PROBLEMS OF MOVING PEOPLE WITHOUT POLLUTION

0. *Introduction*

0.1 A paper entitled "Mass Transit 2000 A.D." presented to a Symposium on "Problems of Moving People without Pollution" might predictably look forward to the Millennium when all private motorised transport is abolished, together with accidents, erosion of environment, fumes, noise, etc., and everyone travels on public transport which is clean, comfortable, convenient, efficient, fast, free, etc. The temptation to write such a science-fantasy paper is strong; unfortunately, the real issue is whether mass transit will have – or should have – any place at all in the AD 2000 environment and in what context it might be expected to operate.

0.2 The paper relies on historical data from which some of the factors affecting mass transit are identified, projects the factors to potential AD 2000 conditions and from these essays a definition of the circumstances under which mass transit can be expected to operate. It is conceded that, despite electronic solid-state logic conversion of the crystal ball, forecasting is prone to error increasing exponentially with time but the time-scale of forecast is within the productive life-span of the Volkswagon, much of the rolling stock of the Sydney Metropolitan Railway and most of the Port Jackson ferries and is based on essentially time-consistent data.

0.3 The forecast is related specifically to Sydney and to the pattern of development not being drastically amended by changes in planning policy – changes which *are not contemplated in the Sydney Region Outline Plan.*[1] A policy based on compelling future development at a *minimum* density of 5000 dwelling units per square mile (gross) coupled with the concentration of industry into large pockets would materially alter some of the conclusions in this paper although the overall thesis would remain valid, so long as the bulk of employment continued to be dispersed.

0.4 In this paper "mass transit" is applied in a *"common usage"* sense to include the following:-

(i) line-haul systems devoted exclusively, or almost exclusively, to passenger public transport systems within a city

(ii) complementary services within a city, such as moving

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1. The Sydney Region Outline Plan, State Planning Authority of N.S.W. 1968.

pavements, etc., used to transport people on an area-wide basis and essentially line-haul in character.

Strictly a high-speed, high capacity, line haul-system linking the outer suburbs of a city to a central distribution system is a rapid transit system while the central distribution system is the mass transit. Thus, in Paris, the R.E.R. (express urbaine) such as the Ligue de Sceaux linking the south-west suburbs to the Metro is a rapid transit system working to a timetable, whereas the Metro itself, operating without a strict timetable, schedules trains to run as frequently as the system instantaneously allows – a true mass transit.

1. *The Problem of Sydney*

1.1 Today it is usual to comment on the changing skyline of the city, be it Sydney, Melbourne, San Francisco, Tokyo, London, etc. Examination of city growth indicates that city skylines have always been prone to change. Two factors are readily observable when studying city growth:-

(i) cities are constantly changing with respect to population, population density and employment location,

(ii) city centre renewal takes place in "waves". One of the problems confronting mass transit is that it represents a long-term fixed element trying to resolve what is essentially a dynamic situation.

1.2 Most of the city centres, last rebuilt in the latter half of the 19th century as a result of introducing the railways, are again being rebuilt to conform to the tertiary industry growth and again about the railways. In this respect, Sydney is not unique, it has merely tended to lag behind some other cities such as London. In the U.S.A., some of the cities which had lost their railways as a result of economic depression and growth of car-ownership are now endeavouring to remedy the deficiency by installing "mass transit systems"; others which never had an effective "mass transit system" are indulging for the first time and finding the novelty stimulating, humiliating and expensive. It is reasonable to ask "how does this affect Sydney" and is there a case for projects such as BART[2] in Sydney?

1.3 The degree of office growth within the Central Business District (CBD) of Sydney which has taken place since 1957 is shown in Figure 1.[3]

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2. i.e., San Francisco's Bay Area Rapid Transit System.

3. "City of Sydney Strategic Plan", The Council of the City of Sydney, 1971.

Some caution must be exercised in interpretation of this data since the average amount of space allocated per office worker has increased from 120 square feet in the early 1950's to about 170 square feet today.[4] Nevertheless, it seems reasonable to conclude that the number of office workers employed in the CBD has risen consistently over the years and that this trend shows no sign of reversing.

1.4 Statistics relating to the pattern of work-trip movement within the Sydney Statistical Division are to be found in the National Census "Journey to Work" Survey 1966.[5] It will be observed that only about 20% of workers are employed in the CBD and that a substantial proportion of work-destinations are scattered, almost random-wise, throughout the metropolitan area.

1.5 Table 1 shows how the population distribution has changed during the post-war years, together with some social measures of affluence including U.C.V. (unimproved capital value of land) and car ownership in 1966 – the last year for which full National Census information is available.[6]

In general, private buses are not permitted to compete with Government Transport buses so that a change-mode from private bus to some form of State-owned transport is usually necessary for passengers to travel to the Sydney CBD.[7]

1.6 In order to illustrate the dramatic change in population density, a smoothed graph of general gross population density with distance from the G.P.O., Sydney in miles has been plotted for the years 1947 and 1971. (Figure 2). It will be observed that there has been a massive movement out of the central city area despite a near-doubling of the population coupled with a general development throughout the region at an overall density virtually impossible to service by public transport except at huge expense and low density of patronage.[8] This is supported in Table 2 which lists all persons who travelled to work in May 1970 by method of travel in Sydney and also in all 6 State Capital cities

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4. Whipple, T., "Office Space Development", Tweksbury Symposium 1970. University of Melbourne.

5. The Journey to Work Survey 1966. Commonwealth Statistician. Tabulations produced by the Sydney Area Transportation Study (available through the State Planning Authority of N.S.W., Sydney, 2000).

6. Abstracted by the Sydney Area Transportation Study from the New South Wales Statistical Yearbook 1969, and publications of the Bureau of Census and Statistics, Canberra.

7. Brain, R., "The Role of the Private Bus Operator in the Urban Passenger Transport System". Australian Road Transport Federation, Canberra.

