THE ECONOMIC VIABILITY OF THE SOUTH AUSTRALIAN METROPOLITAN PUBLIC TRANSPORT SYSTEM

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ABSTRACT: *The existing and proposed South Australian metropolitan public transport system is outlined, patronage trends derived from population and private motor vehicle ownership statistics, actual operating costs and revenue compared and a requirement stated for rationalisation of planners' and operators' objectives in services provided.*

ECONOMIC VIABILITY OF S.A. METRO PUBLIC TRANSPORT SYSTEMS

INTRODUCTION

Population Characteristics

The South Australian Metropolitan Public Transport System as a whole serves a population estimated at 903,200 in 1975 (see Reference 1). Bus, tram and rail systems in the metropolitan area are essentially radial in structure, with limited cross-town, circular and feeder bus routes, either operating now or planned for implementation before 1980. An analysis of the demographic distribution in S.A. derived from the 1971 National Census is summarised in Figure 1 and Table 1, from which it is seen that, in 1971, 71.6% of South Australia's population lived in the metroplitan area of Adelaide and 82.4% of this population (59% of the total S.A. population) lived within 15 Kms of the GPO, Adelaide. There is a trend toward a further increase in the proportion of people living in the metropolitan area, extrapolated to be approximately 74.5% by 1985. An increase in demographic density will occur in the inner suburbs, due to the construction of flats and home units on sites formerly occupied by individual houses, but the most rapid population growth in the metropolitan area since 1971 will continue to be predominantly in the outer suburbs, i.e., the Modbury Corridor, S.E. Coastal strip and the N.E. suburbs centred around Salisbury.

The official S.A. predictions to the year 2,000 show an aging population characteristic with about 10,700 more people entering the over 70's group from 1975 to 1985 and an overall decrease in the number of people entering the age group 0-18 years. The sum of these two groups is almost constant over the decade examined, and almost all the estimated metropolitan area net population increase of 102,700 will occur in the age group 18-70 years (see Table 2, Figure 2).

Private Motor Vehicle Ownership and Trends

It is assumed that the number of persons driving private motor vehicles is relatively insignificant outside the age group 18-70 and that in consequence, those in the age groups 0-18 and over 70, are virtually captive to public transport.

Car and station wagon ownership in the metropolitan area, if increases at the same rate as it has been doing since 1971, will reach a total of 490,000 by 1985, an increase of 40% over present figures. The ratio 0.64 vehicles per person in the age group 18-70 (equivalent to 2.6 persons per vehicle taken overall) must be close to saturation and if this figure is held constant over the period 1975 - 85, the number of registered cars and station wagons in the metropolitan area will then reach a total of 413,000 (See Table 3, Figure 3). Even this lower figure represents a net increase in vehicle registrations of 64,000 compared with a total predicted metropolitan population increase of 102,700. As vehicle ownership increase depends on growth in real incomes and is relatively insensitive to the price of fuel, barring unprecedented increases in fuel and other costs relative to average purchasing power during the next decade, it seems reasonable to assume that the actual increase will be somewhere between the two above-mentioned figures. A figure of 450,000 (an increase of 29%) would appear appropriate for planning purposes, which would imply a significant increase in the number of families owning two or more cars.

Trends in Public Transport Patronage

As in other cities in Australia and in the western world in general, declining patronage of public transport has

compounded the problem of rising deficits caused by cost inflation. Rail patronage has declined steadily from nearly 15,000,000 passenger journeys in 1966 to less than 12,000,000 in 1975. Bus and tram patronage also declined from 1966 to 1971, the apparent net increase from this date may be distorted slightly by the number of passengers using the free 'Bee-Line' bus service in the city.

The Adelaide Metropolitan area currently has few congestion problems at peak periods and adequate short and long-term parking facilities close in to the central business district, the city parklands, and in suburban areas adjacent to the parklands. The availability of cheap or free parking strongly influences modal choice and the marginal disutility between public and private transport is such that many of those who can exercise this choice prefer to use their own vehicles for CBD commuting both on the daily work trip and during off-peak hours. Virtually all this group would use their own cars in preference to public transport to travel elsewhere in the metropolitan area. However, the predicted increase in private motor vehicle ownership and population in the next decade will generate:-

1) a demand for cheap all-day parking in or near the city which will rapidly exceed the limited supply available

2) a large increase in the number of cars circulating in the metropolitan area during off-peak hours, resulting from a higher proportion of families owning two or more cars.

