calcutta-Howrah area. As both the stations are more than one mile away from the central area, neither of them is conveniently situated with regard to accessibility to the Central Business District. Moreover, approaches to both the stations are poor. On account of intense congestion on the Howrah Bridge and its approaches, movement between Howrah station and central Calcutta is much complicated. Similar traffic bottlenecks near Sealdah station due to limitations in surface transport capacity result in heavy pedestrian movements in the east-west corridor. These in turn seriously interfere with movement of street traffic, including trams and buses. Thus, the concentration of commuter traffic at Howrah and Sealdah, the absence of proper dispersal system for such an intense traffic and the inadequacy of existing street system to accommodate it, create chaos in traffic conditions. The situation would further deteriorate with the expected increase in the total number of passengers from 580,000 to 950,000 at Howrah and Sealdah stations by 1976. It is impossible to devise a suitable method of dispersal along the existing road system. It becomes therefore, imperative to resort to some other means of mass transit for their dispersal.

1.1 In the past the central city terminal problems had received considerable attention. The scheme for a circular Railway proposed by the Calcutta Terminal Facilities Committee in 1947, envisaged many conveniently located city area terminals which would provide improved central city distribution of suburban rail passengers. Subsequent reviews of this proposal were made by Sir S. N. Roy Committee in 1953 and the Sarangapani Team in 1954. However, no progress on imple-



Severe congestion on Howrah Bridge

mentation of the scheme was made mainly due to objections raised by the Port Commissioners and the Railway authorities.

The Metropolitan Transport Team examined the circular railway scheme with particular reference to the feasibility of its alignment and to the extent it would ease the traffic situation in Calcutta. As a result of discussions with the Port Commissioners, the Railways and the Study Group appointed by the West Bengal Government, it was felt that the alignment for the circular Railway as proposed earlier, would not serve the purpose fully. An alternate alignment was therefore, drawn up by the Team and discussed with the concerned authorities in June, 1966. It was agreed that a preliminary engineering feasibility study of the suggested alignment was necessary. At the instance of the Team, the Railway Board agreed to undertake the study through a Survey Unit of the Eastern Railway, specially set up for the work. The study related to two sections—one from Dum Dum to Prinsep Ghat and the other to serve the Salt Lake area where the State Government plans to settle about a million people. This study was initiated in June, 1967. The Survey Unit finally submitted its Report to the Team in December, 1968.

1.2. The Survey Unit has found the construction and operation of the proposed Dum Dum Prinsep Ghat and Salt Lake Area alignments feasible.

(i) *Dum Dum Prinsep Ghat Alignment*—This alignment would lay alongside the Central Business area and thus function as a suburban dispersal line for the commuters coming from the northern suburbs with destination in the C.B.D. It would considerably reduce the load from the existing suburban railway routes. It would serve nearly 50 per cent of the total working population expected to be employed in the C.B.D. by 1976, and also reduce their walking distance to less than half a kilometre.

Detailed Origin-Destination surveys were conducted at 33 suburban stations on the Howrah Division, 66 suburban stations in the Sealdah Division, and 5 non-suburban stations situated on the Baraset-Hasnabad Section of Sealdah Division. These surveys revealed the percentage of the total number of passengers travelling to the city who have destinations in areas which will be served by the proposed route. It would be observed from the following table that the main bulk of the traffic likely to be diverted to the Prinsep Ghat route would be for the proposed Fairlie Place and Burra Bazar stations.

TABLE 1

	Distribution to new stations as percentage of total arrival to the city					
	Belgachia	Sobha Bazar	Burra Bazar	Fairlie Place	Prinsep Ghat	Total
1	2	3	4	5	6	7
Sealdah Northern Section						
Main line and via. .	8·1	1·4	10 5	15 2	5·4	40·6
Bongaon Branch and via Calcutta Chord Rly. and via	6·1	0·7	8·5	20 0	3·9	39·2
	2·2	0·6	3·6	18·7	2·0	27·1
Howrah Division						
Main line	5·6	1·2	4·2	16·1	4·9	82·0
Howrah Burdwan Chord	4·2	0·7	5·8	24 5	3 9	39 1
Tarakeswar Branch ..	6·0	1 1	5 4	10 9	4·5	27·9
Bandel-Katwa Section ..	5 4	0 3	7·7	15 4	7·4	36·2

The main advantages of the alignment would be:

(a) availability of direct service to the C.B.D. from the north of Howrah and of interchange facilities with other modes of mass transport for further journeys;

(b) avoidance of changeover;

(c) walking proximity to place of work;

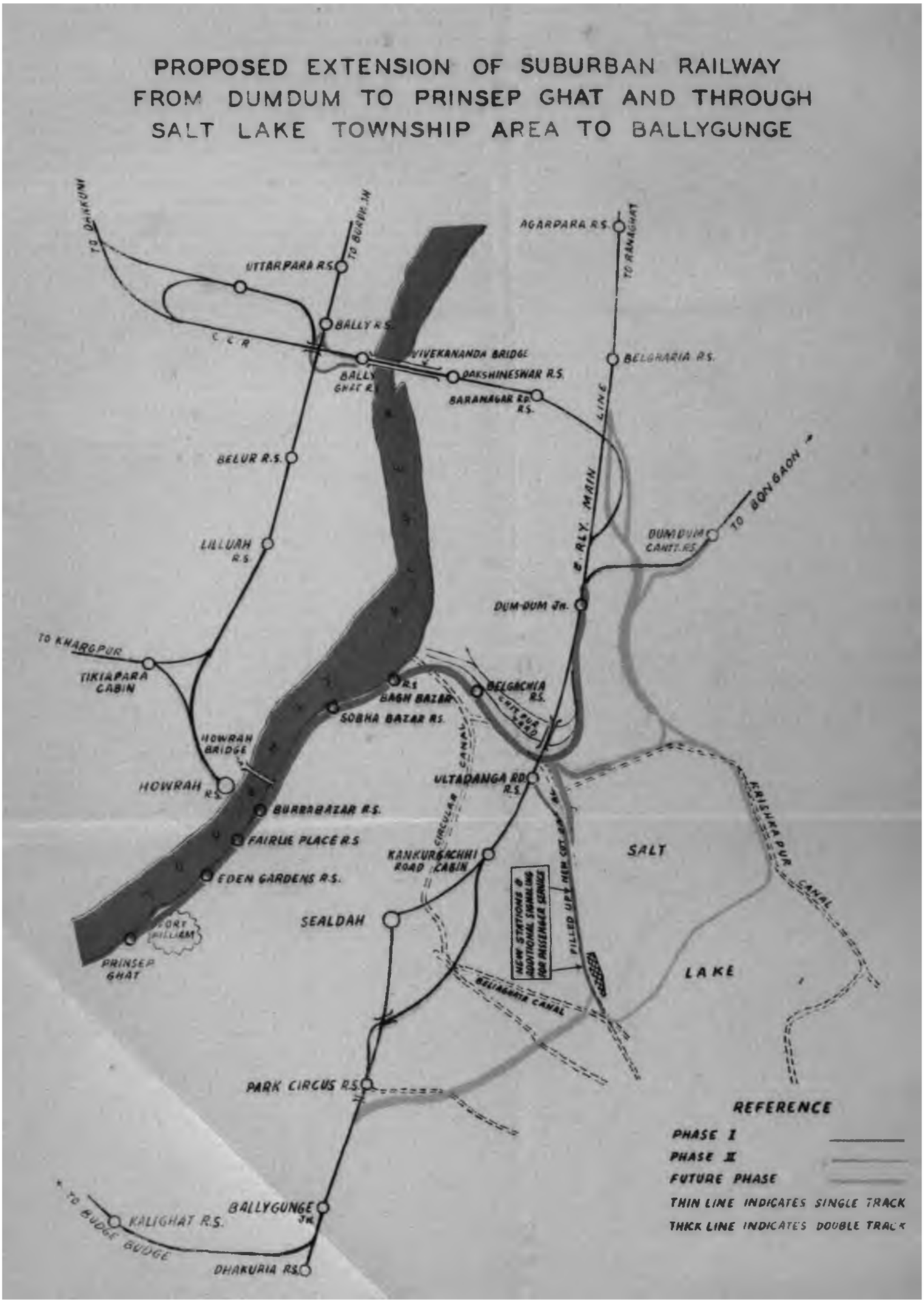
(d) reduction in total journey time;

(e) reliability of service; and

(f) journey comforts.

The length of construction for the Dum Dum Prinsep Ghat route would be 14.39 kms. excluding Bally-Ballyghat link (2.13 kms.). The proposed extension would be of 5'—6" gauge. The alignment would take off south of Dum Dum Jn. and fly over the Chitpur Yard. The site of the interchange station will also lie near the two trunk roads. The Circular canal north bank road and the surface alignment of the railway extension between the two trunk roads would conveniently provide the interchange facilities with the proposed rapid transit system. An elevated formation would have to be adopted in the Calcutta Port Commissioners area. The structures carrying the tracks would straddle across the river side track of the Calcutta Port Commissioners. Full non-electrified working clearance over the Calcutta Port Commissioners tracks would be provided. The gradients of the curves would not present any problem till the formation crosses the extension of the Kali Krishna Tagore Street. It would have to come down at a gradient of 1 in 35 compensated, for passing under the Howrah Bridge road

PROPOSED EXTENSION OF SUBURBAN RAILWAY FROM DUMDUM TO PRINSEP GHAT AND THROUGH SALT LAKE TOWNSHIP AREA TO BALLYGUNGE



approach through its viaduct opening. Immediately after passing the viaduct opening, the CPC track alignment would require to be diverted eastwards slightly taking up the Refugee Market area located on the top of the existing retaining wall. The inadequate clearance under the Howrah Bridge carrying the old Howrah Bridge approach road, the frequent water logging and sogginess of the depressed CPC formation compel dismantling of the old viaduct span to raise the new formation. It would be necessary to replace the old road connection by a level crossing across the Port Commissioners' tracks a little further south in line with Brabourne Road alignment. Outside the Calcutta Jetties, the alignment would follow the single-line CPC track over Babughat. In this zone there are three station sites viz. Sobha Bazar, Burra Bazar and Fairlie Place, the spacing between the last two stations being 0.7 kms. Fairlie Place station will be a three-line station with a common loop. Burra Bazar station would be provided with an elevated pedestrian gangway across the Strand Road terminating on the Brebourne Road. At Fairlie Place, there would have to be more elaborate facilities and its southern end gangway would run the whole length of Koilaghat Street to terminate near the tram stop inside the Dalhousie Square. The terminus of the route would be at Prinsep Ghat.

Remodelling of Dum-Dum Junction Yard—The take off of the route would require remodelling of the Dum Dum Jn. yard including track, signalling and the electric traction overhead installations. It would be necessary to stop all electric powered train movements when the overhead alterations would be in hand during the long power block periods. As the Chitpur Yard operation is vitally connected with Dum Dum Jn. Yard, the layout would entail minor alterations to the overhead sectioning arrangements and would least interfere with the goods operating during the remodelling. The period of remodelling according to the Eastern Railway, might extend upto 4 months. This could be reduced to about 2 months by allowing longer night blocks after the last train. The firm which had originally installed the route relay system is quite optimistic about the minimum time.

(ii) *Salt Lake Reclamation Area*—The Salt Lake Reclamation area which is being developed in the east of Calcutta to accommodate about a million people will be a great traffic generator. Though it is being designed as an independent and self-contained unit, it will be in close proximity to the mother city, and there will be strong attraction for movement between the new settlement and the C.B.D. of Calcutta. The ultimate development of the Salt Lake area, the Lake area and the Patipukur area with an anticipated population of nearly 1.5

million will create immense need for movement into and out of Calcutta.

The advantages of the second dispersal line through the Salt Lake area township to Ballygunge would be as follows:

(a) the large population of the new township would be served mainly by an electrified suburban railway for their work trips;

(b) the Calcutta's northern suburbs and the new township would be connected by a direct link to the southern parts and suburbs of Calcutta where large scale industrial and residential development was taking place;

(c) the new line will reduce the peak commuter load on Sealdah and create a potential for dispersal of 25,000 to 30,000 people per hour in the south of Calcutta; and

(d) an additional branch line along the western side of the proposed Salt Lake Township would be connected with the main route. The station at high level at Maniktala which would be located where Maniktala Main road ends would serve a part of the Salt Lake Township as well as the developed areas of the Calcutta Improvement Trust lying on its west. It is estimated that a population of 110,000 in 1974-75 and 143,000 in 1980-81 would be served by this station.

Since the Salt Lake Branch is expected to handle larger traffic than what a single-line could manage, it will have to be a double-line route. Its take off from the route would have to avoid or minimize any cross movement over the busy Central Business District lines. This Branch would use the Township side of the Krishnapur Canal bank and the alignment should be kept within a 50 ft. strip of border land earmarked for an afforestation belt around the Township sectors I, II and III.

The Team is of the view that at this stage, a strip of land required for the future second dispersal line through the Salt Lake area should be demarcated and reserved. For this, it is necessary to freeze building construction activities immediately on land falling under the alignment of the Salt Lake East and West branches outside the Township area.

The impact of the vast development proposed by the Salt Lake Area Reclamation Project has been fully appreciated by the Eastern Railway. The Railways have suggested that the State Government, in anticipation of the need of bringing in enormous building material, should provide a mineral siding taking off from the Dum Dum or Chitpur Yard. The Team feels

that a mineral siding would be essential for development of the Township. However, its implementation should not be linked up with the proposed suburban railway expansion.

(iii) *Bally-Ballyghat Link*—The extension of electrification by the Eastern and South Eastern Railways would greatly increase the number of commuters intending to come to Sealdah from the north of Howrah. It would be convenient for these commuters to come to the C.B.D. via the proposed dispersal line without alighting at Howrah. The availability of a direct suburban rail route into Calcutta via the Bally Bridge would be convenient to them. The team is therefore, of the view that the new Bally-Ballyghat link is necessary for the diversion of trains between the Calcutta Chord Railway and the Howrah Division Main line. It would have to be provided in a manner so as to avoid any cross movements over the existing main lines of the Howrah Division at Bally.

The Team has discussed the preliminary engineering feasibility report with the concerned authorities, viz. the State Study Group, the Eastern Railway and the Port Commissioners who accept the proposed alignment. Certain marginal issues have been raised particularly, by the Port Commissioners in regard to its implementation which could be taken care of at the stage of Final Location Survey and the preparation of project drawings and estimates. The Team, therefore, recommends that this work should be taken up by the Railways as early as possible in order to avoid delay in implementation of the scheme. This study would take about one year to complete.

1.3. **Cost Estimates and Financial Prospects**—According to the Survey Unit, the capital cost of the Dum Dum Princep Ghat route would be about Rs. 290 million A traffic and financial viability study of the project was also undertaken by the Survey Unit following the principles and criteria laid down in the State Railway Code for a new railway line. Financial prospects have been worked out for the first year of opening of the line i.e. 1974-75 and 6th year of operation i.e. 1980-81 and are given in Appendix I.

It will be noted that the cost of land and property acquisition amounts to Rs. 40 million. Significant economy could be affected (a) with the reduction in the cost of land owned by the State Government and local bodies by free transfer or on a nominal lease and (b) in design loading standards. Estimates have also been made on the basis of reduced capital cost (resulting from the proposed economies in construction) and increase in fare structure *vide* Appendix II.

The fare of a suburban monthly season ticket varies between 8 to 18 equated fares for single journey tickets. Each

monthly season ticket is taken as equivalent to 25 passenger trips per month in each direction (total 50 trips). The quarterly season ticket enjoys further concession. Passengers have to pay 2½ times the charges for the monthly season tickets. The Survey Unit has taken into consideration the existing fare structure both for single journey tickets and for season tickets. In view of the facilities enjoyed by the passengers who would be travelling on this route, a surcharge of 5 paise per single journey ticket and Rs. 3 per monthly season ticket has been suggested. This has been done, taking into consideration the total cost of the journey upto their destinations—rail and bus or tram fare—which would get reduced due to the proposed railway suburban service.

The financial prospects of the scheme shown as percentage return on capital for the two years mentioned above are summarised below:

	1974-75	1980-81
	Percent	Percent
1. On Original capital estimates and existing fares .	0·15	0 80
2. On original capital estimates and proposed fares .	1·65	2·64
3. On reduced capital estimates and existing fares .	0 31	1·05
4. On reduced capital estimates and increased fares ..	2 03	3·17

The Team has considered the scheme with the revised capital estimates as per alternative 4 above. If the interest charges on the capital cost during construction period are excluded, the return would rise from 3.17 per cent to 3.76 per cent by 1980-81.

The return would still be higher if (*a*) the 5 per cent hire charge for the rolling stock—amounting to Rs. 700,000 per year —is left out, on the ground that the Railways themselves would operate the scheme and (*b*) the line terminates at Prinsep Ghat instead of Maidan reducing the capital base by at least Rs. 10 million and thereby increasing the rate of return (the loss of gross earnings on account of omitting the Outram Ghat—Maidan section will be negligible). The Team is of the view that there is further scope of increase in the fare structure as worked out by the Survey Unit. A minimum increase of 10 per cent would secure an additional Rs. 600,000 per year.

If the earnings go up by Rs. 600,000 and the working expenses go down by Rs. 700,000 and if the capital cost falls by Rs. 10 million, the net rate of return will be

$$\frac{\text{Rs. } 9{\cdot}0 \text{ million} + \text{Rs. } 1{\cdot}3 \text{ million}}{\text{Rs. } 2{\cdot}30 \text{ million}} \times 100 = 4{\cdot}48 \text{ per cent or say } 4{\cdot}5 \text{ per cent}$$

by 1980-81. It is an encouraging rate of return for a project of this type.