8. Brain, R., "Residential Distribution in Sydney", (in preparation).

(Sydney, Melbourne, Brisbane, Adelaide, Perth and Hobart).[9]

TABLE 2

JOURNEY TO WORK, MAY 1970

MODE OF TRAVEL	SYDNEY %	SIX CITIES %
Public Transport	36.7	30.6
Train	19.8	14.5
Bus	15.7	13.1
Ferry (and Tram)	1.2	3.0
Car	53.4	59.1
Driver	43.4	47.1
Passenger	9.9	12.0
Cycle	0.4	1.2
Walk	7.9	7.8
Other	1.6	1.3
All Modes	100.0	100.0

Since about 85% of workers in the CBD travel by rail and bus – equivalent to about 17% of the total workforce – it is clear that, for travel to other than the CBD, less than 25% of workers use public transport.

Since May 1970 there has been a dramatic rise in public transport fares across the board by about 50%. There is some evidence that patronage may have fallen a further 15% with the decline less marked in CBD travel than elsewhere, suggesting that only 1 in 5 of all workers outside the CBD uses public transport for his journey to work with the use of rail very modest indeed.

1.7 The "journey to school" – which one would expect almost wholly oriented to public transport – shows a substantial reliance on private transport with little of the traffic handled by train – the traditional "mass-transit" medium.[9]

9. "The Journey to Work and School", May 1970. Commonwealth Bureau of Census and Statistics, Canberra, 1972.

TABLE 3

FULL-TIME STUDENTS WHO TRAVELLED TO SCHOOL BY MODE OF TRAVEL MAY 1970

MODE OF TRAVEL	SYDNEY %	SIX CITIES %
Public Transport	37.6	28.3
Train	7.5	5.0
Bus	29.9	21.8
Ferry or Tram	—	1.5
Car	12.8	16.0
As Passenger	11.4	14.0
Bicycle	1.8	7.5
Walked	47.3	47.8
All Modes	100.0	100.0

Thus it appears that, while the school trip is public transport oriented, it is not a form of traffic which it would be easy to attract to any new rail-oriented medium.

1.8 At least part of the overall problem is due to the very rapid growth of Sydney and the comparatively small change in the railway network since 1900 AD.[10]

TABLE 4

POPULATION OF THE SYDNEY AREA (METROPOLIS AND STATISTICAL DIVISION) 1861–1971

CENSUS DATE	POPULATION		% SYDNEY
	Sydney	N.S.W.	
	(Metropolis)		
7th April, 1861	95,789	350,860	27.3
2nd April, 1871	137,586	502,998	27.4
3rd April, 1881	224,939	749,825	30.0

10. Winston, D., "Sydney's Great Experiment", Angus & Robertson, Sydney, 1957.

Table 4 – continued

CENSUS DATE	POPULATION		% SYDNEY
	Sydney	N.S.W.	
	(Metropolis)		
5th April, 1891	383,333	1,127,137	34.0
31st March, 1901	481,830	1,354,846	35.6
3rd April, 1911	629,503	1,646,734	38.2
4th April, 1921	899,059	2,100,371	42.8
30th June, 1933	1,235,267	2,600,847	47.5
30th June, 1947	1,484,004	2,984,838	49.7
30th June, 1954	1,582,759	3,423,529	45.9
	(Stat. Div.)		
30th June, 1954	1,938,016	3,423,529	56.6
30th June, 1961	2,303,464	3,917,013	58.8
30th June, 1966	2,541,307	4,233,822	60.0
30th June, 1971	2,799,634	4,589,556	61.0

It is difficult to assess how many travellers might use public rather than private transport for their journeys in areas where currently no rail service operates, but general lack of support for travel outside the CBD indicates that the volume may not be large.

1.9 Even this statement requires qualification. Examination of the 1966 "Journey to Work" Survey revealed that there was about 44% of the total population in the workforce and that, even in areas which could be considered residential in general character, there was still approximately one full-time job for every four people or 55 jobs for each 100 resident workers.[11] Thus, a reasonable split of employment distribution based on the present pattern is:

Central Business District (Sydney)	20%
Residential Area Jobs	55%
Jobs in Industrial Centres and Clusters outside the CBD	25%

However, in the opinion of Colin Clarke[12] and others, the CBD workforce growth is highly unlikely to keep pace with population growth of cities in Australia while there is increasing tendency for employment to migrate to areas readily accessible to the motor car. There is thus some evidence that the type of mass transit

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11. Brain, R., "Suburban Job Density in Sydney". *Royal Australian Planning Institute Journal*, Vol. 9, No. 3. pp. 111-113.

12. Clarke, C., "Urban Throttle".

system suitable for travel to the CBD may differ profoundly from that suitable to the non-CBD clusters and that no system is likely to replace the private car and local bus – or their AD 2000 counterparts – for the jobs in residential areas.

2. *The Motor Car*

2.01 No discussion on Mass Transit 2000 AD can be considered valid without considering complementary developments in the motor car. This endearing monster enjoys a love/hate relationship with its owner far beyond any other inanimate – and sometimes animate – object. The reason is not hard to find – the motor car represents the closest approach to the perfect medium of private transport ever conceived and, notwithstanding its undoubted disbenefits, at a social and personal price most people are willing to pay.

2.02 The ideal form of personal transport is one which is, indeed, personal so that the user does not need to rely on the convenience and willingness of some other person. Such a device would occupy no space when not in use and when needed be instantly available, to whisk one to the desired destination at the speed of light, at negligible cost and without hazard or pollution.

The motor car comes much closer to this ideal than many are willing to admit. The average motor car in New South Wales travels about 8500 miles per annum – equivalent to walking about 10 hours per day at 3.5 miles per hour for 250 days of the year – there is already one car for every three persons and most cars are driven without any other occupant than the driver. It is only where the motor car departs very markedly from the ideal that its value becomes subject to question and it is in these fields where the maximum profit to the community might stem from design.

2.03 Figure 3 illustrates the increase in registered car ownership per head of population in New South Wales between 1950 and 1968 projected to the year 2000 AD on the basis of a potential saturation ratio of 0.50 cars per head, 0.55 cars per head and 0.60 cars per head of population. In the analysis referred to[13] the computed saturation ratio was 0.585 and, on the evidence available for car-acquisition between 1948 and 1968 – the range used to make the forecast – a drastic increase in price of vehicles would be necessary with respect to real income before marked departure from the forecast levels could be anticipated.

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13. Brain, R., "A Forecast of Car Ownership in New South Wales". *Royal Australian Planning Institute Journal,* January, 1970.