Coupled with the fact that over the next decade the number of passengers in the age groups 0-18 and over 70, will remain about the same, the net effect of the trends discussed above would be:-

1) an increased demand for public transport to and from the central business district in peak hours,

2) a stationary or declining demand for off-peak public transport.

Both of these factors operate against the economic viability of the system.

SYSTEM ECONOMIC CONSIDERATIONS

Revenue Contribution to Fixed Costs

If variable and fixed components of bus and tram operating costs are considered it is seen that the contribution of revenue to fixed costs on an average passenger journey basis decreased slowly from 1969 to 1974 (see Figure 5, Table 5), a sharp reduction occurring in the following year, accompanied by a corresponding increase in fixed costs. A similar increase in variable and fixed costs per passenger journey in 1975 occurs in metropolitan rail services (see Table 6, Figure 5), but variable costs, which do not include the cost of manning and operating railway stations in the suburban area, have not been covered by revenue over the period examined. The contribution to fixed costs in 1975 for metropolitan rail services was reduced to -24.2¢ per average passenger journey and under these circumstances any increase in rail passenger traffic, if this implies additional rolling stock or operating personnel, would result in a corresponding increase in operating deficit. The narrow margin between variable operating costs and revenue in bus and tram in 1975 also indicates that a crossover into negative contribution will occur in 1976.

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The Problem of Economic Operation

Faced with a task of improving the economic position of rail passenger services with steadily declining patronage (see Table 4, Figure 4) and mounting deficits, an operator of these services would no doubt see as a purely economic solution their cancellation and replacement by equivalent bus routes. However, it is understandable that Government planning authorities wish to retain or improve rail passenger services as an insurance against long-term petroleum shortages and to avoid causing additional short-term congestion in road traffic by replacing these services with extra buses. Nevertheless, metropolitan rail operating deficits are increasing rapidly, the result of which can only be to reduce those funds provided to the operator for capital works to update and improve the system.

There is some scope available in reducing the discrepancy between revenue and operating costs in rail and bus services and although the overall trend cannot be reversed, the rate at which it is rising can at least be slowed down.

Since 50% of the metropolitan population of S.A. lives within 8 Kms of the GPO (See Figure 1), advantage may be obtained from the application of user-oriented marketing principles and system modelling to optimise the frequency and routing of public transport services provided to this zone, where the number of passengers available per route Km is higher than elsewhere in the metropolitan area. At the metropolitan periphery, that is from 12 - 15 Kms from the GPO, which contains a high proportion of young families with wives dependent on public transport, (not necessarily to the central business district) feeder bus services to bus/rail/interchanges, established at local shopping or community centres would provide

an economically more viable solution, by increasing passenger loadings per bus route Km and increasing corridor flows for rail services. There is evidence of the validity of this approach in the recently inaugurated service at Christie Downs in the S.E. metropolitan area, some 15 Kms from Adelaide, where feeder buses serve a rail head with limited stop or express trains to and from the city.

Patronage Trends in Public Transport 1975-85

Population and private motor vehicle ownership projections indicate that little off-peak public transport patronage will be generated through population increases over the next decade, although unpredictable factors outside the scope of this analysis such as large fuel costs increases and higher capital costs relative to real incomes, resulting in a drop in private motor vehicle sales, could modify this trend considerably. Despite official announcements on the subject of declining public transport patronage in Australian cities and the necessity to arrest this trend, it is at the same time, in the short and intermediate term, not practical nor economically desirable to impose restrictions on the manufacture and sale of private motor vehicles in Australia, which are the cause of this decline. The result is that with increasing road traffic in and around Australian cities, including Adelaide, people who have the choice will tend toward restricting their use of public transport to the daily work trip to the central business district: it is noted also that adding to this increase in peak hour public transport patronage is an official policy aimed to discourage progressively the use of private motor vehicle work trips to the central business district of Adelaide and inner suburbs through parking disincentives.