It is important to note however that the direct financial return is not the major consideration in the case of schemes of this type. Passenger transport facilities are a public service and also an important part of the infra-structure required for economic growth. Apart from the direct financial returns, there are indirect economic returns or "external economies" which have to be considered. A full cost-benefit analysis would require very careful and prolonged study, but there are a few facts which require to be emphasized.

The first among these will be the gain in working time and efficiency in the enterprises and establishments, the employees of which are directly benefited by the provision of an easy, comfortable and quick transport to and from work. If the time saved is one hour (i.e. half an-hour-either way), there should be a substantial gain merely on this account.

The second important point to note is that the new service will relieve congestion in the trams and buses services and will enable these services to run more efficiently than at present. They will be able to provide speedier services and therefore more services. They will also find it easier to reduce the leakage on account of travel without tickets. The increase in the return earned by the train and bus services should, therefore, be taken into account.

The third important point is that the railways will be able to put their existing facilities in and around Calcutta to better use. The Survey Unit has taken into account the loss of income to the parent lines resulting from the diversion of the Howrah and Sealdah bound traffic to the new terminal. It has not taken into account the fact that the relief of congestion at Sealdah and Howrah would make it possible to have better planning and implementation of the main services i.e. services other than the suburban passenger traffic. The growth that is likely in the long-distance transport requirements would either require expansion of Howrah and Sealdah or development of alternative terminals. All this will become unnecessary—upto a large extent—if capacity is created by relieving the pressure on the existing capacity.

The Survey Unit has rightly pointed out that the rate of direct return calculated by it goes to 1980-81 only. Railway services, city transport services and the like, are projects in which the planning horizon has to be wide—25 years would be a reasonably appropriate planning period and even 50 years will not be too long. If one considers the population and other prospects for the next generation, even the direct profitability of the scheme will be very large and the indirect gains and benefits

will be not only large but also very widely spread. One can note in conclusion that in the situation that exists in Calcutta now and with the minimum growth that one can assume, the social and economic cost of *not* having an efficient transport service for entry into the city will be stupendously large. The economic cost will be so heavy that one need not emphasize the political and other non-economic factors in the situation.

1.4. **Programme of Construction Work**—The entire programme of construction would extend over a period of 4 years, excluding one year for Final Location-cum-Detailed Planning Survey. This is based on the assurance of successful acquisition of land by the Government. Two years' time might be allowed for land acquisition proceedings, for preparation of detailed design, finalisation of tenders, collection of stores and equipment etc. Construction on vacant land owned by the Government and public bodies could be taken up from the middle of 1970.

1.5. **Foreign Exchange Requirements**—The total foreign exchange requirements work out to Rs. 3 million. For structural works the foreign exchange element would be negligible. The high tensile steel required for prestressed concrete work is being produced indigenously. For construction, special pile driving plant, high capacity road cranes, special bridge erection equipment like jacks and torque wrenches and a track tamping machine will have to be imported which would cost Rs. 1.125 million. The hydraulic re-railing equipment for emergency use would require Rs. 200,000. Some of the materials used in overhead traction equipment and the route-relay signalling works and telecommunications cable would need another Rs. 1.675 million in foreign exchange.

1.6. **Phasing of Total Expenditure**—On the basis of construction being spread over the period of 4 years and the priorities indicated being observed, yearly allocation of funds for the route has been worked out. The phasing of total expenditure would be at the rate of 15, 25, 35 and 25 per cent in the 4 successive years.

In addition to the provision for suburban railway dispersal line, the Team has also attempted to assess the future role of the existing mass transportation facilities within the frame work of the overall transport development plan of the metropolitan city. In this connection, it would be necessary to determine the main characteristics of the existing mass transportation network and the possible ways and means to improve the services offered by the Railways, the buses and the trams. These are described in the Chapters that follow.

Chapter II

SUBURBAN TRAIN SERVICES

The suburban rail services are being operated by the Eastern and South Eastern Railways which provide connections between Calcutta, Howrah and suburban areas. With the electrification of suburban rail lines, these two Railways have played an increasingly vital role in dealing with urban transportation problems.

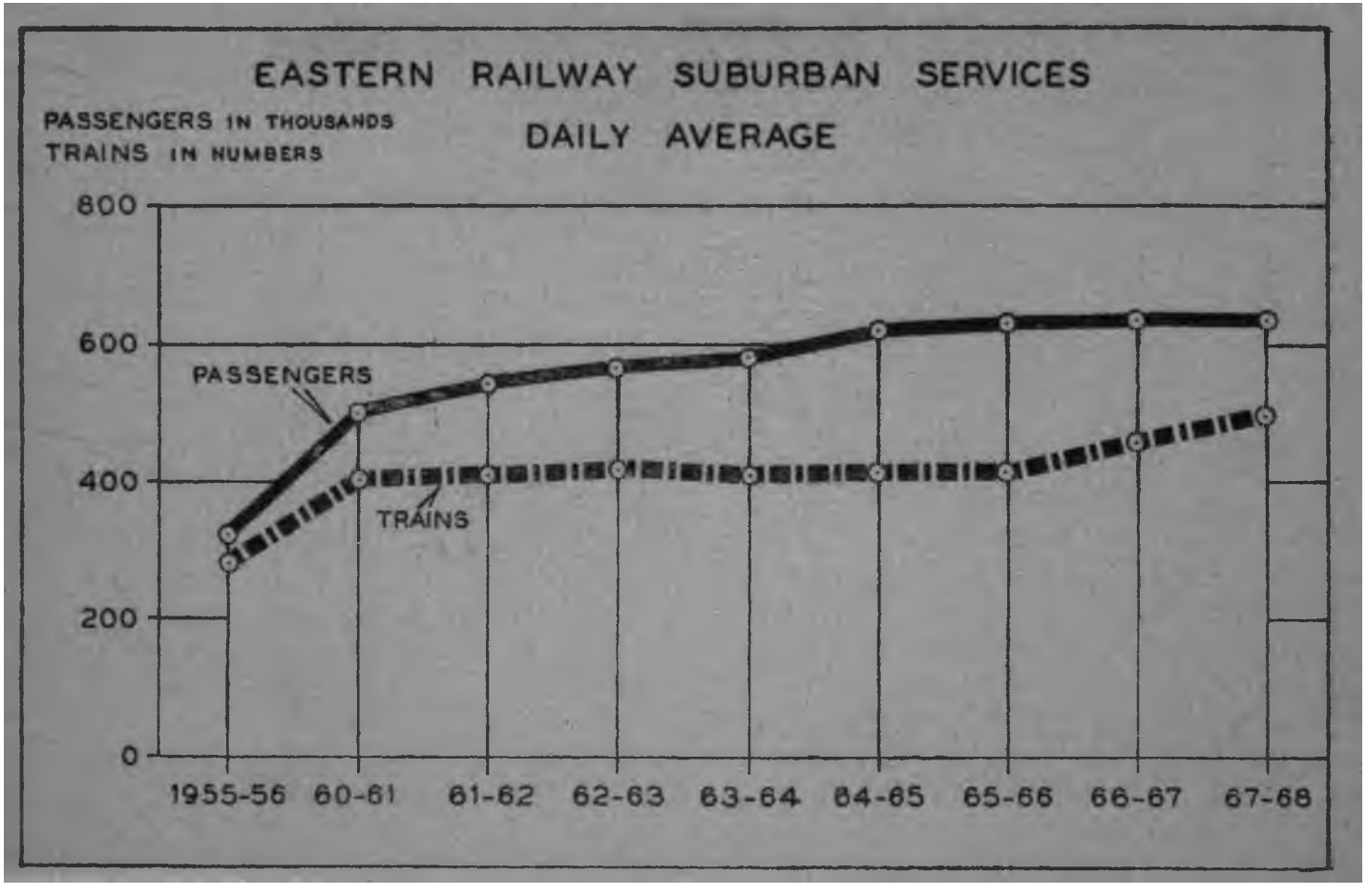
Eastern Railway

2.1. Electrification was first introduced on the Eastern Railway in 1957. This has enabled the Railway to run its suburban trains into Sealdah during the peak hours with a headway of 3 to 5 minutes from all directions. At Howrah the headway is even smaller, sometimes only of one minute. The headway in the evening peak period is about 4 to 5 minutes. With the introduction of electric multiple unit (EMU) stock the carrying capacity has increased from 650 to 1,600 passengers.

The main double line tracks upto Andul and the single line tracks to Krishnapur City and Shantipur via Ranaghat have been recently electrified. The single line to Bongaon, north-east of Sealdah has also been electrified. This part of Calcutta is developing very fast and it is anticipated that the traffic load on this section will increase tremendously in the near future which would necessitate the doubling of this section.

To meet further increase in traffic, the route relay interlocking system has been provided at Dum Dum junction, currently dealing with 250 trains daily. Similar arrangements have been made at Kakurgachi Control Jn. Cabin between Sealdah and Dum Dum. In addition, the electrification of other locations to the south-east and south west of the existing tracks leading to Budge Budge, Diamond Harbour and Lakshmikantpur would open vast areas to the south of Sealdah.

Growth of Traffic—The suburban train passenger traffic at Sealdah and Howrah increased from 118 million in 1955-56 to 232 million in 1967-68. The Eastern Railway have increased the number of suburban trains considerably to meet the growing traffic. It is evident from the table below that during 1955-56 to 1967-68 the number of suburban passengers rose from 323,000 to 635,000 per day, and the number of trains increased from 281 to 496 per day.


EASTERN RAILWAY SUBURBAN SERVICES
DAILY AVERAGE
PASSENGERS IN THOUSANDS
TRAINS IN NUMBERS
800
600
400
200
0
PASSENGERS
TRAINS
1955-56
60-61
61-62
62-63
63-64
64-65
65-66
66-67
67-68

Peak hour rush of rail commuters.

TABLE 2

Year	Passengers	Passenger trains
	Number in thousands per day	Number of trains run per day
1955-56	323	281
1960-61	500	403
1961-62	544	409
1962-63	567	416
1963-64	582	409
1964-65	620	412
1965-66	632	413
1966-67	635	454
1967-68	635	496

Peak Period—On the Eastern Railway the peak period in the morning is from 8.30 hrs. to 10.30 hrs and the evening peak is from 16.30 to 19.30 hrs. It has tried to augment the train services during morning and evening peak hours as given below:

Year	Morning Peak	Evening Peak
1955-56—		
Howrah	18	16
Sealdah	26	27
1960-61—		
Howrah	20	21
Sealdah	27	32
1961-62—		
Howrah	20	21
Sealdah	28	32
1962-63—		
Howrah	20	21
Sealdah	28	32
1963-64—		
Howrah	21	22
Sealdah	28	32

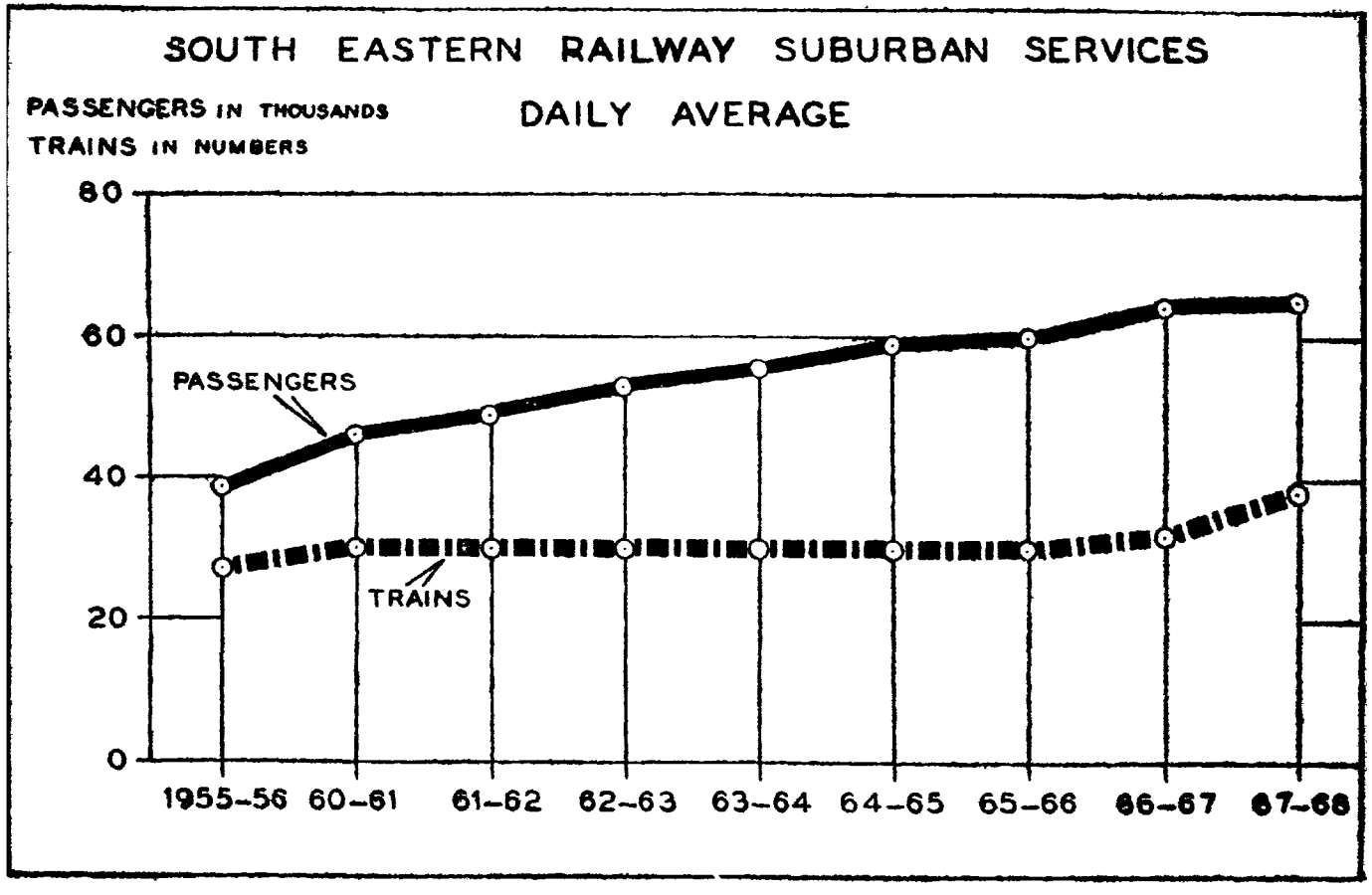
Year	Morning Peak	Evening Peak
1964-65—		
Howrah	22	22
Sealdah	29	32
1965-66—		
Howrah	22	22
Sealdah	30	34
1966-67—		
Howrah	21	21
Sealdah	34	34
1967-68		
Howrah	23	23
Sealdah	34	37
1968-69—		
Howrah	25	25
Sealdah	35	39

E. M. U. Stock—The supply of rolling stock has no doubt been augmented from time to time but the demand of suburban traffic has overwhelmed the supply. The current total holdings of EMU stock are given in the following table:

TABLE 3

Particulars of Units	No. of units	Motor coaches	Trailer coaches	Total coaches	Rakes
SIG	12 (3-car)	12	24	36	6
JESSOP	16 (3-car)	16	32	48	8
HEIL	39 (4-car)	39	111	150	19
HITACHI (Bulk) ..	32 (4-car)	32	96	128	16
HITACHI (Proto) ..	2 (4-car)	2	6	8	1
AEI (Proto)	2 (4-car)	2	6	8	1
PUSH-PULL Formation . ..	30 (4-car)	..	240	240	30
Spare ..	..	2	4	6	..
Total ..	97 EMU +30 Push-Pull Formation	105	519	624	86

These stock holdings can be divided into two main categories—the EMU stock or Double Unit which can be driven from either end, and the "push-pull" type which has the driving


SOUTH EASTERN RAILWAY SUBURBAN SERVICES
PASSENGERS IN THOUSANDS
TRAINS IN NUMBERS
DAILY AVERAGE
80
60
40
20
0
PASSENGERS
TRAINS
1955-56
60-61
61-62
62-63
63-64
64-65
65-66
66-67
67-68

unit in the central position. The total number of 97 EMU stock and 30 of the 'Push-Pull' type, which together with 2 spare motor coaches and 4 trailers, provide a total of 624 coaches with 6 spare motor-coaches. All these vehicles in stock make 86 rakes available for daily suburban service.

The Eastern Railway in anticipation of an increase in the suburban traffic, had programmed for 588 coaches during the Third Five Year Plan. Against this, 312 were received during the plan period and 225 coaches were supplied during 1966-67 to 1968-69. This leaves a balance of 51 coaches yet to be received by the Railway. The Eastern Railway have a procurement programme for 80 coaches during the Fourth Plan.

SOUTH EASTERN RAILWAY

2.2. The suburban services of the South Eastern Railway are run on the Howrah-Kharagpur Section These are being gradually replaced by EMU rakes with the completion of electrification in April, 1968. The traffic on the Howrah-Kharagpur section has been worked partly as suburban and partly as a main line. At present there is not much of suburban traffic between Howrah and Kharagpur. However, in order to serve the major coal/steel industrial complex, there is bound to be further expansion of the electrified suburban section of the South-Eastern Railway westwards from Howrah. There are quite a number of suburban trains which start and terminate at Howrah and run as far as Machada (59 kms.), Panchkura (71 kms.), Uluberia (33 kms.), Deulti (51 kms.) and Kharagpur (116 kms.). In addition, the main line passenger trains are also utilised for commuter movements into and out of Howrah. In order to handle a large number of trains, installation of automatic signalling on Howrah—Haur length is in progress. The flexibility permitted by automatic signalling will considerably increase the frequency of suburban EMU services.