2.04 The major problems created by the motor car today are congestion, parking, accidents, noise and air pollution and in view of the pressures currently exerted by society it is to be expected that profound changes will be made to the vehicle in an attempt to overcome these problems without necessarily altering either the basic concept or general performance. Some of the changes which might take place would attack several problems at the same time and erode the potential functions of mass transit.

For example, one could reduce air pollution in a number of ways, including development of "mixed power-mode" systems. Most linear motors need to pick up power from a conductor but there is, in current development in N.S.W. and possibly elsewhere, a system where the power is applied to the fixed part of the motor with only a small amount of power used on the vehicle. It would be possible with such a system to drive from home to the main highway system under independent power mode and use linear motor electric propulsion for the rest of the journey, with only a small amount of power drawn via the car alternator. Such a system would also permit the spacing of vehicles in a lane at perhaps 5000 per hour in complete safety[14] and erode some of the arguments currently used to support mass-transit systems and against the motor car as we know it today.

In view of the scale of the motor-car industry throughout the world it is inconceivable that a substantial number of the present, environmental porblems of the motor car will not be overcome, at least to the level of social tolerance if not to social desirability.

3. *Other Road Traffic*

3.01 If the motor car is possibly replaceable by an alternative passenger mode it can be regarded as a potentially-marginal form of traffic on the road. The question that then arises is "can we then treat the remaining traffic as potentially replaceable and so abolish completely the need for roads."

This may not be so fanciful as first appears since a substantial proportion of the social benefit of a road system as computed using current techniques stems from use outside the commuter peaks.

3.02 A number of linear systems have been proposed which seek to handle all traffic in unitised load form. For example, there is no reason why a feeder bus could not drive to the line-haul system, travel "piggy-back" as a unitised load of passengers on the line-

14. Brain, R., "Rapid Transport in an Urban Environment". Institution of Engineers, Australia. Sydney Division. July 1972.

haul system in exactly the same way as a containerised load of washing-machine components and distribute its passengers as a feeder bus at the other end. The great advantage of such a system would be that the vehicle could be designed primarily for its feeder-bus function but also enjoy the advantages of high-speed long-range haul.

However, such a method would not abolish the need for highways, all that it would do would be to replace the highway in those locations where the highway is relatively efficient and, in addition, call for a system operation control of great complexity.

3.03 The need for highways might be reduced by using for goods distribution a system very similar to the semi-trailer:

(i) an air-cushion-support trailer
(ii) a rubber-tyred tractor.

However, the system would still require a right-of-way width adequate for the purpose and a surface over which both the air-cushion trailer and the rubber-tyred tractor could travel and a means of calling and returning the tractor and trailer. Given our existing cities and planning strategy, which will effectively dictate how development can take place for the next half-century one is forced to the conclusion that the road will be with us by 2000 AD and that its purpose for goods distribution, as opposed to line-haul, will be very much as today.

3.04 However, if the road is to remain with us as a distribution system for goods traffic the motor car will be a marginal addition to the road traffic. This being so, **the question to be answered is whether it will be more desirable to increase the road system or provide a public transit system for all or part of the line-haul person-movement.**

4. *The Place for Transit*

4.01 The following is a typical "popular presentation" for the case for rapid-transit:[15]

> "The proposed rapid-transit system, already in use in Germany and America, would cost under $60 million to develop, according to the anti-expressway committee.
>
> "The expressway system would cost the taxpayer $201 million in the next five years.

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15. Sydney Morning Herald, Wednesday, February 9th, 1972.

"The rapid-transit system would carry a peak-hour load of 16,000 people an hour, compared with 1,500 an hour on one lane of an expressway.

4.02 Such a presentation is unfortunate because, apart from gross overstatement of the case, it raises a number of basic issues where the merits of rapid transit are open to question:

(i) why only Germany and America and would it indeed cost only $60 million – BART will cost at least $1000 million?

(ii) is it desirable to compel 16,000 people an hour to travel the line at peak period and, if so, are there other systems which can convey more people?

(iii) will one lane of an expressway only carry 1,500 people an hour and under what conditions of travel compared with mass transit?

(iv) what additional functions will the mass transit system perform compared with the expressway and vice-versa?

4.03 The cost of providing right-of-way for a rapid transit or mass transit system is always appreciable although it does not require as much space as an expressway. However, it is often more difficult to locate, as many American cities are finding to their cost, and indeed the preferred location is along the median strip of an expressway where **functions are duplicated.**

In the particular instance quoted in para. 4.01 the proposed route was the freight line to Darling Harbour, Sydney. Had an independent route been selected the land acquisition costs would have been considerable. No mention is made of the compatability of the rapid transit system and the freight traffic.

4.04 The protagonist of rapid transit usually implies a virtue in handling 16,000 people an hour on a transit line, particularly in relation to commuters. This is sometimes taken to the extreme of deliberately concentrating office activities, etc., instead of dispersing on the grounds that "it will support a transit line."

A particular phenomenon of the twentieth century is the growth of the commuter who *Punch* once described as "a hardy traveller of long standing." It is a moot point whether the development generates the transit line or the transit line the development and it is at least possible that, by the year 2000 AD, society will be unwilling to tolerate the long journey to work in exactly the same way that it is now no longer willing to tolerate other erosions of environment.

4.05 If one takes the "State of the Art Car"[16] as the criterion and assumes a peak-hour capacity of 32 trains per hour, this gives an individual train capacity of 500 persons. The "car No.2 seating plan" allows 72 seated passengers per coach so that a 6-coach set would handle 432 seated and 68 standing. Power demand constitutes 4 – 175 hp motors per coach plus 125 KW auxiliaries – equivalent to over 1000 KW per coach or 6000 KW per set; with 10 coaches as in the BART system the demand would be 10,000 KW per set. One of the hidden costs of rapid transit is that of power supply; with the Manly-Warringah railway, for instance, a major obstacle is the inability of the local supply system to tolerate the 1000 KW **total** load of individual sets – and a 6000 KW or 10,000 KW system would raise proportionately greater problems.