CONCLUSIONS

One of the problems facing the operator is inefficient return per route Km travelled, caused by low off-peak ridership and high-peak to off-peak loading ratios. As stated earlier, in the present economic environment of metropolitan public transport, policies designed to restrict the use of private motor vehicles for the central business district work trip tend to increase the demand for public transport during peak hours and act against the economic viability of public transport systems by widening the gap between peak and off-peak loadings. This effect is difficult to analyse quantitively in terms of the resultant increase in operating costs but leads to the objective of matching average revenue to marginal cost per public transport vehicle. If the marginal costs of operating additional bus and rail services in metropolitan Adelaide are not covered by revenue, extra buses and trains needed at peak periods only add to the operator's financial difficulties. It is in consequence essential, if the operator is to provide an adequate service to the public, that revenue, in the form of fares or subsidies, should be related to marginal costs. Together with the objective of providing the metropolitan population with the public transport service it needs, planners' and operators' tasks must include, therefore, the improvement of system economic viability by covering variable costs through the optimisation of revenue per vehicle. As the demand for public transport in the peak hours increases in the Adelaide metropolitan area during the next decade, a compensatory increase in off-peak patronage and revenue must be sought if operating deficits are to be kept within manageable limits.

In addition, elaboration of current accounting and reporting procedures in the form of the operating costs and

revenues of the specific public transport services provided (e.g. peak-hours, off-peak, late night, week-end), would facilitate planners' and operators' task by quantification of the social benefits thereby derived.

Reference: South Australian Population Projections 1975 - 2001
(Premier's Department, June 1971)

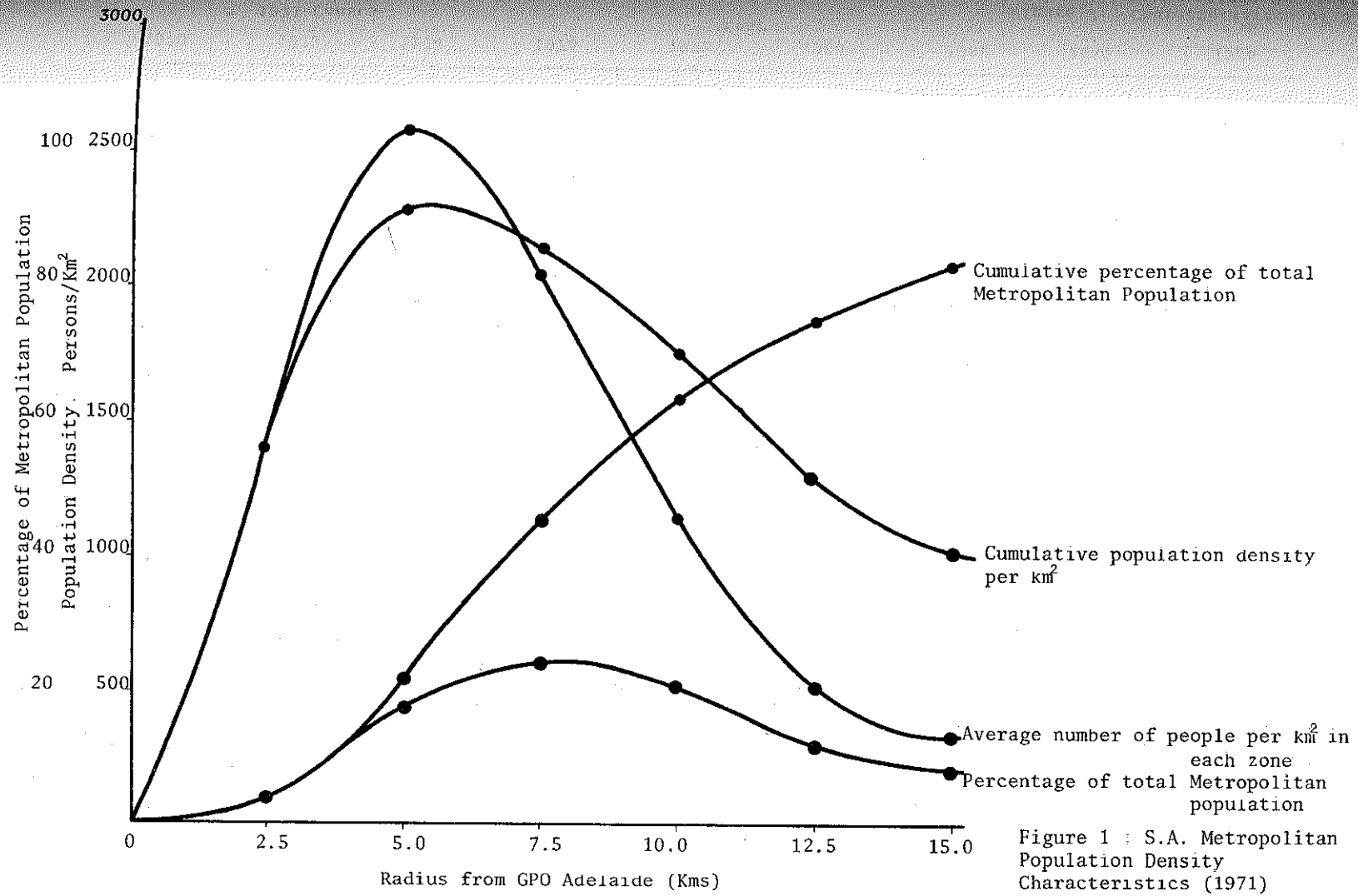

Figure 1 : S.A. Metropolitan Population Density Characteristics (1971)