Growth of Traffic—The growth of passenger traffic on the South Eastern Railway since 1955-56 and the number of trains run daily are given below:

TABLE 4

Year	Passengers originating	Trains
	Number in thousands per day	Number of trains run per day
(1)	(2)	(3)
1955-56	38·5	27
1960-61	46·5	30

TABLE 4—*contd.*

(1)					(2)	(3)
1961-62	..	..	..	..	49·3	30
1962-63	..	..	..	..	52·9	30
1963-64	..	..	..	..	54·9	30
1964-65	..	..	..	..	58·8	30
1965-66	..	..	..	..	59·7	30
1966-67	..	.	..	..	64·6	32
1967-68	..	..	..	..	65·0	38

E.M.U. Stock—The South Eastern Railway has at present 12 units each of 4 cars with 12 motor coaches and 36 trailers, making 6 rakes out of 48 total coaches. The Railway is maintaining 2½ EMU rakes as spares comprising 5 units of 4 coaches each with 5 motor coaches and 15 trailer coaches. The South Eastern Railway had programmed for the procurement of 35 major coaches with 102 trailer coaches during the Third Five Year Plan. However, no coaches were made available to the Railways during this period. During 1966-67 and 1968-69, 17 motor coaches and 51 trailer coaches were received.

Peak Period—The morning peak on the South Eastern Railway is from 8.00 to 10.30 hours and the evening between 16.00 hours to 19.30 hours. The following table gives the number of trains in the morning and evening peak periods:

TABLE 5

Year						Number of suburban trains	
						Morning peak	Evening peak
1955-56	..	..	..	..	..	7	7
1960-61	..	..	..	..	..	8	7
1961-62	..	..	..	..	..	8	8
1962-63	..	..	..	..	..	8	8
1963-64	..	..	..	..	..	8	8
1964-65	..	..	..	..	..	8	8
1965-66	..	..	..	..	..	8	8
1966-67	..	..	..	..	..	8	8
1967-68	..	..	..	..	..	8	8

The intensity of traffic during peak period is approximately two to three times that of the non-peak period.

2.3. Punctuality—In any suburban train services absolute punctuality and regularity of trains are both a 'sine-qua-non'. The Railway Administration have therefore, to ensure that the punctuality is fully maintained and there are no cancellation of trains as far as possible, specially during peak hours. A slight irregularity affects the whole suburban service. It also leads to mass discontent, culminating in unauthorised stopping of trains and even burning of rolling stock. Moreover, the irregularity in service affects the working people living in far-flung places like Burdwan, Krishnagar, Bongaon on the Eastern Railway and Kharagpur on the South Eastern Railway. The following factors affect the punctuality of the suburban trains:

(*i*) *Supply of EMU Stock*—It was brought to the notice of the Team that against 588 coaches programmed by the Eastern Railway during the Third Five Year Plan, only 312 coaches were supplied. Subsequently during 1966—69, 225 coaches were supplied. During the Fourth Plan, the Railways have programmed for 80 coaches. It is recommended that the procurement of EMU stock should be stepped up so as to enable the railways to meet the additional traffic demand.

(*ii*) *Speed Restrictions*—The Eastern and South Eastern tracks were originally laid as inter-city main line routes. Certain speed restrictions have been imposed on account of sharp curvatures and inadequate super-elevation. In order to raise the speed standard and maintenance of tracks, points and crossings should be of a very high order. The Railways should take necessary steps to alter the lay-out of tracks and make the necessary provision of super elevation etc. so that the speed restrictions could be removed.

(*iii*) *Mechanised Track Maintenance*—The intensity of train movements on the suburban sections has not yet reached such proportions as to create a position where track maintenance is impossible by manual methods. However, with the growing suburban traffic it will be necessary to mechanise the maintenance of tracks to keep a watch on the incidence of faster wear and tear.

(*iv*) *Trespassing and Accidents*—A large number of trespassers who are daily run over and killed is a major problem, particularly to the Eastern Railway. The following table gives the number of persons killed or injured while crossing the tracks.

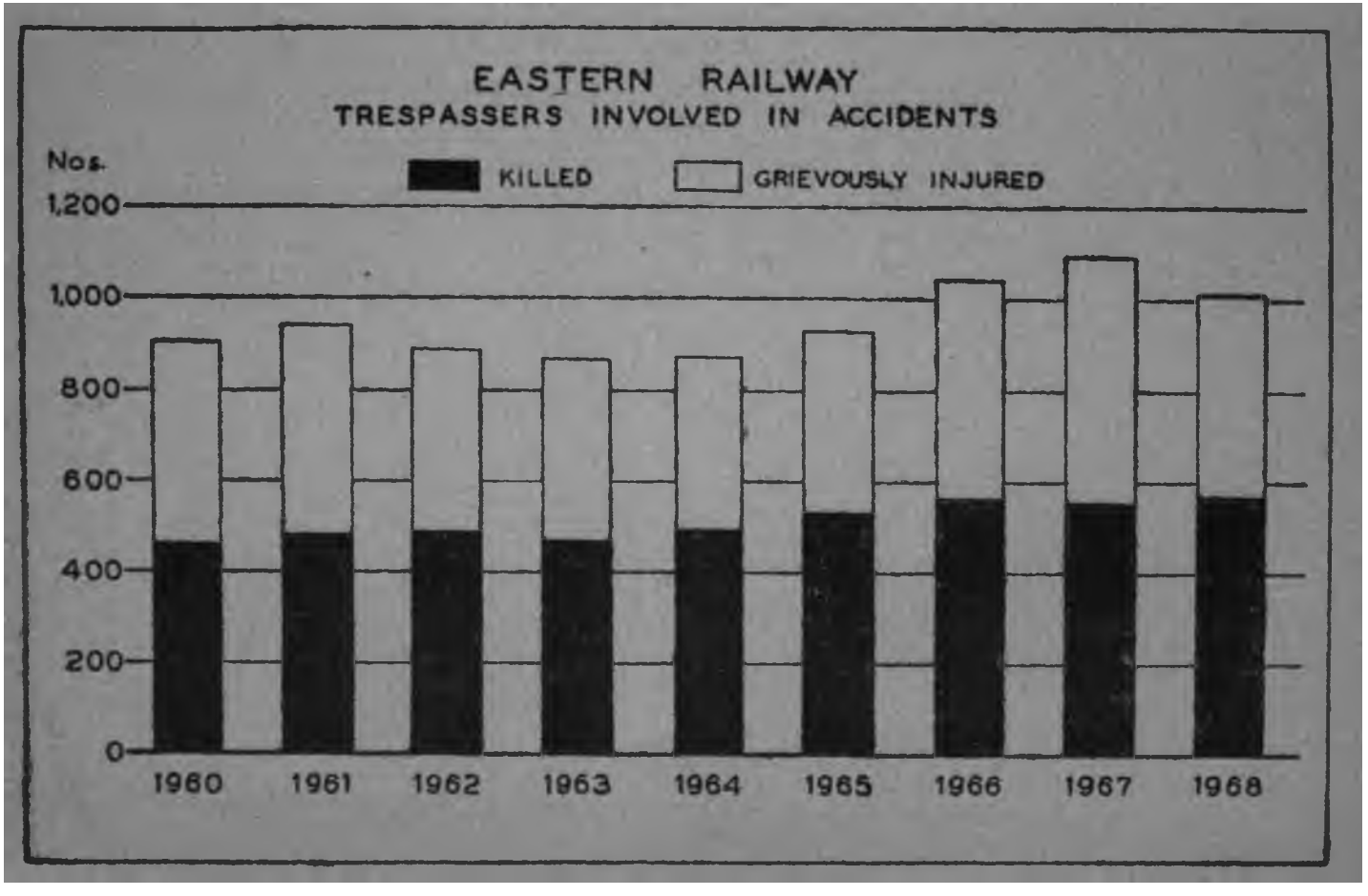

EASTERN RAILWAY
TRESPASSERS INVOLVED IN ACCIDENTS
Nos.
KILLED
GRIEVOUSLY INJURED
1,200
1,000
800
600
400
200
0
1960
1961
1962
1963
1964
1965
1966
1967
1968

TABLE 6

Year	Eastern Railway		South Eastern Railway	
	Killed	Grievously Injured	Killed	Grievously Injured
1960	460	450	5	2
1961	482	460	5	6
1962	493	402	7	2
1963	464	400	6	6
1964	491	382	2	4
1965	532	400	9	4
1966	560	478	18	8
1967	555	540	16	9
1968	572	441	20	3

It is evident from the table above that the number of casualties are gradually increasing on the Eastern Railway As the sub urban tracks on the South Eastern Railway do not pass through the heavily built-up area, the number is not significant. However, as the development takes place alongside the tracks, trespassing will increase It is suggested that the Railway should take measures from now on to fence the tracks so that trespassing could be avoided.

2.4. **Level Crossings**— There are 105 level crossings in the metropolitan area which cause great inconvenience to the move ment of road traffic. Train movement also gets affected as the traffic on road takes a long time to clear The Team, in its Interim Report had recommended that 6 of the most import ant level crossings as given in Appendix III should be replaced by grade-separated arrangements on priority basis Unless this is done it will be difficult to maintain 2 or 3 minutes headway which is necessary in case of suburban rail traffic

2.5. **Law & Order Problem**— The problems created by the law and order situation on both the Railways affect the main tenance of coaching and goods stock, besides affecting the punctuality of suburban services Heavy incidence of alarm chain pulling by smugglers to stop the suburban trains at points between stations is one of the major causes of poor punctuality of trains. Thefts of overhead equipment and tampering with the control gear equipment in electric rolling stock cause serious damage to electric traction motors and put the whole unit out of commission. Thefts and damages are generally confined

to jumper cables, cable boxes, traction motor cables, including aluminium components in compartments, fittings and furnishings. During 1967 there were 54 cases of interference on the Sealdah Division which resulted in the detention of 80 passenger trains, each on an average period for 70 minutes, and 6 goods trains each for an average period of 70 minutes. On the Howrah Division, there were 25 cases involving 75 passenger trains with detentions of 69 minutes on an average and detention of 32 goods trains with 153 minutes loss of time. During 1968, the position had worsened. Upto July 1968, 34 cases of tampering with overhead equipment at Sealdah caused detention to 96 passenger trains each on an average of 27 minutes and 7 goods trains with an average detention of 83 minutes. In Howrah Division for the same period there were 4 cases with 12 passenger trains detained on an average for 93 minutes. On single track sections, the train services got particularly disrupted. Interference due to thefts of overhead equipment is itself the cause of shortening the normal life of contact wires. All this not only affects the reliability of operation but also the safety of running. Besides, replacement of stores throws a heavy burden on the Railway Administration. The Team is of the view that without effective coordination between the State Police, the Railway Police and the Railway Protection Force, the existing lawlessness will not be curbed. The State Government and the Railway Board should take immediate measures in this regard.

2.6. **Development Works** —The Eastern and South Eastern Railways have a number of projects in hand for improvement of their suburban services. The Railways have already installed route relay interlocking system at both the terminals. This sophisticated type of signalling and train control enables quicker receiving and despatch of trains. The main line from Howrah station has automatic colour light signalling upto Serampore. A similar system of signalling has also been planned for one of the down main lines. The second down main line has been proposed for signalling for reversible working. Facilities like tokenless block working have been planned for the central section of Sealdah and the B.A.K. loop upto Katwa. Tracks are being progressively electrified and further major works are being carried out to ensure optimum capacity for receiving and despatch of trains at Howrah as well as Sealdah terminals. Howrah station, which currently deals with 180 suburban trains of both the Eastern and South Eastern Railways is expected to have a capacity to handle 304 suburban trains in and out of Howrah. Similarly Sealdah North and Sealdah main line stations would be able to handle 250 and 180 trains respectively as against the current traffic of 150 and 106 trains respectively per day.

TABLE 6

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Chapter III

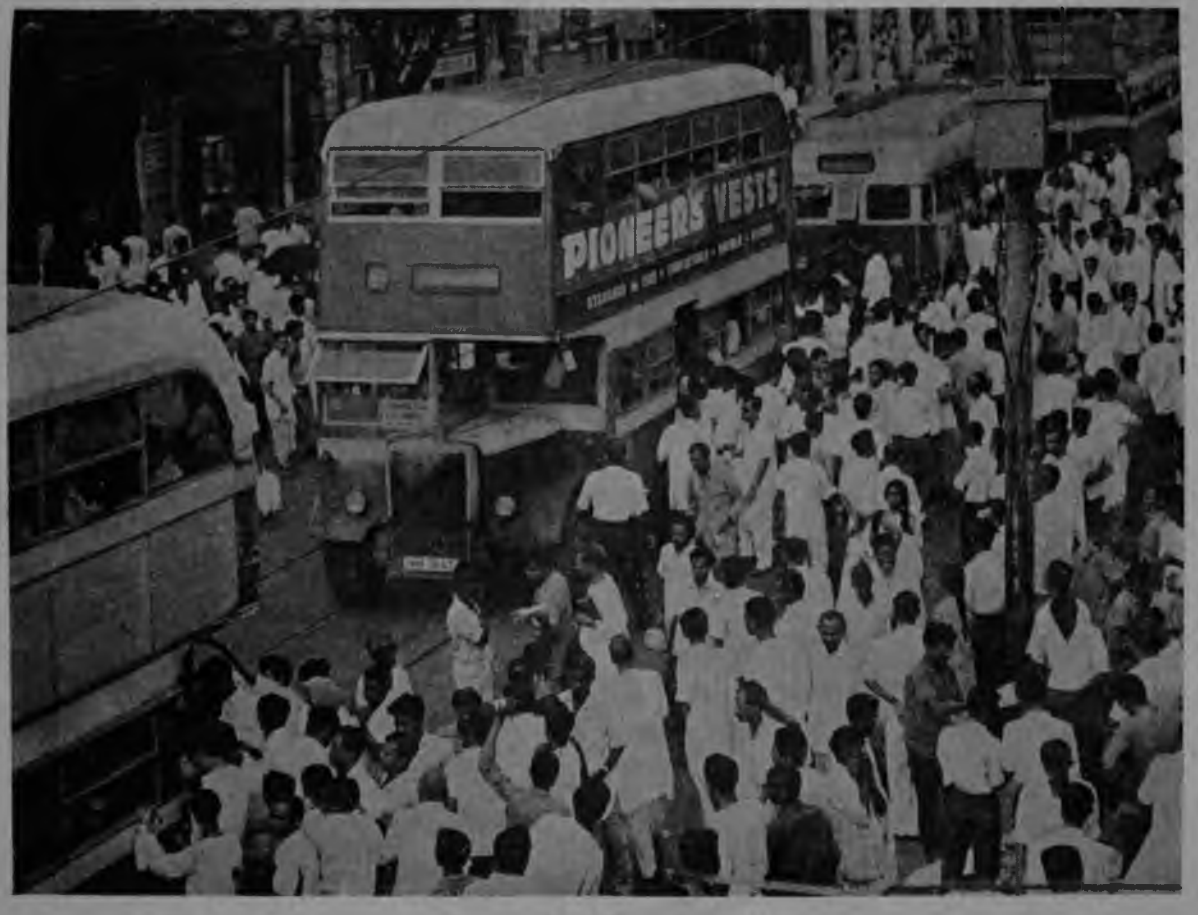
BUS SERVICES

Suburban railway services are by their very nature not able to cater to the needs of passengers who have trip origin or destination at more than convenient walking distance from a suburban railway station. Buses, because of their route flexibility, have great importance in the total transportation net-work of a metropolitan city. Route changes are simpler which enable adjustments in services according to demand. The flexibility of operation requires that buses should travel in normal traffic stream. This, however, has not been found possible in Calcutta. The majority of bus lines provide trunk line type service rather than feeder service and are subject to considerable congestion and street interference as well as chronic overcrowding which cause disruption in schedule and reduce operating efficiency.

The bus system in Calcutta is primarily managed by the State Transport Corporation which was set up in June, 1960. Between 1960 and 1964 the CSTC enjoyed exclusive privilege of running a nationalised transport service. Between 1964 and 1967 it had the virtual monopoly of all intra-city routes. To meet the city's growing demand for transport services, the CSTC had increased its fleet to 1,106* from its initial fleet of 670. In spite of the large increase in fleet, the number of effective buses on road on an average was 575 during the last three years. This was mainly due to a number of overage buses in the fleet and frequent breakdowns.

The city's principal bus lines run from the outlying areas to the Central Business District. Many lines routed to the C.B.D. go to Howrah Station via the Howrah Bridge in order to meet the demand of trans-river traffic. At present, the CSTC operates on 29 routes, covering a distance of about 410 kms. The daily average number of passengers carried is 1.1 million while the bus kilometerage is 104,250. As the CSTC could not meet the growing demand of intra-city travel, private bus operators were therefore granted special permits in November, 1966 to ply buses in Calcutta. At present about 300 private buses operate exclusively within the city. Another 200 buses were permitted to extend their suburban routes in the C.B.D. In all they carry about 500,000 passengers per day.

*As on 31-3-1968.