4.06 Conversely, if instead of 1600 cars per hour with only one occupant – or 3200 cars per hour per lane such as is regularly achieved on the M4 motorway in West London – the track was given over to express buses, a much higher capacity is attainable. Taking a limiting capacity of 500 buses per hour and 64 passengers per bus (all seated) – both reasonable assumptions – the bus transit line could handle 32,000 persons per traffic lane or double the mass transit capacity at present levels of technology. The bus has the further advantages of flexibility, ability to use existing rights of way and not requiring a huge outlay on a special right of way before introduction, while the complementary terminal problems are also easier to handle.

The rapid and mass transit rail proposals usually call for special-purpose rolling stock, sophisticated signalling and low-standard clearances which render the route usable only by passenger-carrying rail-sets. By contrast the exclusive bus lane on an expressway can be made available for exclusive commercial vehicle use outside the peak at trifling cost.

4.07 The above is not to be construed as implying that there is no place for railed rapid transit in the 2000 AD system, but that many of the usual arguments advanced to support rapid transit proposals will often give even stronger support to bus routes on their own right of way. This will be of still greater import if the expected developments in private car design are continued into public transport road vehicles.

4.08 The true mass transit such as the Sydney Circle line is in a much stronger – though not always unassailable – position, since there is no effective competition from the bus. However, its value is a maximum where there is a high level of demand for access

16. "The State of the Art Car – Transpo 1972". Boeing Company, Vertol Division, P.O. Box 16858, Philadelphia, Pennsylvania. 19142.

requiring frequent stopping and starting, resulting in a very modest overall journey speed, if station dwells are at all prolonged (Figure 4). From the viewpoint of the user access to the system should be virtually continuous in space and time while from the Operator's viewpoint a modest continuous speed is much to be preferred. A further problem is that, as more trains enter the system, the problem of continuous progression becomes more intractable and may require trains to be withdrawn from service to create spaces into which following vehicles can move. Moreover, while on the rapid transit system one needs ample seating and high inter-station speeds, the main requirement on a mass transit is for a large number of quick-operating doors and ample space adjacent thereto to aid egress and ingress.

A theoretical solution is to link all trains together on the Circle Line (say) and run at a uniform speed applying power from outside the system. The walls and ends of the coaches can be knocked out, all seats removed and access allowed at frequent intervals along the length using parallel "half-speed" or "third speed" stages. Allowing 2½ mph speed increments a two-stage moving pavement would have a linear speed of 5 mph – allowing with a 3 mph walk speed a total speed of 8 mph continuous and a pavement capacity of the order of around 5000 persons per 2 ft. lane per hour using a 6 ft. mean spacing and a mean space speed of 6 mph. This is not to imply that all mass transit systems will be replaced by moving pavements but that there is a specific area which mass-transit tries to fill and which can be handled far more effectively by moving pavements. It should be noted that a moving pavement need not be at street level nor in the street right-of-way width; indeed, its ideal position is centrally down the middle of a block of shops and offices at basement level subject to this not being used for car parking.

4.09 The (central-city) mass-transit is also under attack from another quarter, namely the introduction of "common-user, self-drive road vehicles." A number of these devices have been put forward ranging in sophistication from the "white-bicycle" used in Belgium to magnetic or ultrasonic-key activated electric powered vehicles. There are three basic problems with this system which might restrict its use:

(i) It is open to vandalism and theft.

(ii) At time of maximum demand all vehicles are being driven away from the centre of generation i.e. away from the railway station to park at a location convenient to the last user but perhaps highly inconvenient to the next potential user.

(iii) The cost of installation and operation is likely to be considerable and will be reflected in the price charged for use. However, traditional taxi fares are rising – in New York the current fare is 50 cents flagfall plus $1.00 per mile – and each rise brings self-drive vehicles closer.

4.10 It could be argued that this leaves no slot for railed transit of any significance and this is probably true if there is to be no need to go more than a short distance to work. However, given the continued importance of the city centre and major centres such as Parramatta in Sydney it is possible to identify the most effective sectors for mass transit and rapid transit and where these are likely to be economically justified. These are:

(i) The city centre using a true mass transit system and station spacing of about 1 Km, supplemented by moving pavements, self-drive taxis, etc. A scale factor is involved insofar as the justification in cities of less than 1 million population may be marginal; with cities of 5 million population it will probably be essential.

(ii) Radial "rapid transit" routes directed at the CBD from the outlying suburbs and used essentially by the white-collar commuter. Some diversion may be desirable to take in major centres but it seems unlikely that these will be able to sustain independently a rapid transit rail system on its own right of way. Again, it is a matter of scale and case of provision with the express bus operating on its own right of way or using exclusive lanes a very serious – and inexpensive – competitor.

5. *Performance and Hardware Selection*

5.01 Performance and its relation to initial acceleration, station spacing and station dwell were dealt with at length in the recent paper "Rapid Transport in an Urban Environment".[14] The following is a summary of the conclusions drawn:

(i) On a rapid transit system subject to a maximum speed of 80 mph there is very little to be gained by using high acceleration rates provided stations are spaced at intervals of 2 miles or more (Figure 5). On the other hand, power consumption rises very rapidly with high acceleration rates. It is reasonable to conclude that the currently favoured 3 mph/second accelerations probably represent the upper limit of what is likely to be proposed for 2000 AD rapid transit.

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14. Brain, R., "Rapid Transport in an Urban Environment". Institution of Engineers, Australia. Sydney Division. July 1972.

(ii) For close station spacings the time saving on a station-to-station basis is small for high acceleration rates with the major gains stemming from reduced stop time and wider spacing of stations. Under these circumstances greater benefit should accrue from providing rapid ingress and egress facilities on trains and platforms than from high-acceleration rolling stock.

(iii) Human beings are subject to Newtonian gravitation laws, a standee lady passenger of 8 stone being subjected to a force of about 15 lbs under a 3 mph/second acceleration or deceleration. It is possible that 3 mph/second will be acceptable only if all passengers are seated.

5.02 There is much ill-informed comment on the advantages of the more exotic "new technology systems" as though a change in technology automatically results in a change in system characteristics. For example, the monorail is still a linear system like the railway and subject to the same fundamental limitations. The magnetic levitation train and the guided air-cushion support vehicle are similar variants of the monorail and duorail linear systems except that the wheel is replaced by an alternative form of support and traction does not depend on friction.