Figure 2: Characteristics of S.A. Metropolitan Population Prediction

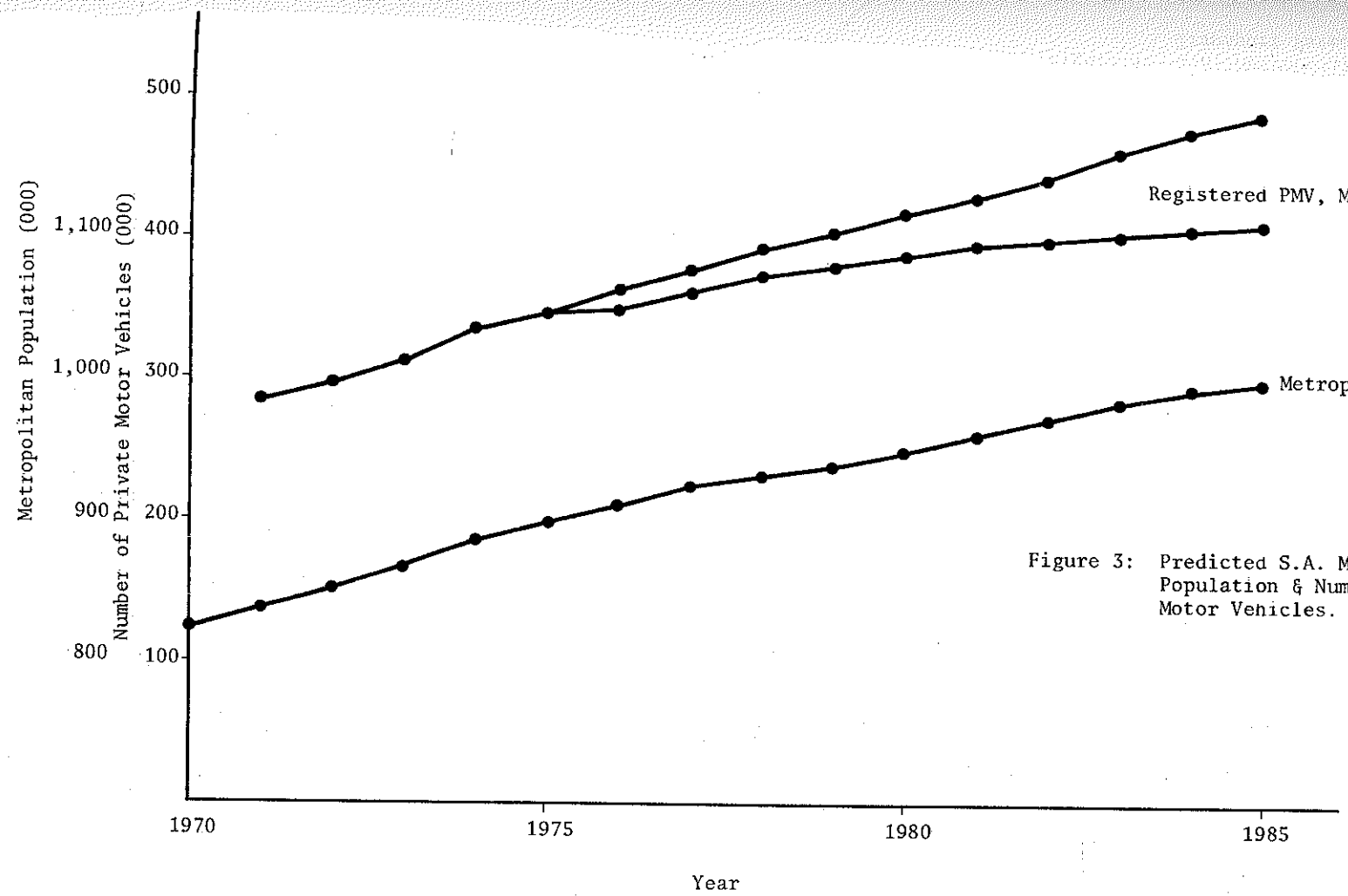

Figure 3: Predicted S.A. Metropolitan Population & Number of Private Motor Vehicles.