Overcrowding in buses

3.1. Fleet Growth—The fleet has grown from 813 (574 single decker and 239 double decker) to 1,106 (757 single decker and 349 double-decker) during the period 1-4-1962 to 31-3-68 showing an increase of 36 per cent. The growth of the fleet from 1961-62 to 1968-69 is given in the table below:

TABLE 7

Year	Single Decker	Double Decker	Total
1961-62	574	239	813
1962-63	580	287	867
1963-64	581	306	887
1964-65	609	307	916
1965-66	747	323	1070
1966-67	757	347	1,104
1967-68	757	349	1,106

The CSTC bus fleet consists mostly of imported double-deckers and heavy duty single deckers. Recently, a few single deckers manufactured in India have also been added to the fleet.

3.2. Passenger Growth—The growth of bus passengers during 1961-62 to 1967-68 is given below:

TABLE 8

Year	Average No. of passengers carried daily*
1961-62	1,300,000
1962-63	1,400,000
1963-64	1,351,000
1964-65	1,341,000
1965-66	1,090,000
1966-67	1,091,000
1967-68	1,075,000

*Upto April, 1965, the passenger figures were based on the number of tickets sold. Two or more tickets were used to be issued for some fare stages, for which tickets of the appropriate denomination were not printed. Hence the figures upto 1964-65 are on the higher side.

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3.3. **Overcrowding**—During the peak periods the proportion of journeys to work/home is about 65 per cent of the total trips performed. Concentration of employment in the C.B.D. aggravates the problem. The buses are not able to cope with the demand, and the passengers have to wait for a considerable time. The extent of congestion is evident from the table below:

TABLE 9

Type of bus	No. of buses	Passenger carrying capacity			
		Seated	Standing	Total	Average load per bus
Single decker (conventional)	713	36	18	54	125
Single decker (underslung)	44	42	21	63	
Double-decker ..	349	64	22	86	150

Overcrowding on Calcutta's buses, even beyond peak hours has now become common. It is a normal sight to see bus passengers clustered all around the bus body maintaining a precarious foothold by taking advantage of any projection. Evidently, the fleet in operation is not adequate to meet the present requirements of the passengers. To meet such demand, strengthening of the bus fleet is imperative. However, it may not be feasible to augment the fleet beyond a certain limit as the economics of transportation does not justify procurement and maintenance of a large fleet of buses on the basis of peak period demand only. It is felt that for the economic operation large capacity buses should be added to the fleet. Conventional single deck buses are not economical since the pay load is small, being about 60 per cent of that of a double decker, while the cost of operation is marginally less. The double deck buses also occupy less road space for carrying a given number of passengers.

The Corporation has not been able to add so far double deck buses to its fleet in the required number as these are not readily available. It is now understood that Messrs Ashok Leyland have started manufacturing double deck buses since April, 1968. It will facilitate the CSTC to procure sufficient number of such buses in the near future to meet their requirements.

Typical overcrowding scene during peak hours

The CSTC should design buses with only one row of seats on either side and with a big gangway so that larger number of passengers could be accommodated. It may be mentioned that this experiment has been very successful in Tokyo. It would be useful to have buses in the city with 60 per cent overhang instead of 50 per cent as allowed at present. It is also suggested that the CSTC should alter the design of the underslung single deck into predominantly 'standee" buses so as to accommodate about 80 to 100 passengers. These 'standee' vehicles could be operated specially on short-distance heavy flows of traffic on a single flat fare so that the passengers would pay on entering the vehicle. These buses would run with very few intermediate stops. This would also solve the problem of fare collection in a vehicle with such a high density of passengers.

3.4. Operating Ratio—The operating ratio is an indication of the state of serviceability of the fleet and efficiency of the maintenance methods used. The ratio for the CSTC fleet since 1961-62 are given in the table below:

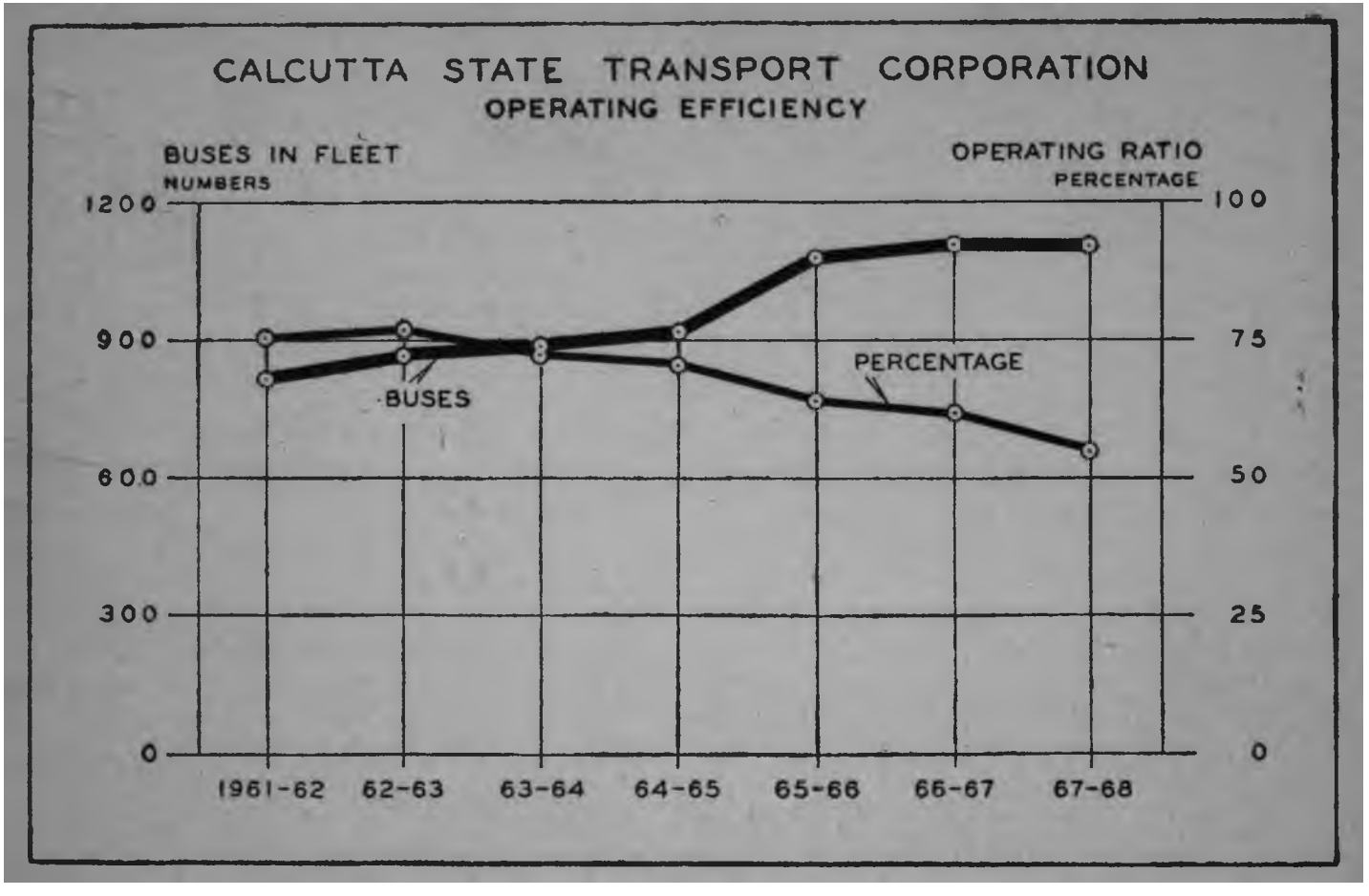
TABLE 10

Year	No. of buses in fleet	Average No. of buses in service daily	Operating ratio percentage
1961-62	813	613	75·4
1962-63	867	666	76·8
1963-64	887	643	72·5
1964-65	916	645	70·5
1965-66	1,070	685	64·0
1966-67	1,104	682	61·7
1967-68	1,106	607	54·8

Breakdowns—One of the important factors for the low operating ratio is the alarmingly increasing number of breakdowns experienced which is evident from the following table:

TABLE 11

Year	Breakdowns per day	Breakdowns per 10,000 kms.	Per cent increase over 1961-62
1961-62	46	3·7	..
1962-63	74	5·5	48·65
1963-64	114	9·3	151·35
1964-65	138	11·7	216·22
1965-66	123	10·0	170·27
1966-67	143	12·4	235·14
1967-68	193	17·3	367·57


CALCUTTA STATE TRANSPORT CORPORATION
OPERATING EFFICIENCY
BUSES IN FLEET
NUMBERS
OPERATING RATIO
PERCENTAGE
1200
900
600
300
0
100
75
50
25
0
BUSES
PERCENTAGE
1961-62
62-63
63-64
64-65
65-66
66-67
67-68

Expressed in terms of the number of buses on road per day the figures for the last twelve months are as under:—

TABLE 12

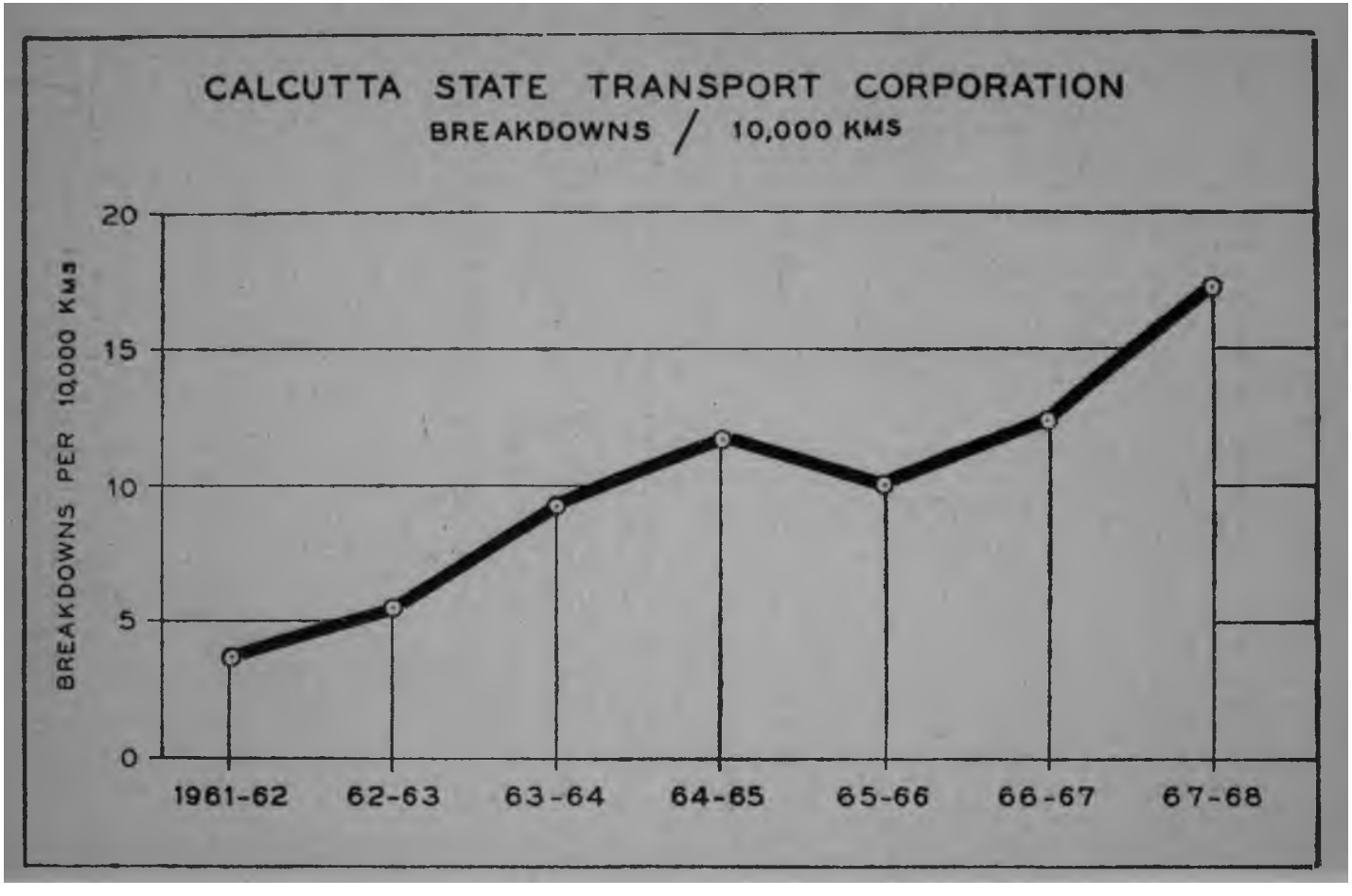
Year 1968	Daily average fleet on road	No. of break-downs in the month	No. of break-downs per vehicle
January	655	6,104	9·3
February	639	5,542	8·7
March	607	6,330	10·4
April	621	6,412	10·3
May	601	7,142	11·9
June	597	6,504	10·9
July	559	6,740	12·1
August	537	6,397	11·9
September	599	7,113	11·9
October	616	7,288	11·8
November	606	7,086	11·7
December	612	6,959	11·4

It will be seen that when the average strength of the fleet on road varied from 537 to 655, each operating bus broke down on an average about 11 times per month. On an average, about 180 to 200 buses out of the total buses put on road in the morning broke down at various periods of the day. Ageing buses and poor maintenance are mainly responsible for increasing number of breakdowns.

Immobilised buses—The CSTC has 267 buses of the following makes in its fleet:

Make	No. of Buses
AEC Mark III	134
AEC Mark IV	35
AEC Mark V	40
Leyland Royal Tiger	9
Leyland Tiger Cub	49
Total ..	267

According to the Evaluation Committee of the Government of West Bengal, the AEC Mark III buses had been laid off due to failure of their gear boxes. The AEC Mark IV were never


CALCUTTA STATE TRANSPORT CORPORATION
BREAKDOWNS / 10,000 KMS
BREAKDOWNS PER 10,000 Kms
20
15
10
5
0
1961-62
62-63
63-64
64-65
65-66
66-67
67-68

trouble-free due to overheating and defective air compressor drive and dangerously low fuel injection system. AEC Mark V buses could never be used in appreciable strength because of their defective clutch and self starter. Leyland buses have under-floor engine and had therefore to be taken off the road during the rainy season. As suggested by the Evaluation Committee it is necessary that a technical group of experts should immediately examine whether these buses could be made road-worthy. These immobilised buses lock up valuable space in the garages of the CSTC and to some extent interfere with the proper maintenance and repairs of other vehicles.

Age of the Fleet—Out of the total fleet of 1,104 buses as on 31-3-67 about 69.3 per cent buses were over 5 years old and 44.20 per cent buses were over 8 years old. The overage fleet is a serious problem for the Corporation. Although it is difficult for the CSTC to dispose of or replace such a large number of vehicles within a short period nevertheless, all out efforts have to be made to scrap overage and uneconomic-to-repair buses to the extent possible so that the present maintenance work load (45.2 per cent of total fleet) is significantly reduced. This will also help in reducing the rate of breakdowns per day and minimise the missed kilometres which were as high as 6,265,707 during 1967-68. The CSTC is losing about Rs. 25,000 per day on account of such missed kilometerage.

The additions to and scrappings from the fleet during the period 1962-63 to 1967-68 are given in the following table:

TABLE 13

Year	Addition	Scrapped	Closing total
1962-63	51	..	868
1963-64	19	..	887
1964-65	29	..	916
1965-66	183	26	1,073
1966-67	31	..	1,104
1967-68	2	..	1,106

It is suggested that a phased programme should be drawn up to increase the operating ratio to at least 80 per cent during the next five year period by adopting better maintenance practices and replacement of overage buses.

3.5. Expansion and Replacement Programme of the Fleet—The CSTC has a programme to procure 25 new buses (10 single decker and 15 double decker) during 1968-69, increasing its fleet strength to 1,131. Out of these 245 buses were fully depreciated by the end of 1967-68 and 91 more buses would stand depreciated by the end of the current year i.e. 1968-69. Thus on 1-4-69, the effective fleet strength of the CSTC would be 795 buses (294 double decker and 501 single decker).

During the Fourth Plan period (1969—74), 484 vehicles (311 single decker and 173 double decker) would stand depreciated and need replacement for just maintaining the position as on 1-4-69. Keeping in view the demand for bus travel in Calcutta, the Study Team suggests that the CSTC fleet strength should be raised to 1,000 by the end of the Fourth Plan (550 double decker and 450 single decker). It would ensure out-shedding of at least 800 buses daily on the road on the basis of vehicle utilization rate of 80 per cent which is both reasonable and practical to achieve. A year-wise phased programme for replacement of fully depreciated buses and expansion of the fleet have been worked out as given in table 14 on page 33.

According to table 14 the CSTC will have to procure 429 double deck and 260 single deck buses during 1969—74. On the basis of the cost of one double deck bus at about Rs. 180,000 and that of a single deck at Rs. 85,000, the above programme would need funds to the tune of Rs. 99.3 million. In connection with the formulation of the Fourth Five Year Plan, the State Government had drawn up a programme for purchase of 460 buses only with an outlay of Rs. 52.5 million. The Team strongly recommends that the State Government should provide an additional amount of Rs. 46.8 million to the Corporation for purchase of another 229 buses in the Fourth Plan.

3.6. Procurement of Spare Parts—The fleet of the Corporation consists mostly of imported double deckers and heavy duty single deckers though lately some medium duty single deckers of Indian manufacture have been added. The Corporation has been facing serious difficulties in procuring imported spare parts so essential for overhauling and maintenance of heavy duty buses. The number of buses held up for want of spare parts at the CSTC have been mounting up from month to month as is evident from table 15 on page 34.