There are many problems with new technology systems. With monorails the major problems are switching and the damping of lateral oscillations, with air-cushion vehicles the support power required is about 12 KW per ton, with magnetic levitation the problem is controlling the air gap between the two magnetic faces while the linear motor also suffers the same problem regarding the air gap. In the case of levitated vehicles power drawn to sustain a stationary vehicle is considerable while there is also the problem of "fail-safe" in the case of electricity-supply failure, usually involving wheels and friction applied to the fixed rail.

On the evidence available today there seems to be no substitute for the wheel below 150 mph – the selection of steel-on-steel flanged-wheel duorail or rubber-tyre on concrete being dependent upon a number of factors including drag, quietness, etc. If any system is to take over from the wheel for rapid transit use the magnetic-support vehicle probably has the advantage.

5.03 A great deal can be done to improve system capacity and, to a lesser degree, performance on the existing system of suburban rail in Sydney. Insofar as investment in the existing system is very substantial, the present structure will dictate to some large degree what the system will be in the year 2000 AD since it is inconceivable that it will be entirely dismantled. In Paris, for example, the Metro is currently being re-equipped with rubber-tyred vehicles to replace the existing steel-wheel rolling stock;

the resultant system is merely the old Metro on rubber-tyres, not some new system entirely. Computerised control has been introduced to improve operational performance and computerised control is being introduced on all new major "Metro-type" systems such as Mexico, Washington, BART, etc., without, however, changing the basic system design. Such computerised control, upgraded in technology but basically unaltered in concept is likely to be a standard feature of 2000 AD transit systems.

5.04 In essence, therefore, one must conclude that 2000 AD will still be a wheel-oriented society, that the motor car – in terms of a self-propelled passenger-carrying capsule of small dimensions – will continue to dominate city growth and travel, that dramatic improvements in performance of public transport vehicles are unlikely and that the major improvements in city transit systems will stem from making better use of investment.

Society cannot expect to solve its motor car pollution problems of today on the basis that, if one waits long enough, they will go away because everyone will be using transit; rather it should operate on the basis that transit is merely an expedient to handle a particularly unsatisfactory distribution of residences and work-places and that the need for transit may eventually disappear. In the words of the South East Study:[17] "In theory, commuting implies a deliberate choice by individuals of a daily journey to work in a city in order to have a home outside it. But for most people who work in central London today, commuting is no longer a matter of choice; and, at its worst, it can be one of the most wearing and unpleasant features of urban life."

Insofar as commuting may not be avoidable in the year 2000 AD, well-designed transit systems may do much to make the central city journey to work more tolerable than it is today.

S.0 ***Summary***

S.1 The paper looks at the ever-changing pattern of city development and the difficulties facing long-term fixed-element systems such as rail in trying to resolve essentially dynamic problems. It would appear in Sydney that, for the journey to work, only about 1 in 5 use public transport if CBD workers are excluded while there is almost negligible reliance on rail for the journey to school. From the evidence available the CBD workforce is likely to decline in terms of total persons employed thereby eroding further the likelihood of transit carrying the major proportion of the "journey to work" traffic.

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17. "The South East Study, 1961-1981". Ministry of Housing and Local Government H.M.S.O., London, 1964.

S.2 The idealised form of personal transport is discussed and it is shown that the motor car tends to come reasonably close to the ideal. Motor cars continue to be acquired at a predictable rapid rate and it is to be expected that changes in design to counter current adverse criticisms of pollution, etc., will make the vehicle more socially acceptable while it may take on some of the characteristics of linear transit systems.

S.3 In current economic analysis the bulk of the benefit from a road system stems from use outside the peaks, mainly from commercial vehicular traffic. A brief examination is made of handling freight distribution by means other than road and it is concluded that this is improbable before the middle of the next century. But if the road is to remain for freight traffic the motor car will be a marginal addition only leaving the question to be answered "will it be more desirable to increase the road system or provide a public transit system for all or part of the line-haul person movement?"

S.4 The place for transit is analysed on the basis of the "popular presentation" and it is shown that, with many of the arguments advanced, the express bus on its own exclusive lane or right of way may be a better proposition. Rapid transit has no intrinsic merit apart from servicing the long journey to work – a phenomenon which the transit line tends to stimulate – and it is at least possible that, by the year 2000 AD, society will be unwilling to tolerate this type of journey.

Rapid transit systems are very large users of electric power and tend to be built with less-than-standard clearances, hence their use outside peak periods for commercial traffic is severely restricted. By contrast, the true mass transit is in a much stronger position with such projects as moving footways and common-user self-drive road vehicles tending to reinforce the pattern.

It is concluded that, in the centre of large cities there will always be a place for the truemass transit system and that the rapid transit system will probably continue as a high-speed radial link to the CBD for white-collar workers, although with severe competition from express bus.

S.5 On a rapid transit system subject to a maximum speed of 80 mph no appreciable gain in overall performance is achieved with high accelerations. Similarly, on a mass transit system, major time savings stem from reduced station dwell and wider spacing of stations.

"New technology" systems do not change the basic system characteristics and, on the evidence available today there is no substitute for the wheel below 150 mph with magnetic levitation the only likely substitute for rapid transit.

It is concluded that 2000 AD will still be a wheel-oriented society strongly dependent on the motor car, that dramatic changes in performance of public transport vehicles are unlikely and that major improvements in city transit systems will stem from making better use of investments.