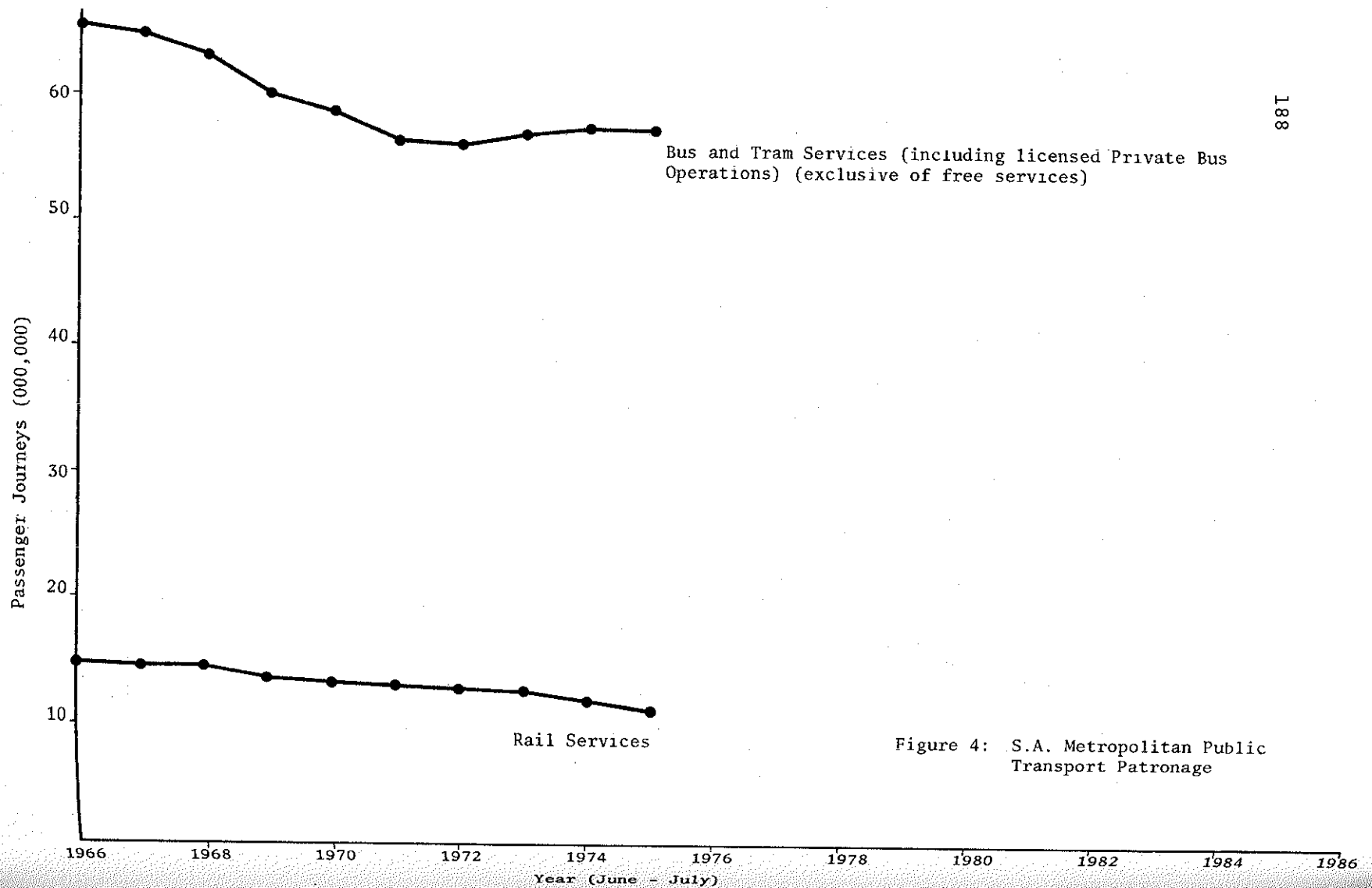

Figure 4: S.A. Metropolitan Public Transport Patronage

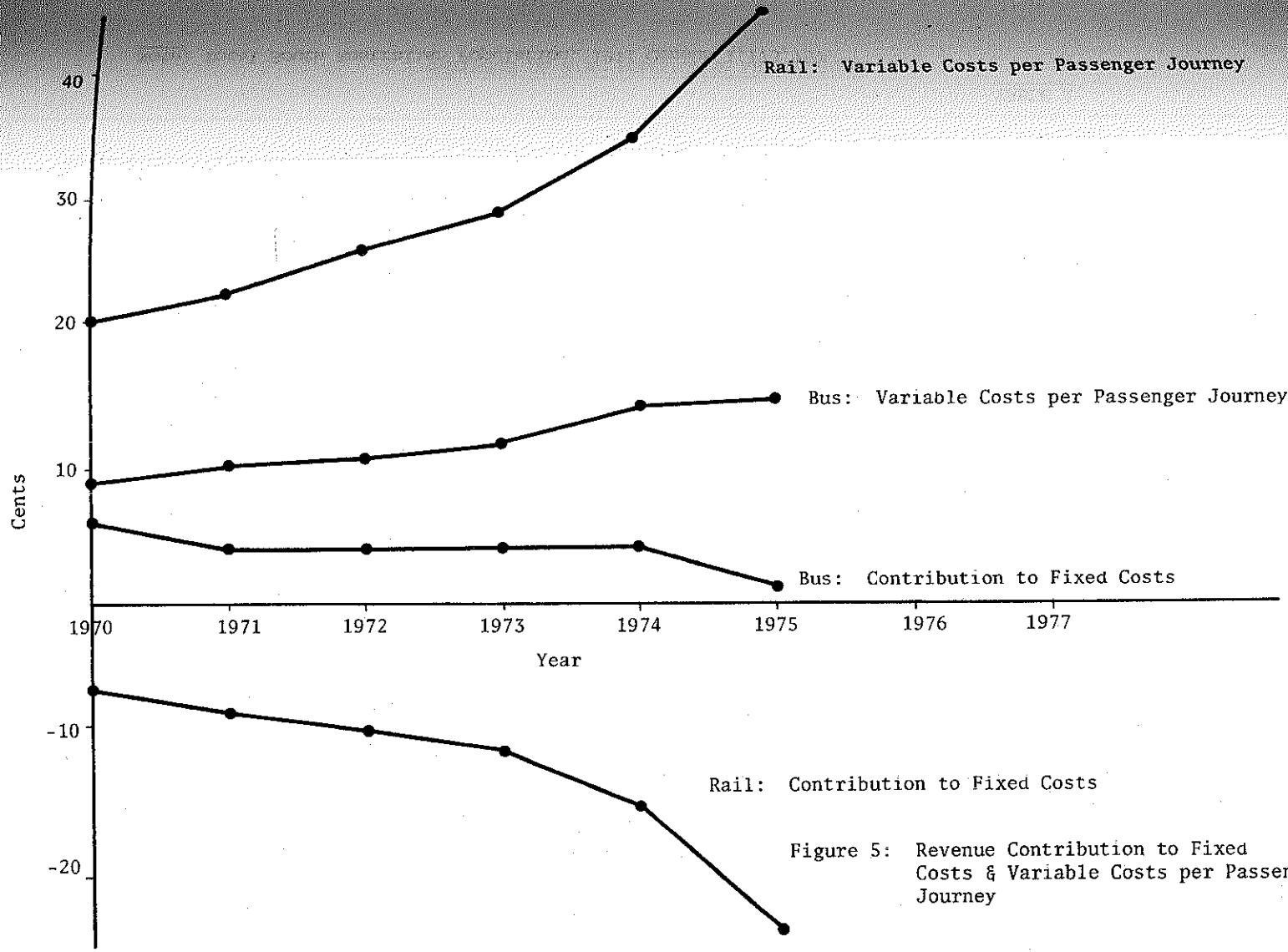

Figure 5: Revenue Contribution to Fixed Costs & Variable Costs per Passenger Journey

DEMOGRAPHIC DISTRIBUTION

ADELAIDE METROPOLITAN AREA (1971)

Inner Metropolitan Zones	Radius (Kms)	Zone Area Kms^2	Population	Pop. Density P/Km^2	% Total Metropolitan
1	2.5	19.64	26,743	1,361.7	3.18
2	5.0	58.9	151,975	2,580.2	18.09
3	7.5	98.175	201,696	2,054.5	24.00
4	10.0	137.45	156,439	1,138.2	18.62
5	12.5	176.71	85,400	483.3	10.16
6	15.0	215.99	70,282	325.4	8.36
		706.86	692,535	979.7	82.41
Outer Metropolitan Zones					
Pt. Adelaide –					
Outer Harbour			7,429		)
Salisbury			37,244		)
Elizabeth			33,389		)
Gawler			5,681		)
Noarlunga			28,464		)17.59
Stirling			4,957		)
Others			30,614		)
			147,778		
Total Metropolitan			840,313		100

TABLE 1

Note: Total South Australian Population, 1971 Census 1,173,707.