The Central Government allow import of spares at the rate of Rs. 500 half yearly per diesel vehicle. This amount is barely adequate for meeting the needs of the Indian made medium duty vehicles. To meet the backlog requirements and provide for reserve stock to cover the 'lead period' for annual imports, it is

TABLE 14

Year	Effective fleet at the beginning of the year			Scrapping programme			Additions			Effective fleet at the close of the year		
	Single deck	Double deck	Total	Single deck	Double deck	Total	Single deck	Double deck	Total	Single deck	Double deck	Total
1969-70	501	294	795	33	50	83	30	110	140	498	354	852
1970-71	498	354	852	94	5	99	90	80	170	494	429	923
1971-72	494	429	923	21	78	99	30	88	118	503	439	942
1972-73	503	439	942	54	32	86	40	82	122	489	489	978
1973-74	489	489	978	109	8	117	70	69	139	450	550	1000
	..	..	..	311	173	484	260	429	689	..	..	..

TABLE 15

Month	Total No. of buses held up	No. of buses held up for want of spare parts only
1967		
April	380	172
May	409	183
June	395	188
July	371	185
August	409	184
September	405	184
October	392	184
November	415	190
December	420	201
1968		
January	433	203
February	465	207
March	442	239
April	479	258
May	475	257
June	483	286
July	532	266

suggested that *ad hoc* allocation of foreign exchange should be made to the Corporation.

There is also inordinate delay in the supply of spare parts from overseas suppliers with the result that a large number of vehicles are out of repairs. Due to limited fleet strength the Corporation has been obliged to keep such buses on the road resulting in frequent breakdowns, interruption in service schedules and increased cost of operation. The Team is of the view that this could be remedied to a considerable extent if proper forward planning is done by the Corporation. The priorities in the utilisation of rationed foreign exchange should be made with reference to actual assessment of vehicle-wise requirement, stores in hand and the prospect of ultimate economic repair of such buses. Simultaneously, the Government should also ensure issue of import licenses to the Corporation well in time.

3.7. **Need for Scientific Stores Management**—A broad study of the stores revealed that the CSTC besides shortage, has also been suffering from over-stocking, the average inventory holdings being 12 months' supply. It is possible because surpluses and shortages are really the obverse and reverse of the same

coin namely, the poor inventory control. The effect of shortages and stock-outs is that a good proportion of buses remains off the road for long intervals thus lowering fleet utilisation and earnings which is quite evident in the case of CSTC.

The following factors are *prima facie* responsible for such a state of affairs:

(*i*) Long procurement lead time—In the CSTC, the lead-time—the time that elapses between the raising of an indent until the delivery of the ordered material—ranges from 6 months to 24 months in cases of imported spares and one to 36 months in case of indigenous stores, depending on the type of stores.

(*ii*) Non-selective control.

(*iii*) Wide variations between estimates of requirements and inventory levels.

(*iv*) Non-fixation of inventory levels—minimum, maximum and ordering for each item of stores.

(*v*) Lack of regular and timely review of requirements.

(*vi*) Non-disposal of obsolete and redundant stores.

In order to avoid overstocking and minimise stockouts, the Team recommends that:

(*i*) The modern method of stock control on the basis of A-B-C Analysis (selective analysis) should be introduced. A-B-C Analysis breaks down inventory items into three classes: 'A' items are those few major ones which tie up most of the inventory investment and need constant review. 'B' items are those of secondary importance; and 'C' items are the numerous but inexpensive ones that make up only a minor part of inventory investment.

(*ii*) The CSTC should fix minimum, maximum and reorder levels for 'B' and 'C' items both in terms of months' supply and quantity. The levels in quantity terms should be reviewed every year and revised so as to be in line with the latest consumption.

(*iii*) In preparing estimates of requirements, the past actual consumption in relation, of course, to fleet strength should be given adequate consideration and variation from it should be made only on valid grounds of change in the strength of the fleet, age of fleet, overhaul and repair programmes, etc.

(*iv*) The CSTC should lay down targets of inventory holdings, review the actual position and study variances between promise and performance.

(v) Disposal of obsolete and redundant stores: The CSTC had about Rs. 11.1 million worth of surplus stores on 31-3-1966. According to the Evaluation Committee, stores worth Rs. 4 million were virtually dead and had little prospect of being utilised by the Corporation. About Rs. 3.5 million worth of stores date prior to 1961-62. The Team recommends that prompt and effective measures should be taken for the disposal of dead stock since delay merely adds to the carrying cost and also to the loss from disposal sales.

As regards the stores surplus to current requirements but not obsolete, it is suggested that the Stores Division should regularly prepare a list of items not moving for more than a year in the proforma below:

S. No.	Part No./ Group No.	Description	Month of last movement	Unmoved for No. of months	Average annual consumption in the past	Stock in hand in quantity and time supply
1	2	3	4	5	6	7

The CSTC should fix a time supply limit, say 2 years, beyond which stock should be disposed of. Action should be taken to secure its disposal through use, either immediately or in the future expansion programme; sale to other transport undertakings or usual suppliers at discount; auction or any other means.

(vi) Disposal of uneconomic-to-repair buses: There are a large number of old and derelict buses which are uneconomic to repair and create congestion in garages and depots of the CSTC and thus hamper the repair works of the running buses. The Study Team recommends that the CSTC should evolve a regular system of thorough examination of buses becoming idle so that any bus which cannot be repaired economically should be considered for disposal without undue delay.

3.8. **Route Planning**—The CSTC do not seem to have planned bus routes on the basis of objective data. The initial allotment was based on the number of buses that the private operators used to run before the take-over. Subsequent changes in routes were made without taking into account their profitability.

With a view to improve the commercial effectiveness of the fleet, it is suggested that the Corporation should prepare a plan for re-routing of its services on scientific lines. The existing long bus routes should be split into shorter ones. This would bring about a closer correspondence between the deployment of the total fleet and the varying passenger pressure on different routes.

At present the average number of stops per mile on different routes varies from 4.4 to 7.3. It is suggested that CSTC should explore the possibility of minimising bus stops which do not contribute more than a few passengers during peak hours.

3.9. Bus Depots—The CSTC has 5 depots and a Central Workshop at Belghoria. The depots are used as garage-cum-workshop. Engines and other units such as gear boxes, differentials, etc., are overhauled in all the depots. It is suggested that the depots should be relieved of the heavy repairs and mainly concerned with light docking and running repairs. Heavy types of job should be entrusted to the fully equipped Central Workshop at Belghoria.

The depots of the CSTC are too big for efficient maintenance. For economic operation, it is suggested that a depot should be medium-sized with a stabling capacity of 100 to 125 buses and located in such a way that dead kilometerage is reduced to the minimum before the buses go into service. At present the daily dead kilometerage on an average is about 7,000. This is primarily due to location of the depots only in northern and southern ends of the city. The Study Team recommends that the CSTC should explore the possibility of having a new depot in the central part of the city.

3.10. Bus Halting Bays and Quick Turn Round Facilities—Special bus halting bays or even the facilities for a quick turn round at terminals have not generally been provided in Calcutta. It is suggested that special attention should be paid to the provision of such facilities while widening and improving existing roads. For network of new roads particularly, the main arteries consisting of expressways and freeways, need for running fast express bus services should not be overlooked.

3.11 Low Average Speed—Time schedules for buses are based on speeds derived from trial runs along the actual routes, and therefore, depend largely on traffic hazards and degree of congestion. The average speed of buses in Calcutta is about 14 kms. per hour. If this could be improved, there would be saving in time and equipment. Roughly, an increase in speed by 1.6 km. per hour could reduce operational costs to the extent of about

10 per cent. It is therefore, absolutely necessary to identify areas of traffic congestion on the CSTC routes. Once the crowded routes are identified, it would be easy to pinpoint the reasons, such as narrow roads and faulty intersections, lack of space for bus bays to stop, unregulated pedestrian movements and poor parking and terminal facilities in the CBD etc. It is, therefore, suggested that Corporation should make speed and delay surveys on its routes and list out all the bottlenecks hampering the flow of traffic which should be removed by the concerned authorities, as far as possible.

3.12. Staggering of Office Hours—Overcrowding during rush hours leads to early wear and tear of the buses and shortens their effective life considerably. It creates severe problem of traffic congestion on most of the main routes of the city. In order to reduce congestion by diffusing the peak traffic load, staggering of working hours is absolutely necessary. It has already been introduced in the cities of Delhi and Bombay. The Team recommends that concrete steps, even by enacting suitable legislation should be taken to stagger the working hours as early as possible.

3.13. Financial Difficulties of the CSTC—The financial position of the CSTC has been deteriorating steadily due to heavy losses since 1962-63. The accumulated loss was Rs. 13.6 million as on 31-3-1965. At present, the CSTC is incurring a loss at the rate of Rs. 2 million per month. There is an urgent need to arrest these losses by suitable measures such as checking ticketless travel, increase of fares, setting up depot-wise targets, and purposeful appraisal of their performance at regular intervals.

Ticketless Travel—The leakage in daily earnings of CSTC is estimated at 15 to 20 per cent. The Team feels that with greater alertness on the part of the conductors and the supervisory staff, the leakage could be reduced. Legislation making ticketless travel in State buses an offence should be enacted, and institution of mobile courts should be enforced as has been done in Delhi. Posters requesting passengers to pay fares to the conductors and drawing their attention to the penal provisions of the Act may be exhibited inside the buses at conspicuous places. This practice is expected to yield satisfactory results.

The Team also recommends that arrangements should be made for advance booking at heavy loading points.

3.14. Fare Structure—The Study Team has given a careful thought to the question of revision of fare structure of CSTC and had in this connection, studied the comparative fare structure in the four cities of Bombay, Calcutta, Delhi and Madras.

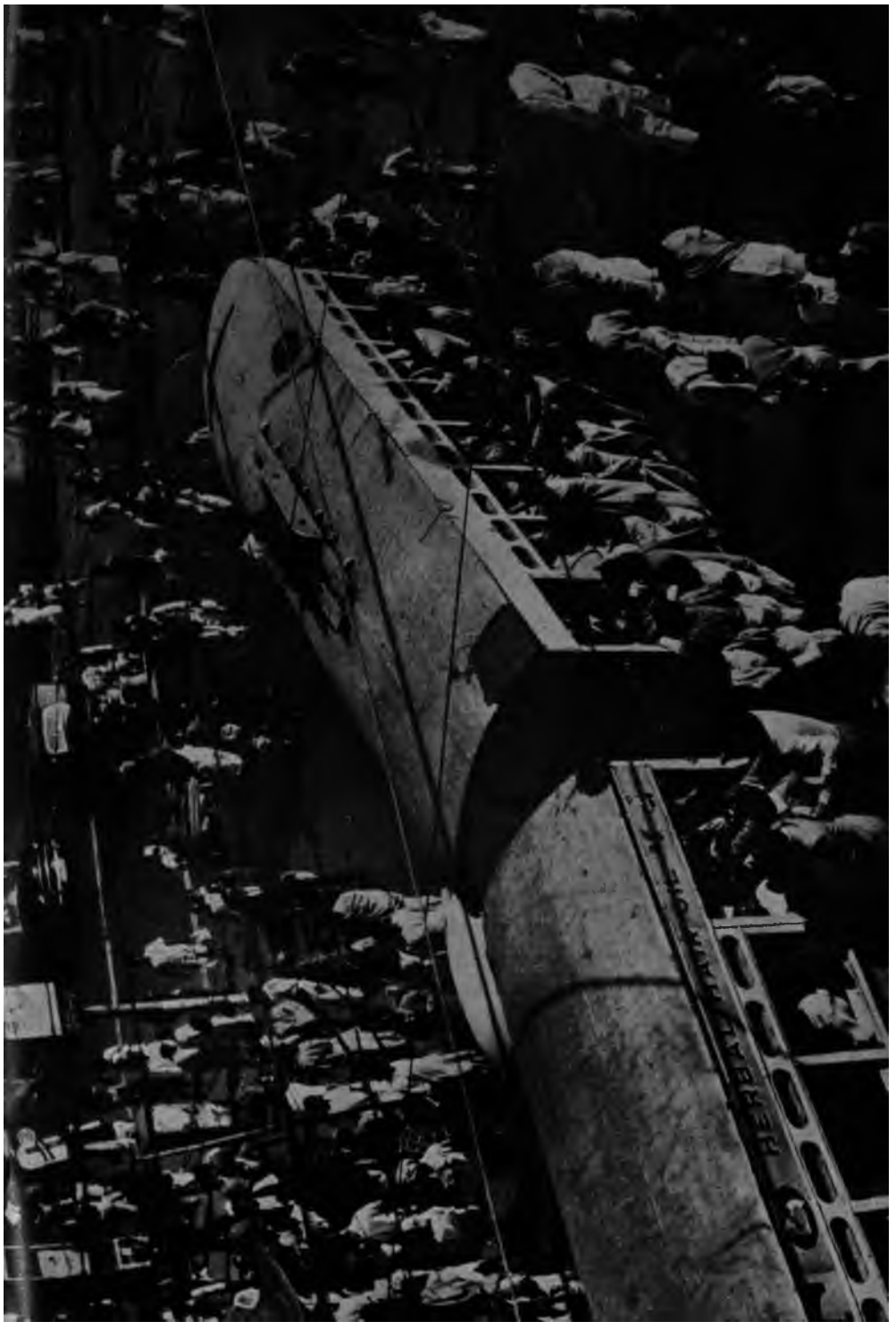
It will be seen from the table below that for every fare-stage the travelling distance allowed by the CSTC is by far the highest in the whole country. In fact, for lower-stages the travelling distance allowed by the CSTC is 50 per cent more than that allowed by the other three cities.

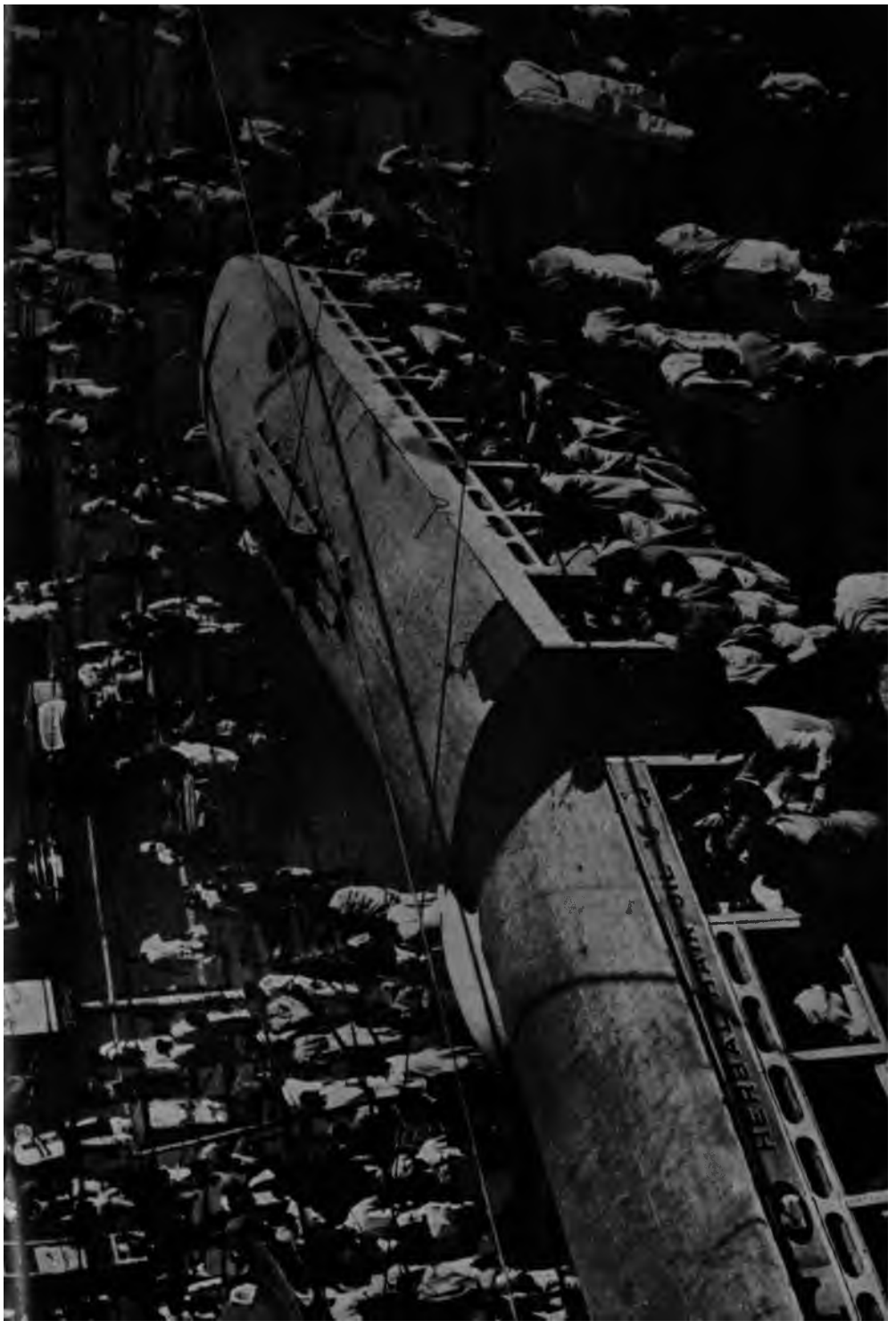
TABLE 16

(In kilometers)

Fare Paise	Madras	Delhi	Bombay	Calcutta
10	2·0	2·5	2·0	3·5
15	4·5	4·0	2·6	6·9
20	7·0	6·0	6·4	10·9
25	9·5	8·0	8·2	13·9
30	12·0	12·0	12·0	17·6
35	14·5	16·0	14·8	19·6

Keeping in view the difficult financial position of the CSTC and the prevalent rates of fares, the Team feels that there is a definite case for their upward revision.





cars in the city. Observations made during peak hours have revealed that as many as 250 passengers travel in a tram car whereas the average capacity of a double unit tram car varies from 152 to 181 only. The continuous fall in operating ratio has further aggravated the problem of overcrowding particularly, during the last few months.