Sydney Area Transportation Study,
New South Wales

R. Brain

FIGURE 1

GROWTH OF TOTAL OFFICE FLOOR SPACE IN THE CBD

1957-1972

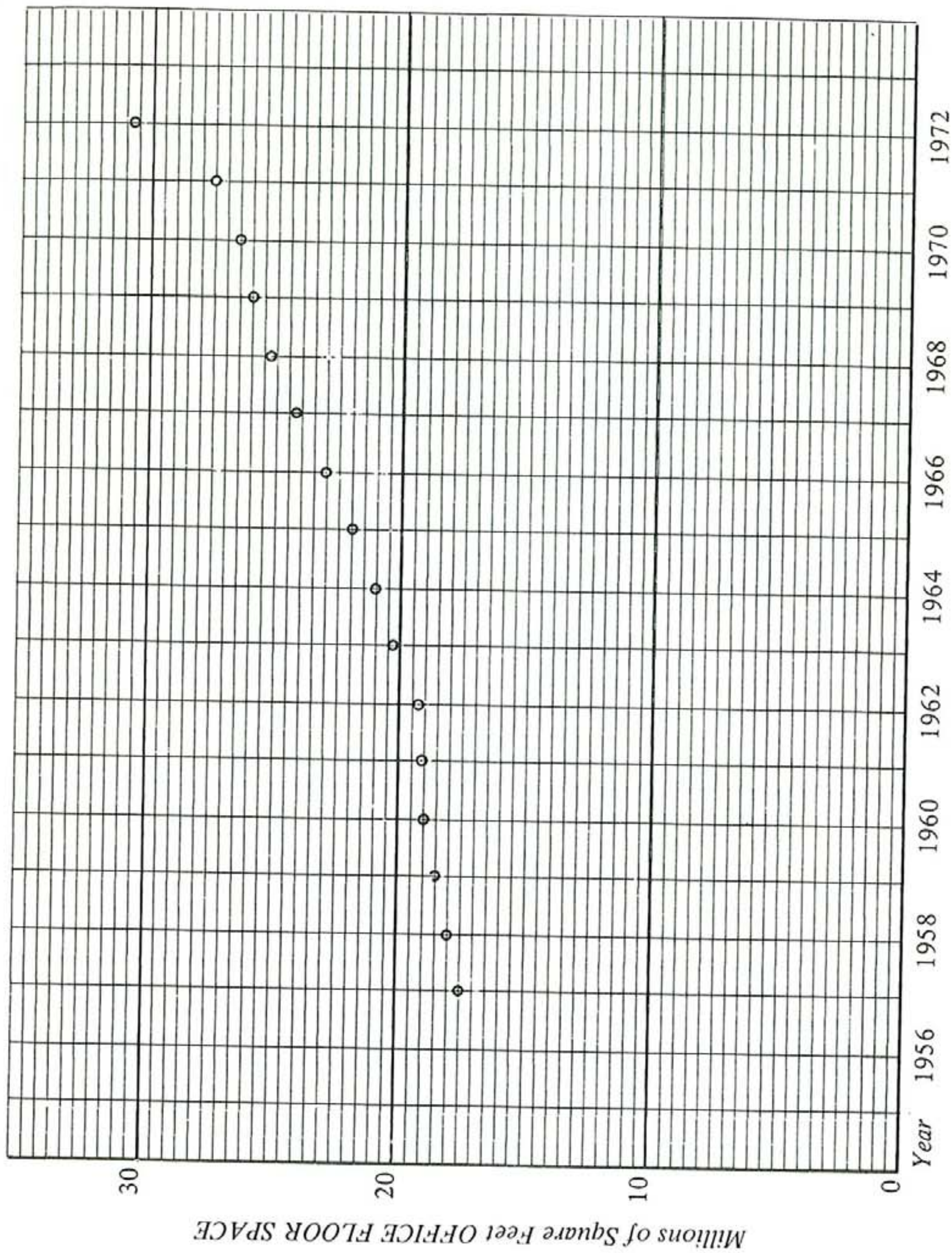

FIGURE 2

RELATIONSHIP BETWEEN AVERAGE GROSS RESIDENTIAL DENSITY AND DISTANCE FROM THE G.P.O. SYDNEY (AIRLINE MILES) 1947 AND 1971

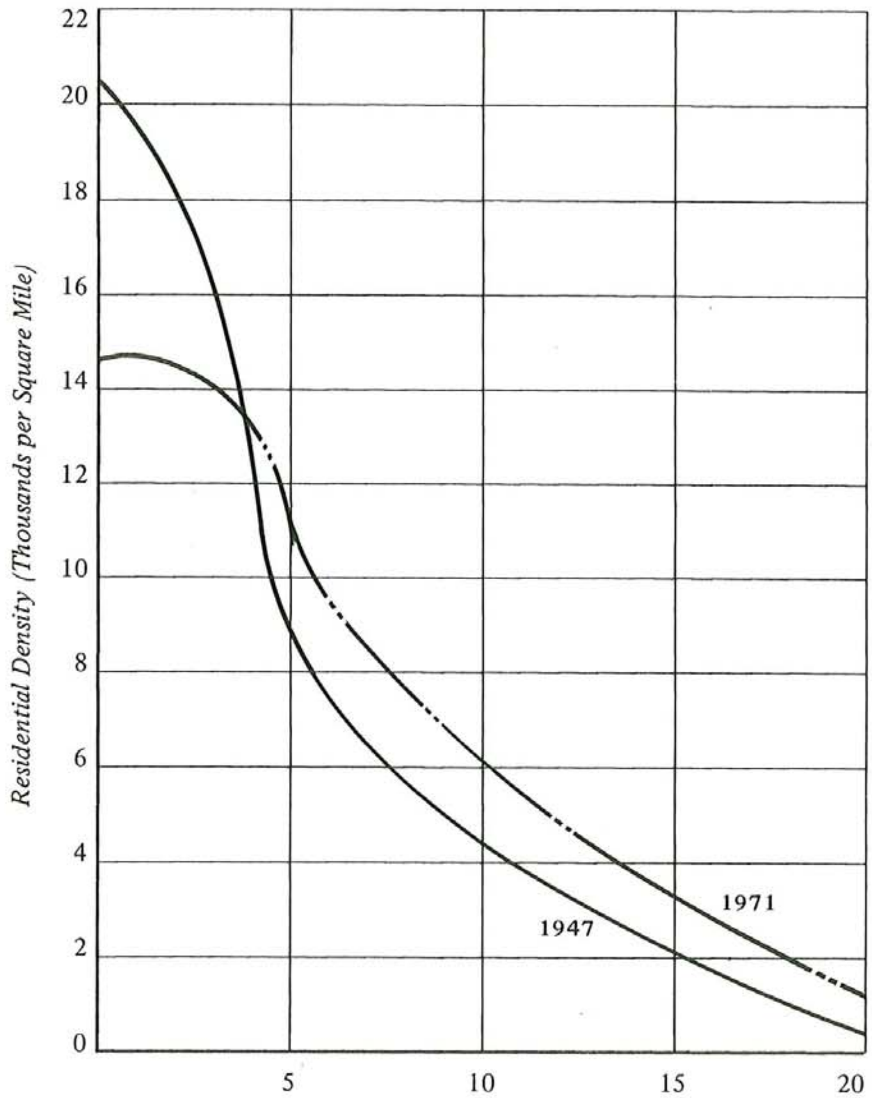

FIGURE 3

CAR-OWNERSHIP IN NEW SOUTH WALES (REGISTERED VEHICLES PER HEAD OF POPULATION) 1950-1968 PROJECTED TO THE YEAR 2000 A.D.