ANALYSIS OF S.A. POPULATION PREDICTIONS

Year	SA Population				SA Metropolitan Population				
	Total	⩽ 18 Years	⩾ 70 Years	18< P<70	⩽ 18 Years	⩾70 Years	18< P<70	Total	⩽18⩾ 70
1971 *	1,173,707*	426,452*	64,725*	682,530*	306,182	46,471	490,040	842,693	352,653
1975**	1,240,900	429,587	64,141	747,172	312,680	46,685	543,835	903,200	359,365
1976	1,252,300	427,146	65,120	760,034	311,580	47,502	554,418	913,500	359,082
1977	1,263,800	425,134	66,189	772,477	310,760	48,382	564,658	923,800	359,142
1978	1,275,200	422,206	67,043	785,951	309,270	49,110	580,720	934,100	358,338
1979	1,286,600	419,432	67,857	799,311	307,870	49,809	586,721	944,400	357,679
1980	1,298,100	416,123	69,121	812,856	306,040	50,836	597,824	954,700	356,876
1981	1,309,500	413,614	70,530	825,356	304,800	51,975	608,225	965,000	356,775
1982	1,321,000	411,721	71,960	837,319	303,980	53,128	618,192	975,300	357,108
1983	1,332,400	410,285	73,640	848,475	303,590	54,473	627,537	985,600	358,063
1984	1,343,700	409,810	75,419	858,471	303,705	55,892	636,203	995,800	359,597
1985**	1,355,000	409,772	77,262	867,966	304,200	57,356	644,344	1,005,900	361,556

TABLE 2

Reference: *1971 Census

** S.A. Population Projections (Premier's Department) June 1975

ESTIMATED METROPOLITAN AREA REGISTERED CARS AND STATION WAGONS

Year	Metropolitan Population		Cars & Station Wagons Registered SA	$\left(\frac{C \& SW}{P.}\right)_1$	Cars & Station Wagons Registered SA Metro (Estimate 1)	$\left(\frac{C \& SW}{P.}\right)_2$	Cars & Station Wagons Registered SA Metro (Estimate 2)
	Total	$18 < P. < 70$					
1971	842,693	490,040	392,015	0.57	281,500		
1972	855,000	500,000	412,786	0.59	296,000		
1973	868,000	516,000	436,985	0.605	312,000		
1974	885,400	520,000	451,840	0.625	331,000		
1975	903,200	544,000	477,675	0.641	349,000		
1976	913,500	554,000		0.653	362,000	0.641	355,000
1977	923,800	565,000		0.665	375,000		362,000
1978	934,100	581,000		0.676	393,000	"	372,000
1979	944,400	587,000		0.689	404,000	"	376,000
1980	955,000	598,000		0.70	418,000	"	383,000
1981	965,000	608,000		0.712	433,000	"	390,000
1982	975,000	618,000		0.724	448,000	"	396,000
1983	986,000	627,000		0.736	462,000	"	402,000
1984	995,800	636,000		0.748	476,000	"	408,000
1985	1,005,900	644,000		0.760	490,000	"	413,000

TABLE 3

PASSENGERS CARRIED

METROPOLITAN BUS AND TRAM						METROPOLITAN TRAIN
Year	MTT	Licensed Private Bus Operators	Total	B-Line Free Service (Estimated)	Net Total Paying Passengers	Passenger Journeys
1966	53,112,075	13,692,739	66,804,814	-	66,804,814	14,670,833
1967	49,734,554	14,955,915	64,690,469	-	64,690,469	14,608,070
1968	47,812,639	15,399,877	63,212,516	-	63,212,516	14,446,980
1969	45,393,415	15,087.921	60,481,336	-	60,481,336	13,759,615
1970	43,345,396	15,702.408	58,547,804	-	58,547,804	13,441,027
1971	41,259,153	14,794,929	56,054,082	-	56,054,082	13,393,275
1972	40,841,680	15,239,251	56,080,931	-	56,080,931	12,918,129
1973	41,680,407	16,600,346	58,280,753	-	56,990,753	12,755,869
1974	47,533,014	11,256,697	58,789,711	1,290,000	57,499,711	12,914,028
1975	58,257,593	1,434,330	59,731,923	2,211,000	57,520,923	11.944,000