4.1. **Operating ratio**—The tram-car utilisation ratio during the period 1961 to 1967 is given in the table below:

TABLE 18

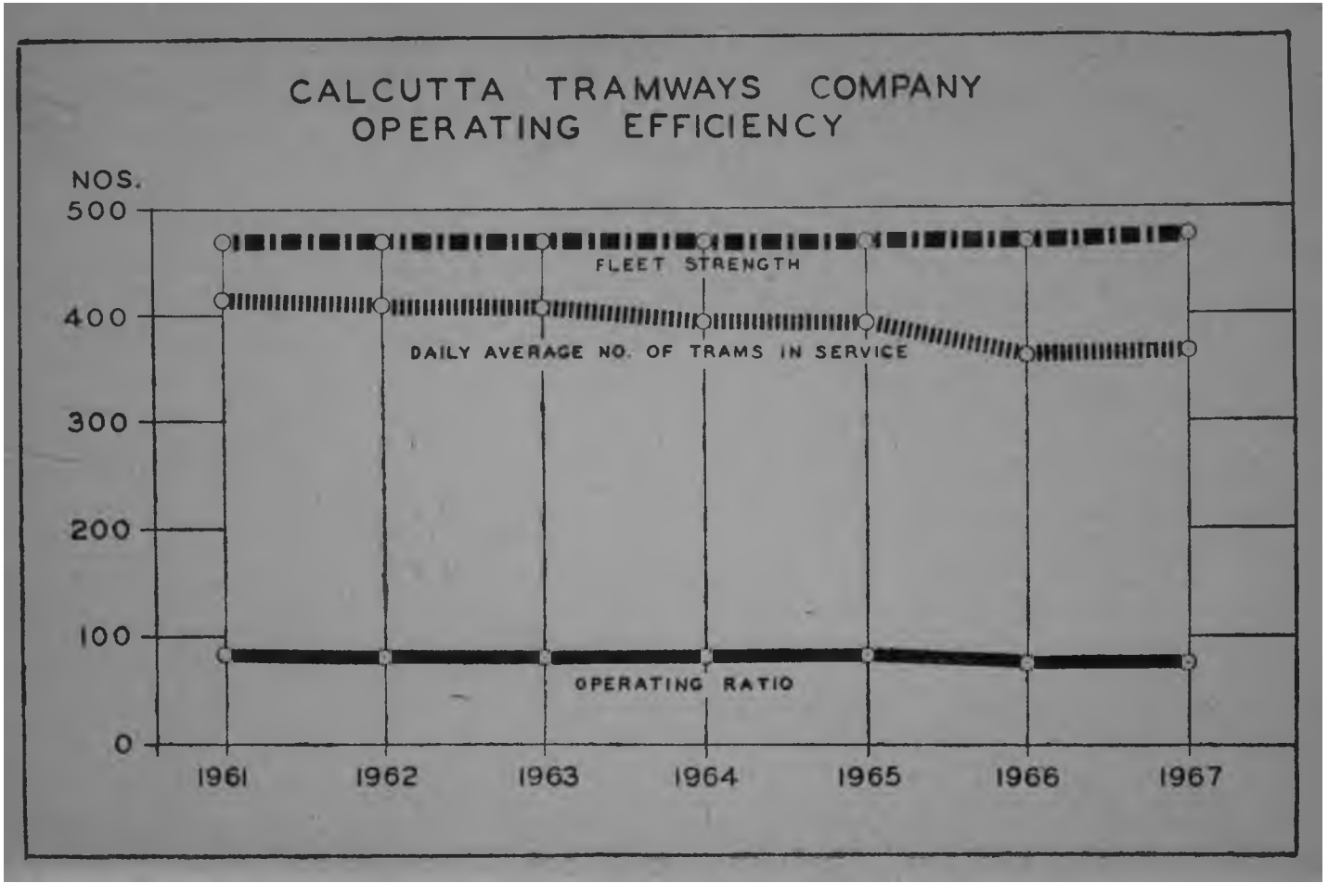
Year	Fleet Strength	Average no. of trams in service daily	Tram utilization ratio
1961	470	413	87·9
1962	470	408	86·8
1963	470	406	86·4
1964	470	396	84·3
1965	470	394	83·8
1966	471	361	76·6
1967	474	367	77·4

During the year 1968, the fall in the rate of tram car utilization was more pronounced. It came down to 61.1 per cent in August, 1968.

Breakdowns—Frequent breakdowns have reduced operating ratio considerably and increased missed kilometres. The following table shows the rate of breakdowns and the extent of daily missed kilometres during the years 1961—67:

TABLE 19

Year	Average no. of breakdowns per 10,000 kms.	Daily average missed kilometres
1961	1·8	4,909
1962	1·8	5,799
1963	1·8	7,603
1964	2·4	11,924
1965	2·9	12,212
1966	2·6	15,217
1967	2·2	18,662


CALCUTTA TRAMWAYS COMPANY
OPERATING EFFICIENCY
NOS.
500
400
300
200
100
0
FLEET STRENGTH
DAILY AVERAGE NO. OF TRAMS IN SERVICE
OPERATING RATIO
1961
1962
1963
1964
1965
1966
1967

During the months of June, July and August 1968, the missed kilometres had risen steeply i.e. 25,566, 28,752 and 28,046 respectively. Failure to maintain and renew the track, rolling stock and overhead equipment etc. in proper condition for long is responsible for frequent breakdowns. The Team recommends that a phased programme should be drawn up by the Calcutta Tramways Company to raise its operating ratio to at least 80 per cent during the next five year period. This requires a well-planned programme for overhaul of tramcars to make them road worthy and improvement of track and overhead equipment etc.

4.2. **Stockouts of Spare Parts**—The number of trams held up for want of spares rose from 53 in April 1967 to 132 in July 1968 as shown in the table below:

TABLE 20

Month	Number of trams held up for want of spares
April 1967	53
May	71
June	67
July	70
August	76
September	68
October	63
November	82
December	80
January 1968	82
February	86
March	75
April	102
May	116
June	114
July	132

The Team has noted that the Tramways Company find it difficult to get import licence to procure some essential materials and components, like traction motors, insulated copper wire, switches, rails etc. which are not manufactured in the country. Substitutes for a few which are available are more expensive and their quality is often below standard. There are a few items of components and stores, that can be manufactured indigenously but manufacturing firms are not willing to take up the job as it may not be profitable. It is suggested that *ad-hoc* allocation of foreign exchange should be made to the Tramways Company to meet its requirements.

4.3. **Derailment**—The derailment of trams increased by about 100 per cent from 1958 onwards. The figure for 1958 was 283 while in 1964 it rose to 553. Since then the number of derailments has always been more than 500. This is due to the heavy wear and tear of the track. It may be added that out of 71 kms. of double track, nearly half of the track needs renewal and about 11 kms. overhauling. Out of 383 pairs of points, 227 pairs require renewal. Of the 778 crossings, 242 need renewal. The percentage of renewal of points and number of crossings comes to 59.27 and 31.1 per cent respectively. Besides renewal and overhaul, there are pot-holes and depressions in the track. It is suggested that there should be regular lubrication of the joints and the worn-out rails be replaced as early as possible.

4.4. **Rolling Stock, etc.**—Out of the total strength of the Company's fleet, 14 (Howrah single Unit type) need scrapping as they are uneconomic to repair. 10 cars need their underframes and bodies to be rebuilt. Besides, 275 cars require renovation which are overdue. Some of these have not been attended to for more than 4 years.

The Company has 160 kms. of over-head trolly wire including 16 kms. for Howrah and 6 kms. for depot service. Trolly wire, manufactured locally from imported electrolytic copper wire bars, is generally replaced in about 7 years' time. This however, could not be done due to import restrictions. The Calcutta Tramways Enquiry Commission, in its Report (February 1968) had estimated that the backlog of repairs and maintenance, renewal and replacement of track, rolling stock, overhead equipment etc. would cost about Rs. 40 million.

4.5. **Financial Difficulties of the Tramways Company**—The financial position of the Company has been deteriorating day by day due to the increasing gap between its income and expenditure. The Government of West Bengal had to take over the management with effect from July 19, 1967 mainly to safeguard the interests of the passengers.

The Commission went into the question of economy in expenditure and found that the revenue of the Company derived from its existing rate of fares, was not sufficient even to meet the operational expenses. The Company's income was estimated at Rs. 35 million per year. The expenditure on the other hand including the cost of backlog of repairs and maintenance both of the track and rolling stock, spread over a number of years, was placed at about Rs. 51 million per year. Thus, there was an annual gap of Rs. 16 million between the income and expenditure. The Government of West Bengal, keeping in view the deteriorating financial position and the need to preserve the well established and useful means of public transport system without which Calcutta cannot do for years to come, accepted the proposal of the Company and directed them to reclassify their fare stages in the First and Second class as below, with effect from January 2, 1969.

1st Class	2nd Class
15p (upto 3 miles)	12p (upto 3 miles)
20p (above 3 miles)	15p (above 3 miles)

The Team hopes that the rationalisation of fare structure would gradually narrow down the gap between the income and expenditure and help in rehabilitating track, rolling stock, overhead structure etc. It would also enable the Company to put more tram-cars in service.

4.6 **Ticketless Travel**—Many passengers travel without tickets specially during the peak hours. Some of them are unable to purchase tickets due to overcrowding. It is estimated that the loss of revenue on this account is of the order of 10 per cent of the gross daily collections and works out to Rs. 3.5 million annually. The Team recommends the following measures for minimising the loss due to ticketless travel:

(*i*) Introduction of PAYE Cars—The Company had already introduced on Route No. 31—Kalighat Alipore/Esplanade what is known as PAYE Cars where the collection has improved on an average by as much as 21.5 per cent. It is desirable to extend this scheme to as many routes as possible.

(*ii*) Ticketless travel should be declared an offence. Institution of mobile courts should also be introduced.

4.7. **Low Average Speed**—An examination of the operating characteristics during the peak period, would confirm that there is considerable deviation from the scheduled headways. On some sections, where it has reserved right-of-way, the trams attain speed upto 40 kms. per hour. On many sections in the C.B.D. the speed is reduced to 11 to 16 kms. per hour. Vehicular congestion and conflict in movements on these sections are so great that scheduled operations get completely disrupted and trams either bunch together and move very closely or are blocked to a standstill position for quite some time.

There is no doubt about the capacity of electric tramcar to move people in large numbers and at reasonable speed, provided a reserved right-of-way is afforded to it. It is worth considering whether the tram-cars which find difficulty in movement on Calcutta's busy roads particularly at difficult crossings, could be put underground. In West Germany, Frankfurt recently completed the first five mile stage of a scheme to ease traffic congestion on roads by taking the trams underground in the busy city centre. The possibility of providing similar subways for the tram-cars built by the 'cut and cover' method should be examined in detail.

Chapter V

ROAD DEVELOPMENT AND TRAFFIC OPERATION IMPROVEMENTS

5.1 **Roads and Bridges**—The Team in its Interim Report had recommended a major street and highway plan for the Calcutta Metropolitan District. Some of the schemes have already been included in the State Development Programme for implementation during the Fourth Plan. It is proposed to have a new bridge over the Hooghly near Prinsep Ghat. The new bridge is expected to serve an average daily movement of about 69,000 vehicles by 1983. Another bridge over the Hooghly has been suggested at Kalyani with proper approach roads to connect the proposed Eastern Metropolitan By-pass with National Highway No. 2. One of the important schemes which has been recommended is the construction of the Eastern Metropolitan By-pass—Narkel Danga Main Road to Lower Circular Road and link connector to Lower Circular Road. The other arterial road proposed for construction during the Fourth Plan, is an extension of Amherst Street upto Park Street which will greatly improve north-south traffic circulation on the east bank. Besides, there are other proposals for widening major arterial roads and schemes for ensuring easy circulation between fast developing areas in the metropolitan city.

In relation to the existing Howrah bridge and the two major railway termini on the east and west banks of the Metropolitan District, the major traffic bottlenecks are: (i) the Howrah Station area; (ii) the Sealdah Station area; and (iii) the approaches on the Calcutta side to the existing Howrah Bridge. It is strongly recommended that the necessary improvements as planned by the C.M.P.O. should be carried out at the earliest.

5.2 **Traffic Operation Improvements**—In addition, a traffic operations plan has been suggested which would optimise the capacity and efficiency of operation of the existing buses and trams and arrest further deterioration in services. Scope for massive redevelopment is limited due to physical and

financial difficulties. The traffic circulation in the central business area could be maintained at a tolerable level of service only through effective operational improvements. Traffic engineering methods would help in providing a smooth traffic flow conducive to safer and quicker transportation of men and materials and enable about 25 per cent capacity increase in the existing street system, These assume greater importance particularly, in context of the time involved in the construction of the mass transit facilities.

The Team is of the view that logical and practical approach to solve the traffic problems lies in the application of traffic engineering techniques, sound and uniform traffic regulations, strict enforcement and education of road users etc. There is, however, no single agency responsible for all aspects of traffic engineering works. Some of the traffic engineering functions are being shared by several authorities while others are not carried out at all. The Team, therefore, feels that there is an urgent need of setting up a Traffic Engineering Cell attached to the Police Department. The main functions of this cell should be:

1. installation, operation and maintenance of traffic control devices, such as road signs, signals, markings etc.;
2. checking all the proposed designs of new roads and streets from safety point of view;
3. studying the accident black spots in the built-up areas and removing the causes of accidents arising out of lack of safety design features;
4. designation of cross-walks, parking zones, loading zones, bus stops, silence zones, speed zones etc.;
5. co-operation with other interested agencies for public education of traffic regulations and their advantages of proper use of the road; and
6. developing other ways and means to improve traffic conditions.

Traffic signals in Calcutta are installed and maintained by the Public Works Department. They are a few in number. Most of them have been donated by commercial firms who in turn display their hoardings on them. This distracts the attention of drivers. Moreover, most of the existing signals are substandard, difficult to adjust and inadequate in terms of placement and visibility. The signals are not properly synchronised or timed for progressive flow of traffic to meet changing volume demands. The Team is of the view that development of a properly related signal system for central Calcutta is urgently needed.

The C.M.P.O. have also made a thorough study of major intersections and parking and terminal requirements in the C.M.D. area. The Team is of the view that its recommendations in this regard be implemented without further delay to minimize economic losses attributable to congestion and accidents and to achieve intensive use of the city's commercial vehicle fleet-trucks, buses and trams.

A provision of Rs. 13 million has been recommended by the Team for implementing the traffic operations programme during the Fourth Plan. It is hoped that the State Government would take early steps to implement the above recommendations.