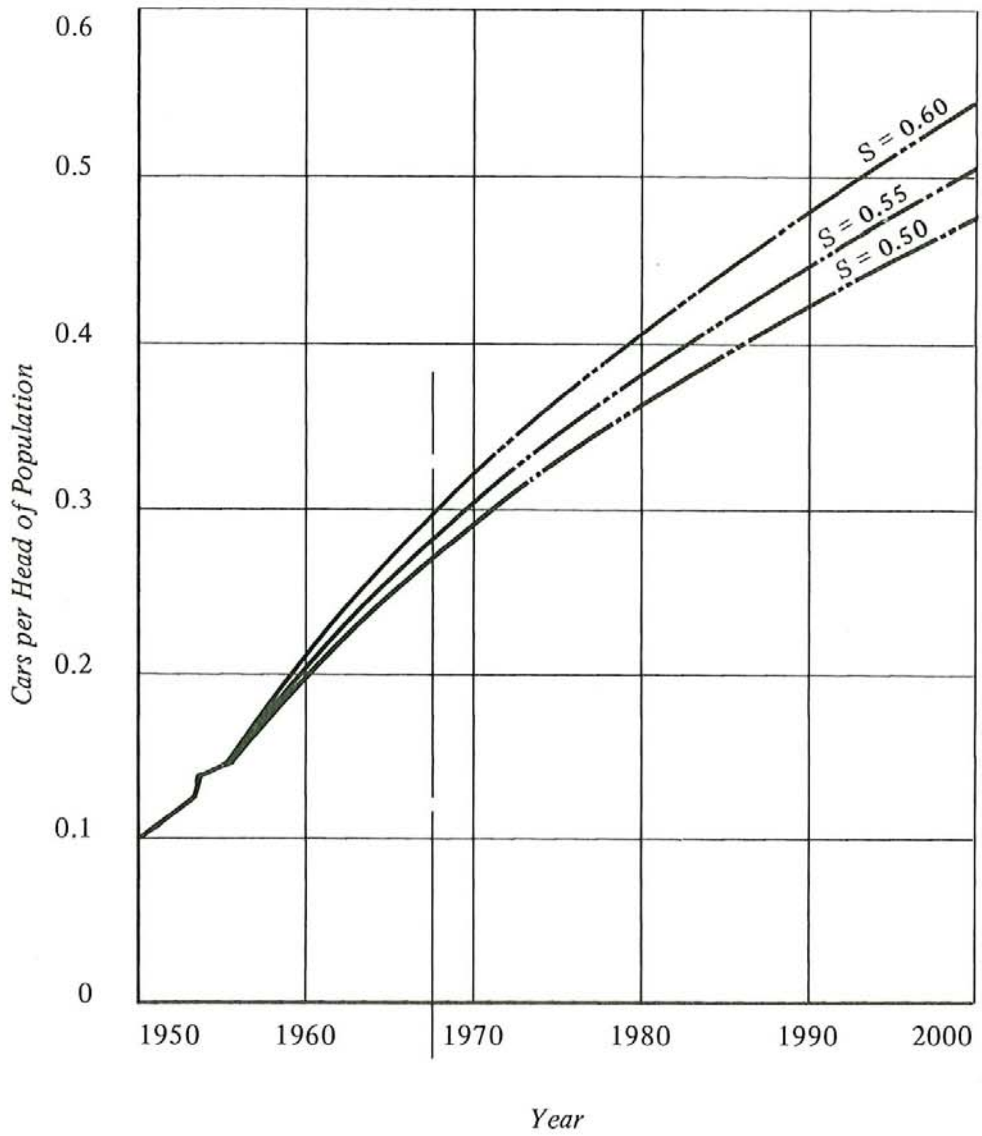

FIGURE 4

EFFECT OF STATION DWELL ON MEAN JOURNEY SPEED

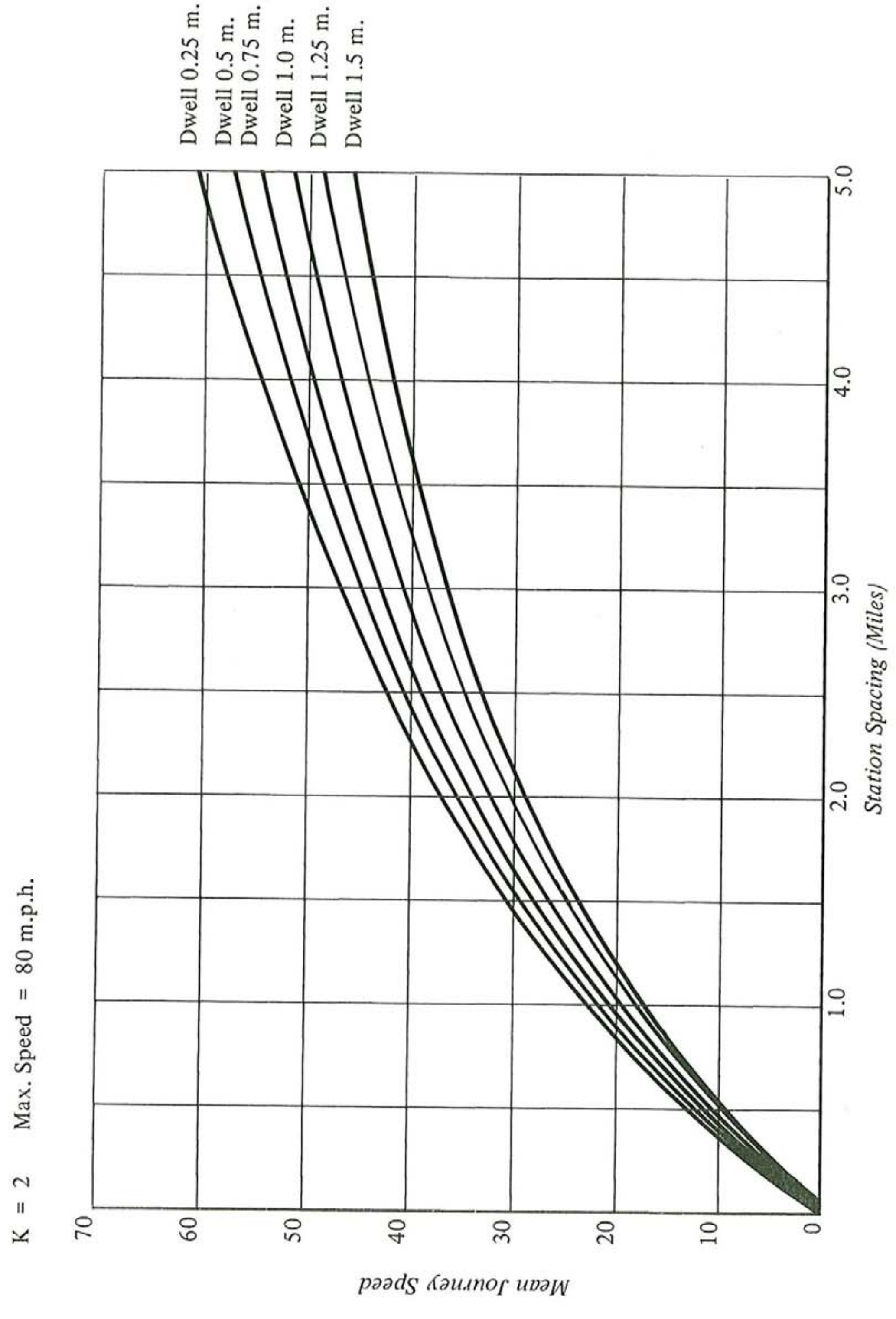

FIGURE 5

EFFECT OF K (INITIAL ACCELERATION) ON MEAN JOURNEY SPEED