TABLE 4

RUNNING COST ANALYSIS - STA BUS & TRAM DIVISION

Year	Traffic Operations	% of Total	Power for Traffic	Fuel & Oil	% of Total	Total Marginal Costs	% of Total	Traffic Receipts	Contribution to Fixed Costs	Fixed Costs	Total Costs & Expenses
	$		$	$		$		$	$	$	$
1974/75	10,759,113	90.9	39,752	1,035,829	8.7	11,834,694	62.4	12,711,264	876,570	7,116,683	18,951,377
1973/74	6,397,933	90.6	36,583	629,959	8.9	7,064,475	60.2	9,614,685	2,550,210	4,670,837	11,735,312
1972/73	4,440,526	91.5	31,035	379,137	7.8	4,850,698	58.7	7,035,708	2,185,010	3,418,473	8,269,171
1971/72	4,094,355	90.8	30,892	349,128	7.8	4,474,375	61.4	6,783,471	2,309,096	2,807,871	7,282,246
1970/71	3,954,383	92.3	29,619	301,413	7.0	4,285,415	61.3	6,640,077	2,354,662	2,700,243	6,985,658
1969/70	3,479,168	92.6	29,738	247,917	6.6	3,756,823	59.7	6,447,510	2,690,687	2,536,166	6,292,989
	Number of Passengers					Variable Cost per Passenger Journey		Traffic Revenue per Passenger Journey	Contribution to Fixed Costs ¢ per Passenger Journey	Fixed Cost per Passenger Journey	Total Cost per Passenger Journey
						¢		¢	¢	¢	¢
1974/75	58,297,593					20.3		21.8	1.5	12.21	32.51
1973/74	47,533,019					14.86		20.2	5.34	9.83	24.69
1972/73	41,680,407					11.6		16.9	5.3	8.20	19.8
1971/72	40,841,680					11.0		16.6	5.6	6.88	17.88
1970/71	41,259,153					10.4		16.1	5.7	6.54	17.08
1969/70	43,345,396					8.7		14.9	6.2	5.85	14.55

TABLE 5

SUBURBAN PASSENGER COSTS & REVENUE ANALYSIS ($)

STA RAIL DIVISION

Year	Maintenance Ways & Works (A)	Maintenance Rolling Stock (B) & (C)	Motive Power & Lubrication (D) & (E)	Total Variable Costs	Transportation & Traffic (F)	Other Fixed Costs	Total Fixed Costs	Total All Costs	Traffic Receipts	Contribution
	$	$	$	$	$	$	$	$	$	$
1974/75	1,503,570	2,199,736	1,929,888	5,633,194	4,485,760	1,984,053	6,469,813	12,103,007	2,735,526	(2,897,668)
1973/74	1,155,133	1,777,646	1,487,163	4,419,942	3,474,252	1,306,100	4,780,352	9,200,294	2,416,984	(2,002,958)
1972/73	1,002,076	1,660,542	1,158,579	3,821,197	2,834,565	1,147,923	3,982,488	7,803,685	2,285,172	(1,536,025)
1971/72	784,303	1,532,061	1,103,684	3,420,048	2,484,928	1,050,998	3,535,926	6,955,974	2,151,838	(1,268,210)
1970/71	715,802	1,378,190	1,009,664	3,103,656	2,307,248	1,064,628	3,371,876	6,475,532	2,048,221	(1,055,435)
1969/70	621,536	1,332,261	889,308	2,843,105	2,008,812	918,692	2,927,504	5,770,609	1,995,577	(847,528)
	Number of Passengers			Variable Cost per Passenger	Rate of Increase %		Fixed Cost per Passenger	Total Cost per Passenger	Revenue per Passenger	Contribution per Passenger
				¢			¢	¢	¢	¢
1974/75	11,996,792			47.0	37.4		53.9	100.9	22.8	(24.2)
1973/74	12,914,028			34.2	20.4		37.0	71.2	18.7	(15.5)
1972/73	12,755,869			30.0	7.17		31.2	61.2	17.9	(12.04)
1971/72	12,918,129			26.5	14.2		27.4	53.9	16.7	(9.8)
1970/71	13,393,275			23.2	9.4		25.2	48.4	15.3	(7.9)
1969/70	13,441,027			21.2			21.8	43.0	14.8	(6.3)

TABLE 6