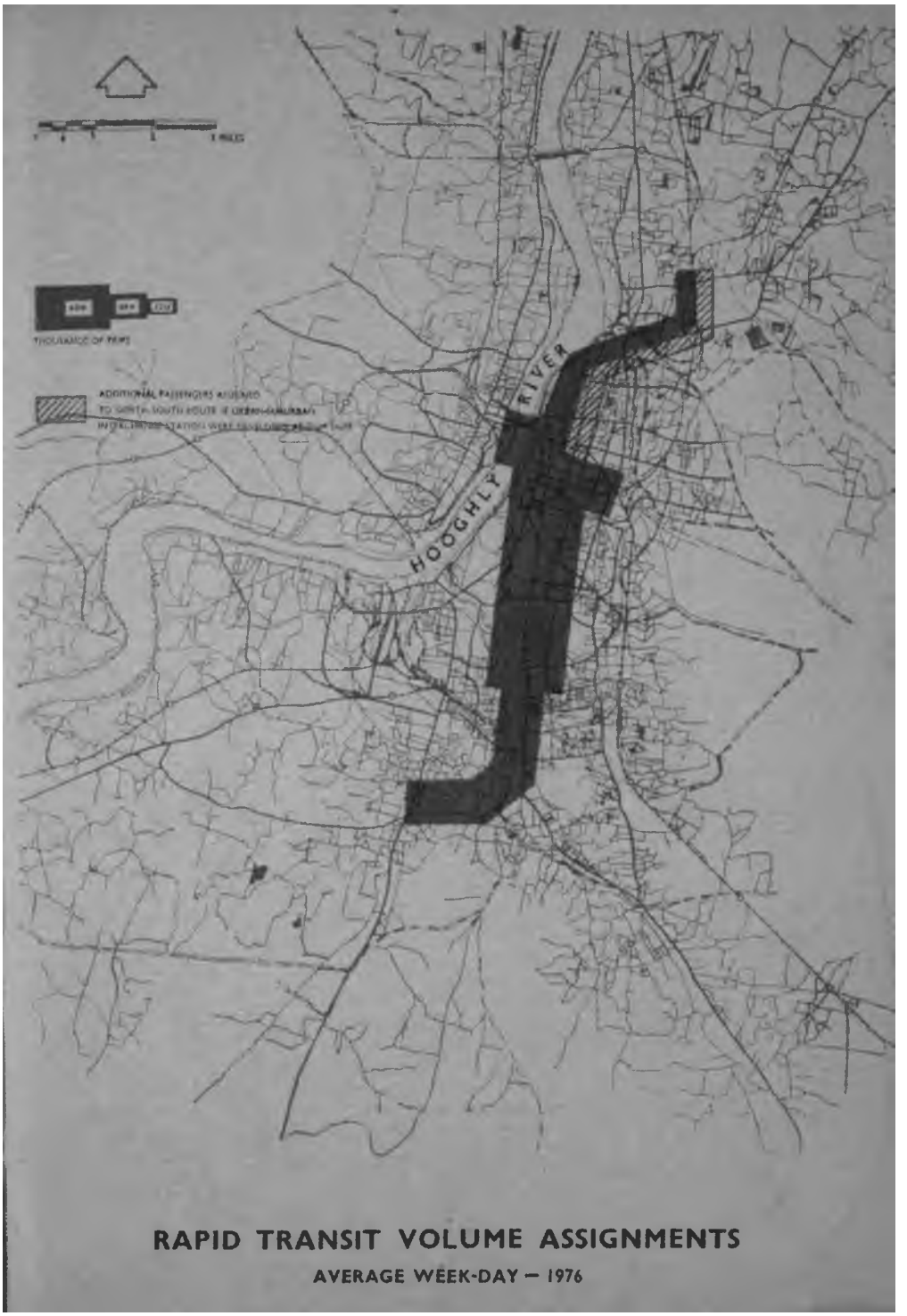
Chapter VI

RAPID TRANSIT SYSTEM

In the earlier chapters the role of principal mass transport services has been discussed in detail. The suburban rail lines serve 700,000 passengers a day and the buses and trams more than 2,500,000 passengers per day. By 1986 it is anticipated that there would be a growth of 65 per cent in suburban passenger traffic and about 75 per cent in urban services in Calcutta—Howrah complex. According to the C.M.P.O. estimates, the growth would be largely due to 50 per cent increase in the population of Calcutta Metropolitan District during 1966—76. In addition, there would be considerable demand for increased mobility due to planned dispersal of people and activities and rise in personal incomes. It would not be possible to meet a demand of such magnitude even with the suggested improvements in the existing mass transportation services or by provision of the suburban dispersal railway line.

6.1. According to the Origin and Destination Survey conducted by the CMPO in 1964, there was a concentration of transit passenger trips in the east-west corridor betwen Howrah and Sealdah—the principal rail terminals and in north-south corridor along the Chittaranjan Avenue—Jawaharlal Nehru Road—Ashutosh Mukherjee Road alignments. The projections revealed that movements in these corridors would remain dominant despite the disperal of transit movements on account of growth in fringe areas of the Calcutta-Howrah complex, including the Salt Lake Reclamation area, Behala and others.

From traffic assignments of 1976 week-day passenger volume, it is noticed that maximum capacity loading occurred in the north-south alignment near the Dalhousie Square. For most southern sections of the north-south alignment, volume exceeding 700,000 passengers daily assigned; falling below this level only was the section south of the Rash Behari Avenue. The northern sections of this alignment had maximum daily loads of 574,000 passengers immediately north of B.B. Ganguli Sreet; 370,000 passengers in the vicinity of Arvinda Sarani (Grey Street) and 198,000 passengers on the extreme northern section. On the east-west corridor, maximum volume



RAPID TRANSIT VOLUME ASSIGNMENTS

AVERAGE WEEK-DAY — 1976

PROPOSED RAPID TRANSIT ALIGNMENT

METROPOLITAN CENTRE

of 581,000 passengers daily was assigned to the section extending through Dalhousie Square area; 475,000 and 543,000 passengers to sections approaching the Sealdah and Howrah stations respectively.

6.2 Techno-economic Feasibility Study for System Selection—The above traffic analysis strongly emphasises the need for a high-capacity rapid transit system along the two corridors. The selection of the type of rapid transit system—underground or elevated—most suitable for these two corridors calls for compatibility with the over-all general development plan of the region. It must embody the most modern transportation concepts and must be adequate for meeting the long-term travel demands. It should be fast, safe and convenient and provided for at a cost compatible with the metropolitan regions' ability to support it financially.

Several types of system may be found to have merits. Before decision is taken regarding over-all investment in mass transportation, a study of the different types of rapid transit system is absolutely necessary. It is proposed to divide the rapid transit design studies into two phases. During the first phase, evaluations leading to the selection of a specific type or a combination of types of rapid transit for required alignments would be made. Second phase studies include preparation of detailed project reports and tender documents. In order to avoid all possible chances of bias the first phase design studies would give full consideration to all types of system of rapid transit.

The object of the first phase study, that is the techno-economic feasibility study, is to compare the engineering, operating, economic and administrative benefits of the different types of rapid transit system, such as underground or elevated. A detailed prospectus for the techno-economic feasibility study is given in Appendix IV. This would provide evidence that possible alternative designs have been investigated, and that the most economic design, location etc. have been selected. The study would thus determine the basis on which rational decisions could be taken regarding the long range investment in mass transportation. Although the services provided by rapid transit system and the existing suburban mass transportation system are substantially different, the two have to be closely integrated elements in the over all mass transportation system of the metropolitan city.

The preparation of the project report and estimates could be undertaken, only after the technical and economic soundness of the final design system has been established, and its integration with the over-all urban planning process ensured.

This stage includes preparation of working plans, time schedule and detailed estimates for obtaining administrative sanction. Here it may be mentioned that after the selection of final design system has been made by the Team, the preparation of the project report etc. would have to be undertaken by the Metropolitan Transport Authority proposed to be constituted for the metropolitan city. The Team is already seized of the question regarding the detailed set-up of such an authority and hopes to finalise its recommendations soon.

6.3 Agency for Undertaking Techno-economic Feasibility study—The Metropolitan Transport Team had considered the question of appointing a suitable agency which might be entrusted with the first phase of the study—the techno-economic feasibility study for the rapid transit system in Calcutta. The Team held the view that it was not necessary to appoint a foreign consulting firm to undertake the job as substantial portion of the work relating to civil, mechanical, operational etc. could be done by Indian Railway personnel. The West Bengal State Study Group also subscribed to this view. The Ministry of Railways were, therefore, approached to undertake this study on a purely consultancy basis. The Railways have kindly agreed to do the job provided funds are made available to them outside their normal capital allocation. The Team has noted with interest that necessary financial provision has been made in the Railways' Development Programme. It is hoped that the study will be initiated soon.

A. V. D'COSTA—*Leader*
HARKIRAT SINGH—*Member*
K. K. NAMBIAR—*Member*
B. DATTA—*Member*
S. N. SINHA—*Member*
G. C. BAVEJA—*Member*
K. A. KHAN—*Member*
B. G. FERNANDES—*Member*
V. G. BHATIA—*Member*
PRAKASH NARAIN*—*Member*
S. B. SAHARYA—*Secretary*

NEW DELHI
FEBRUARY 28, 1969

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* On leave.

A note received from Shri Prakash Narain subsequent to the presentation of the report is given in Appendix V.

MAIN CONCLUSIONS AND RECOMMENDATIONS

1. As suggested in the Interim Report of the Team, a preliminary engineering feasibility study of the alignments—Dum Dum—Prinsep Ghat and Salt Lake Area—for the proposed electrified Suburban Dispersal Line was undertaken by the Survey Unit of the Eastern Railway. The construction and operation of the above alignments has been found feasible. The Team, therefore, recommends that the Final Location Survey and preparation of project drawings and estimates for the proposed line should be taken up by the Railways as early as possible so as to complete its construction before the end of the Fourth Plan.

(Page 5, Para. 1.2)

2. The Team is of the view that at this stage, a strip of land for the future second dispersal line through the Salt Lake area should be demarcated and reserved. For this, it is necessary to freeze building construction activities immediately on land falling under the alignment of the Salt Lake East and West branches outside the Township area.

(Page 8, Para. 1.2 (ii))

3. The Team is convinced that availability of a direct suburban rail route into Calcutta via Bally Bridge would be necessary for the diversion of trains between the Calcutta Chord Railway and the Howrah Division Main Line. It would enable the commuters from the north of Howrah to come to the Central Business District via the proposed dispersal line without alighting at Howrah Station.

(Page 9, Para 1.2 (iii))

4. According to the Survey Unit, the capital cost of the Dum-Dum—Prinsep Ghat route would be about Rs. 290 million. Out of this, the cost of land and property alone amounts to Rs. 40 million. Significant economy could be effected if land owned by the State Government and the Public bodies was available free or on a nominal lease. As a result of Traffic and Financial Viability Study, the Team is of the view that it should be possible to achieve a return of 4.5 per cent by 1980-81 provided (i) land could be made available free to the Railways (ii) interest charges during construction are waived and (iii) there is slight increase in the fare structure. Taking into account the social

benefits of the project, the Team is of the opinion that this is an encouraging rate of return.

(Page 10, Para. 1.3)

5. The direct financial return should not be the major consideration in case of schemes of this type. Passenger transport facilities are a public service and also an important part of the infra-structure required for economic growth. Apart from the direct financial returns, there are indirect economic returns or "external economies" which have to be considered.

(Page 11, Para. 1.3)

6. It was brought to the notice of the Team that against 588 coaches programmed by the Eastern Railway during the Third Five Year Plan, only 312 coaches were supplied. It is recommended that the procurement of EMU stock should be stepped up so as to enable the Railways to meet the additional traffic demand.

(Page 20, Para 2.3 (i))

7. The Eastern and South Eastern Railway tracks were originally laid as inter-city main line routes. Certain speed restrictions have been imposed on account of sharp curvatures and inadequate super-elevation. In order to raise the speed, standard and maintenance of tracks, points and crossings should be of a very high order. The Railways should take necessary steps to alter the layout of tracks and make the necessary provision of super elevation etc. so that the speed restrictions could be removed.

(Page 20, Para. 2.3 (ii))

8. The intensity of train movements on the suburban section has not yet reached such proportions as to create a position where track maintenance is impossible by manual methods. However, with the growing suburban traffic it will be necessary to mechanise the maintenance of tracks to keep a watch on the incidence of faster wear and tear.

(Page 20, Para. 2.3 (iii))

9. A large number of trespassers who are daily run over and killed is a major problem, particularly to the Eastern Railway. It is suggested that the Railways should take measures from now on to fence the tracks so that trespassing could be avoided.

(Page 20, Para. 2.3 (iv))

10. There are 105 level crossings in the Metropolitan area which cause great inconvenience to the movement of road traffic. Train movement also gets affected as the traffic on road

takes a long time to clear. It is recommended that 6 of the most important level crossings should be replaced by grade separated arrangements on priority basis. Unless this is done it will be difficult to maintain 2 or 3 minutes headway which is necessary in case of suburban rail traffic.

(Page 22, Para. 2.4)

11. Overcrowding on Calcutta's buses, even beyond peak hours has now become common. To meet such demand, strengthening of the bus fleet is imperative. For the economic operation large capacity buses should be added to the fleet.

(Page 26, Para. 3.3)

12. The Calcutta State Transport Corporation should design buses with only one row of seats on either side and with a big gangway so that large number of passengers could be accommodated. It would be useful to have buses in the city with 60 per cent. overhang instead of 50 per cent as allowed at present. The CSTC should also alter the design of the underslung single deck into predominantly 'standee' buses so as to accommodate about 80 to 100 passengers. The 'standee' vehicles could be operated specially on short-distance heavy flows of traffic on a single flat fare. These buses should run with very few intermediate stops.

(Page 27, Para. 3.3)

13. The operating ratio had come down from 75.4 in 1961-62 to 54.8 in 1967-68. The main factor responsible for the low operating ratio is the alarmingly increasing number of breakdowns. The average number of buses on road during 1968 varied from 537 to 655. Each operating bus during 1968 broke down on an average about 11 times per month. Ageing buses and poor maintenance are mainly responsible for increasing number of breakdowns.

(Page 29, Para. 3.4)

14. The CSTC has 267 buses of old make. Most of these buses had been laid off due to failure of gear boxes, defective air compressor drive, dangerously low fuel injection system, defective clutch and self starter. It is necessary that a technical group of experts should immediately examine whether these buses could be made road-worthy. These immobilised buses look up valuable space in the garages of the CSTC and to some extent interfere with the proper maintenance and repairs of other vehicles.

(Pages 30 & 31, Para. 3.4)

15. Out of the total fleet of 1104 buses as on 31-3-67, about 69.3 per cent buses were over 5 years old and 44.2 per cent buses were over 8 years old. The overage fleet is a serious problem for the Corporation. Although it is difficult for the CSTC to dispose of or replace such a large number of vehicles within a short period nevertheless, all out efforts have to be made to scrap overage and uneconomic-to-repair buses to the extent possible so that the present maintenance work load (45.2 per cent of total fleet) is significantly reduced. This will also help in reducing the rate of breakdowns per day and minimise the missed kilometres which were as high as 6,265,707 during 1967-68. The CSTC is losing about Rs. 25,000 per day on account of such missed kilometerage.

It is suggested that a phased programme should be drawn up to increase the operating ratio to at least 80 per cent during the next five year period by adopting better maintenance practices and replacement of overage buses.

(Page 31, Para. 3.4)

16. Keeping in view the demand for bus travel in Calcutta, the Study Team suggests that the CSTC fleet strength should be raised to 1000 by the end of the Fourth Plan (550 double decker and 450 single decker). It would ensure outshedding of at least 800 buses daily on the road on the basis of vehicle utilization rate of 80 per cent which is both reasonable and practical to achieve. According to the phased programme, the CSTC will have to procure 429 double deck and 260 single deck buses during 1969—74. This programme would need funds to the tune of 99.3 million. In connection with the formulation of the Fourth Five Year Plan, the State Government had provided Rs. 52.5 million. The Team strongly recommends that the State Government should provide an additional amount of Rs. 46.8 million to the Corporation.

(Page 32, Para. 3.5)

17. The Corporation has been facing serious difficulties in procuring imported spare parts so essential for overhauling and maintenance of heavy duty imported buses. The number of buses held up for want of spare parts at the CSTC have been mounting up from month to month. The Central Government allow import of spares at the rate of Rs. 500 half yearly per diesel vehicle which is barely adequate for meeting the needs of the Indian made medium duty vehicles. To meet the backlog requirements and provide for reserve stock to cover the 'lead period' for annual imports, it is suggested that *ad hoc* allocation of foreign exchange should be made to the Corporation.

(Page 32, Para. 3.6)

18. There is also inordinate delay in the supply of spare parts from overseas suppliers that with the result a large number of vehicles are out of repairs. Due to limited fleet strength the Corporation has been obliged to keep such buses on the road resulting in frequent break-downs, interruption in service schedules and increased cost of operation. The Team is of the view that this could be remedied to a considerable extent if proper forward planning is done by the Corporation. The priorities in utilisation of rationed foreign exchange should be made with reference to actual assessment of vehicle-wise requirement, stores in hand and the prospect of ultimate economic repair of such buses. Simultaneously, the Government should also ensure issue of import licenses to the Corporation well in time.

(Page 34, Para. 3.6)

19. A broad study of the stores revealed that CSTC has also been suffering from overstocking, the average inventory holdings being 12 months' supply. The effect of shortages and stockouts is that a good proportion of buses remains off the road for long intervals thus lowering fleet utilisation and earnings which is quite evident in the case of CSTC. In order to avoid this, the Team recommends that:

(i) The modern methods of stock control on the basis of A-B-C Analysis (selective analysis) should be introduced.

(ii) In preparing estimates of requirements, the past actual consumption in relation to fleet strength should be given adequate consideration and variation from it should be made only on valid grounds of change in the strength of the fleet, age of fleet, overhaul and repair programmes etc.

(iii) The CSTC should lay down targets of inventory holdings, review the actual position and study variances between promise and performance.

(iv) Disposal of obsolete and redundant stores is necessary. The CSTC had about Rs. 11.1 million worth of surplus stores on 31-3-66. According to the State Evaluation Committee, stores worth Rs. 4 million were virtually 'dead' and had little prospect of being utilised by the Corporation. About Rs. 3.5 million worth of stores date prior to 1961-62. The Team recommends that prompt and effective measures should be taken for the disposal of dead stock. Delay merely adds to the carrying cost and also to the loss from disposal sales.

(Pages 34 & 35, Para. 3.7)

20. As regards the stores surplus to current requirements but not obsolete, it is suggested that Stores Division should regularly prepare a list of items not moving for more than a year. The

CSTC should fix a time supply limit, say 2 years, beyond which stock should be disposed of. The Study Team recommends that the CSTC should evolve a regular system of thorough examination of buses becoming idle so that any bus which cannot be repaired economically should be considered for disposal without undue delay.

(Page 36, Para. 3.7 (v) & (vi))

21. The CSTC do not seem to have planned bus routes on the basis of objective data. With a view to improve the commercial effectiveness of the fleet, it is suggested that the Corporation should prepare a plan for re-routing of its services on scientific lines. The existing long bus routes should be split into shorter ones. This would bring about a closer correspondence between the deployment of the total fleet and the varying passenger pressure on different routes.

At present the average number of stops per mile on different routes varies from 4.4 to 7.3. It is suggested that CSTC should explore the possibility of minimising bus stops which do not contribute more than a few passengers during peak hours.

(Pages 36 & 37, Para. 3.8)

22. The CSTC has 5 depots and a central workshop at Belghoria. The depots are used as garage-cum-workshop. Engines and other units such as gear boxes, differentials,etc. are overhauled in all the depots. It is suggested that the depots should be relieved of the heavy repairs and mainly concern with light docking and running repairs. Heavy types of job should be entrusted to the fully equipped central workshop at Belghoria.

(Page 37, Para. 3.9)

23. The depots of the CSTC are too big for efficient maintenance. For economic operation, it is suggested that a depot should be medium-sized with a stabling capacity of 100 to 125 buses and located in such a way that dead kilometerage is reduced to the minimum before the buses go into service. At present the daily dead kilometerage on an average is about 7000 which is primarily due to location of the depots only in northern and southern ends of the city. The Study Team recommends that the CSTC should explore the possibility of having a new depot in the central part of the city.

(Page 37, Para. 3.9)

24. Special bus halting bays or even the facilities for a quick turn round at terminals have not generally been provided in Calcutta. It is suggested that special attention should be paid

to the provision of such facilities while widening and improving existing roads. For network of new roads particularly, the main arteries consisting of expressways and freeways, need for running fast express bus services should not be overlooked.

(Page 37, Para. 3.10)

25. The average speed of buses in Calcutta is about 14 kms. per hour. If this could be improved there would be saving in time and equipment. Roughly, an increase in speed by 1.6 km. per hour could reduce operational costs to the extent of about 10 per cent. It is, therefore, suggested that Corporation should make speed and delay surveys on its routes and list out all the bottlenecks hampering the flow of traffic which should be removed by the concerned authorities, as far as possible.

(Page 37, Para. 3.11)

26. Overcrowding during rush hours leads to early wear and tear of the buses and shortens their effective life considerably. It creates severe problem of traffic congestion on most of the main routes of the city. In order to reduce congestion by diffusing the peak traffic load, staggering of working hours is absolutely necessary. The Team recommends that concrete steps, even by enacting suitable legislation should be taken to stagger the workings hours as early as possible.

(Page 38, Para. 3.12)

27. The financial position of the CSTC has been deteriorating steadily due to heavy losses since 1962-63. At present, the CSTC is incurring a loss at the rate of Rs. 2 million per month. There is an urgent need to arrest these losses by suitable measures, such as checking ticketless travel, increase of fares, setting up depots-wise targets, and purposeful appraisal of their performance at regular intervals.

(Page 38, Para. 3.13)

28. The leakage in daily earnings of CSTC is estimated at 15 to 20 per cent. The Team feels that with greater alertness on the part of the conductors and the supervisory staff, the leakage could be reduced. Legislation making ticketless travel in State buses an offence should be enacted, and institution of mobile courts should be enforced as has been done in Delhi. The Team also recommends that arrangements should be made for advance booking at heavy loading points.

(Page 38, Para. 3.13)

29. For every fare-stage the travelling distance allowed by the CSTC is by far the highest in the whole country. In fact, for lower-stages the travelling distance allowed by the CSTC is

50 per cent more than that allowed by the other three cities i.e. Bombay, Delhi and Madras. Keeping in view the difficult financial position of the CSTC and the prevalent rate of fares, the Team feels that there is a definite case for its upward revision.

(Pages 38 & 39, Para. 3.14)

30. There has been continuous fall in the tramcar utilisation ratio since 1961. It fell down to 61.1 per cent in August, 1968. Frequent breakdowns have reduced operating ratio of tram cars considerably and increased missed kilometres. Failure to maintain and renew the track, rolling stock and overhead equipment etc. in proper condition for long, is responsible for frequent breakdowns. The Team recommends that a phased programme should be drawn up by the Calcutta Tramways Company to raise its operating ratio to at least 80 per cent during the next five year period. This requires a well-planned programme for overhaul of tram cars to make them roadworthy and improvement of track and overhead equipment.

(Pages 41 & 43, Para. 4.1)

31. The number of trams held up for want of spares rose from 53 in April 1967 to 132 in July 1968. The Team has noted that the Tramways Company find it difficult to get import licence to procure some essential materials and components, like traction motors, insulated copper wire, switches, rails etc. which are not manufactured in the country. Substitutes for a few which are available are more expensive and their quality is often below standard. It is suggested that *ad hoc* allocation of foreign exchange should be made to the Tramways Company to meet its requirements.

(Pages 43 & 44, Para. 42)

32. The derailment of trams increased by about 100 per cent from 283 in 1958 to 553 in 1964. Since then the number of derailments has always been more than 500. This is due to the heavy wear and tear of the tracks. It is suggested that there should be regular lubrication of the joints and the worn-out rails be replaced as early as possible.

(Page 44, Para. 4.3)

33. The financial position of the Company has been deteriorating due to increasing gap between its income and expenditure. The Team feels that with the rationalisation of fare structure it would be possible to gradually narrow down the gap and help in rehabilitating track, rolling stock, overhead structure etc. It would also enable the Company to put more tramcars in service.

(Pages 44 & 45, Para. 4.5)

34. To check ticketless travel, it is necessary to introduce PAYE Cars on as many routes as possible. Institution of mobile courts should also be introduced.

(Page 45, Para. 4.6)

35. The electric tramcar has capacity to move people in large numbers and at reasonable speed, provided a reserved right-of-way is afforded to it. It is worth considering whether the tramcars which find difficulty in movement on Calcutta's busy roads, particularly at difficult crossings could be put underground. The possibility of providing subways for the tramcars bulit by the 'cut and cover' method should be examined in detail.

(Page 46, Para. 4.7)

36. In relation to the existing Howrah Bridge and the two major Railway termini on the east and west of the Metropolitan District, the major traffic bottlenecks are the Howrah station area, Sealdah station area and the approaches on the Calcutta side to the existing Howrah Bridge. It is strongly recommended that the necessary improvements as planned by the C.M.P.O. should be carried out at the earliest.

(Page 47, Para. 5.1)

37. In Calcutta, there is no single agency responsible for all aspects of traffic engineering works. The Team feels that there is an urgent need of setting up a Traffic Engineering Cell attached to the Police Department.

Most of the existing signals are sub-standard, difficult to adjust and inadequate in terms of placement and visibility. The signals are not properly synchronised or timed for progressive flow of traffic to meet changing volume demands. The Team is of the view that development of a properly related signal system for Central Calcutta is urgently needed.

(Page 48, Para. 5.2)

38. The C.M.P.O. have made a study of major inter-sections and parking and terminal requirements in C.M.D. area. The Team is of the view that its recommendations in this regard be implemented without further delay. A provision of Rs. 13 million has been recommended by the Team for implementing the traffic operations programme during the Fourth Plan. It is hoped that the State Government would take early steps to implement it.

(Page 49, Para. 5.2)

39. According to the Origin and Destination Survey conducted by the C.M.P.O. in 1964, there was a concentration of transit passenger trips in the east-west corridor between Howrah

and Sealdah—the principal rail terminals and in the north-south corridor along the Chittaranjan Avenue—Jawaharlal Nehru Road—Ashutosh Mukherjee Road alignments. The projections revealed that movements in these corridors would remain dominant despite the dispersal of transit movements on account of growth in fringe areas of the Calcutta—Howrah complex, including the Salt Lake Reclamation area, Behala and others. The above traffic analysis strongly emphasises the need for a high-capacity rapid transit system along the two corridors. The selection of the type of rapid transit system—underground or elevated—most suitable for these two corridors calls for compatibility with overall general development plan of the region. The Team recommends that a Techno-economic Feasibility Study for selecting the type of rapid transit system should be undertaken by the Railways as early as possible.

(Pages 50 & 51 Paras. 6.1 & 6.2)

APPENDICES

Appendix I

Dum Dum—Prinsep Ghat Route

Financial prospects (on the basis of existing fares)

	1974-75 Rs.	1980-81 Rs.
(A) (I) Capital cost	29,11,14,000	29,11,14,000
(II) Interest on above during construction ..	2,91,11,400	2,91,11,400
(III) Total capital cost	32,02,25,400	32,02,25,400
(B) Gross earnings of the proposed line on existing fare	67,16,164	86,44,816
(C) Earnings from Publicity	3,00,000	14,20,000
(D) Total Gross earnings (B+C)	70,16,164	100,64,816
(E) Working expenses of the proposed line ..	43,58,929	55,26,511
(F) Hire charges for rolling stock @ 5% of gross earnings of the line (excluding earnings on publicity	3,35,808	4,32,241
(G) Depreciation @ 1/100th of capital cost (excluding interest)	29,11,140	29,11,140
(H) Total working expenses (E+F+G) ..	76,05,877	88,69,892
(J) Net earnings of the proposed line (D—H) ..	—5,89,713	11,94,924
(K) Saving in operating expenses on parent line ..	10,76,012	13,66,814
(L) Net amount creditable to the new line (J+K)	4,86,299	25,61,738
(M) Percentage return on capital cost $\frac{L \times 100}{A\ (III)}$	0·15	0·80

Appendix II

Dum Dum—Prinsep Ghat Route

Financial prospects (on the basis of surcharge on tickets)

	1964-75 Rs.	1980-81 Rs.
(A) (I) Capital cost	25.31,31,000*	25,31,31,000*
(II) Interest on above during construction	2,53,13,100	2,53,13,100
(III) Total capital cost	27,84,44,100	27,84,44,100
(B) (I) Gross earnings of the propcsed line on existing fares	67,16,164	86,44,816
(II) Addl. earnings by levy of surcharge on tickets	50,52,489	62,03,920
(C) Earnings from publicity	3,00,000	14,20,000
(D) Total earnings (B+C)	120,68,653	162,68,736
(E) Working expenses of the proposed line ..	43,58,929	55,26,511
(F) Hire charges for rolling stock @ 5% of gross earnings of the line (excluding earnings on publicity)	5,88,433	7,42,437
(G) Depreciation at 1/100th of capital cost (excluding interest)	25,31,310	25,31,310
(H) Total working expenses (E+F+G) ..	74,78,672	88,00,258
(J) Net earnings of the proposed line (D—H) ..	45,89,981	74,68,478
(K) Saving on operating expenses on parent line	10,76,012	13,66,814
(L) Net amount creditable to the New line (J+K)	56,65,993	88,35,292
(M) Percentage return on capital Cost $\frac{(L \times 100)}{A\ (III)}$	2·03	3·17

*Reduced capital for likely economies due to reduction in loading standard in bridge design and likely reduction in the cost of land.

Appendix III

List of important Level Crossings

1. Serampore Level crossing over the G.T. Road;
2. Baidyabati South crossing over the G.T. Road;
3. Baidyabati North crossing over the G.T. Road;
4. Lilluah Level crossing;
5. Maurigram Level crossing—Howrah-Andul Road; and
6. Punjab Line Level crossing gate over the G.T. Road.

Appendix IV

Techno-Economic Feasibility Study for Selecting the Type of Rapid Transit System

Sl. No.	Items of Study	Agency to Undertake
1	2	3
1	Supplementary origin destination data will be obtained through surveys of transit riders on all routes operating in the study area, particularly the routes in or adjacent to the corridors of proposed rapid transit routes. Related information will be obtained on travel purpose, boarding and departure points, and the time of day that trip is made.	Metropolitan Transport Team in association with the State Study Group.
2	Operating characteristics of existing mass transportation service. These characteristics will be studied in depth to determine current usage of each system on normal weekdays, including service schedules, vehicles loading, vehicles headways and layover time by vehicles at terminals. Speed and delay studies would be conducted on lines within the influence area of the proposed rapid transit system. Overall travel times between terminals will be obtained for all lines. All prior operational studies will be reviewed in detail.	
3	Examination of present distribution pattern of transit passengers in the central part of the metropolitan city and at major shopping centres and points of heavy traffic generation.	
4	Assignments of vehicles and passenger volumes will be made to recommend routes for current and future years. The projections of travel volumes will be co-ordinated with the current overall transportation study now under way. Population trends, land use potentials, traffic data, operating programmes and other transportation factors will be considered in detail as they relate to the proposed rapid transit alignment in particular, and to the entire mass transportation system in general. The evaluation will also be related to recommended improvements in surface transportation in outlying area.	
5	Travel demands on individual sections of both types of rapid transit facilities will be evaluated and the implication of estimated usage of both systems for the overall mass transportation network will be analysed and compared. A programme of staged construction, changing future demands and future extensions in rapid transit service will be suggested.	Railways.

Appendix IV—contd.

1	2	3
6	Complete civil engineering studies for both systems of rapid transit in order to determine the civil engineering feasibility and problems related to the development of each system. These studies would include investigation of soil conditions, drainage requirements, interference with underground utilities, building foundations and other sub-surface construction, and a determination of the availability of materials and contractors to develop each type of system. Time required for the development of each system will be estimated and the adaptability of each system to a programme of staged construction will be evaluated.	Railways.
7	Examination and comparison of legal problems that might arise from construction and operation of both elevated and underground systems. These studies would include legal action that might result from right-of-way acquisition, excessive and damaging ground settlement or other damage to buildings attributable to underground construction, and possible nuisance factors such as noise, loss of privacy and interference with light and air.	
8	Analysis of access points to stations and terminals along the alignments of both rapid transit systems as they would relate to likely volumes of passengers to be served, density of the area, type of construction and convenience to passengers and pedestrians. The use of escalators and other facilities necessary for passenger convenience will be determined.	
9	Engineering studies of alternative types of modern, urban rapid transit rolling stock for both rapid transit systems, their approximate cost, and whether they can be properly manufactured or assembled in India.	
10	Evaluation of power requirements and maintenance facilities for both systems of rapid transit.	
11	Preparation of preliminary functional plans for both systems of rapid transit. The functional plans will include recommended basic vertical and horizontal alignments, including stations and yards, to ensure physical feasibility of the routes within the accuracy permitted by available topographic information.	
12	Estimates and comparison of capital and operating cost for both elevated and underground transit systems. These will include required rights-of-way, equipment, stations and terminals, rolling stock and all supporting facilities. The foreign exchange component required for the development of each system will be estimated. A comparison of maintenance, control, safety and ease of operation for each system of rapid transit.	

Appendix IV—concld.

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13	A complete examination and comparison of the financial aspects of both rapid transit systems. This will include evaluation and comparison of estimated annual gross earnings based on alternative fare structures, operating costs, amortisation of capital costs based on probable life of each system.	Railways.
14	Appropriate interest rates, necessary subsidies and alternative methods of financing have to be estimated.	
15	Recommendation of policies of co-ordination between rapid transit service and all other mass transportation systems, particularly as they relate to routes, fare collections etc.	Metropolitan Transport Team.

Appendix V

Note by Shri Prakash Narain, Jt. Director, Traffic (Coordination Research), Railway Board

I agree with the major recommendations as indicated in the Draft Report on Mass Transportation System in Calcutta (Feb. 1969) and most of my views, after discussions, have already been incorporated in it. There is an important aspect in regard to which, however, I could not find myself in agreement with the majority view of the Team. The Team had already mentioned in the Interim Report on "Traffic and Transportation Problems in Metropolitan Cities" (May 1967) Chapter VI, para. 2 that there is need for a single Metropolitan Traffic and Transport Authority responsible for planning, financing and operation of the entire transportation system in the metropolitan cities. In the present report, the Team has, however, implied (para 6.2)—and this was confirmed in the discussions—that it was only the proposed Rapid Transit System whose operation should be placed under the control of the Metropolitan Transport Authority while the Dum Dum—Prinsep Ghat Suburban Dispersal Line should be treated as an extension of the Railway's existing suburban services. According to this, while the recurring financial burden of operating the services on the Rapid Transit System would be met by the Metropolitan Transport Authority, in case of the services on the Dispersal Line, this would have to be done by the Railways. During discussions, the members holding this view argued that there is a fundamental difference between a grade separated Rapid Transit system and an extension of the suburban Railway services like a Suburban Dispersal Line. I am sorry that I have not been able to appreciate this distinction. It is a fact that so far all suburban rail services have been run by the Railway in India. This was the position in most of the metropolitan cities of the world also till some years back when it was gradually realised that these services should be run by a single road-cum-rail Transport Authority for the city. Since metropolitan transport involves development of capacity for brief peak periods and under-utilisation of that capacity on the rest of the day, it is now generally accepted that it is not a financially remunerative proposition. At the same time since it is a common man's transport, fares cannot be increased unduly and it cannot therefore, be based

on a fare-supported economics. It is, therefore, generally accepted now in most countries of the world that City transport is to be treated like a social necessity for the city, to be paid for by the general exchequer rather than by the Railways or the railroad finances.

2. All the members of the Team have already accepted that the Rapid Transit System should be operated and its finances met by the proposed Metropolitan Transport Authority (recommendations regarding the detailed set up of which would be given by the Team subsequently). This in effect amounts to an acceptance of the principle that metropolitan transport is to be treated as the financial responsibility of the City and that of the Railway in keeping with the world-wide trend mentioned above. Having agreed to this principle, we can hardly maintain a distinction between the surface scheme and grade-separated schemes so long as they are both meant primarily for the use of the commuter rather than the long distance traffic. It is true that there are suburban surface services already being run by the Railway but this should be no reason not to introduce the world-wide change in orientation as far as the future services are concerned, even if the old services cannot, for practical reasons, be taken up by the new Metropolitan Transport Authority.

3. I, therefore, feel that it would be necessary and desirable to mention in the Report of the Team that not only the proposed grade-separated Rapid Transit system but also the proposed Suburban Dispersal Line from Dum Dum to Prinsep Ghat in Calcutta should either be run by the proposed Metropolitan Transport Authority or its finances should be met with by this Authority.

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