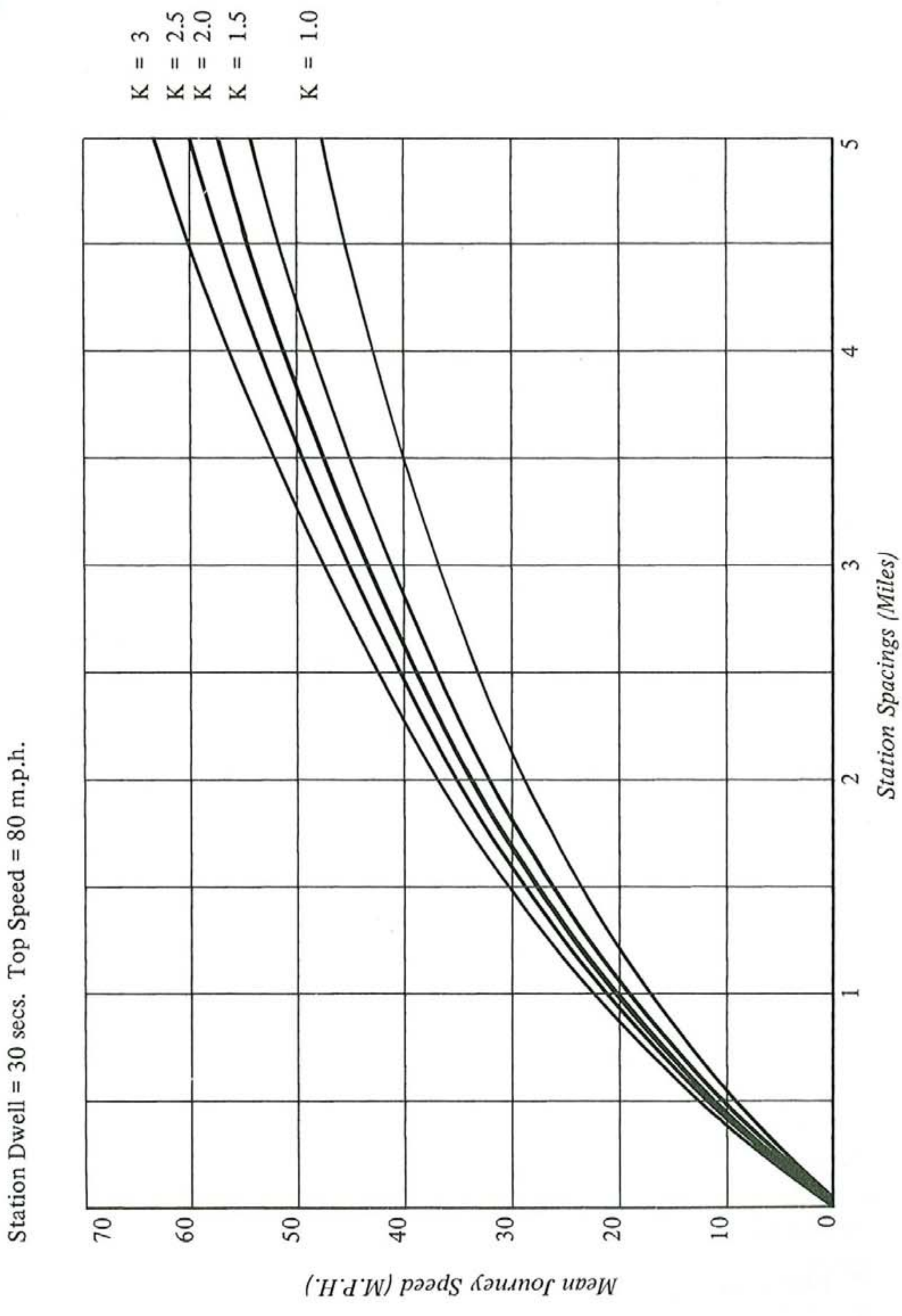

TABLE 4
POPULATION OF THE SYDNEY AREA
(METROPOLIS AND SYDNEY STATISTICAL DIVISION)
1861-1971

L.G.A. Area Population (Thousands)					1966 UCV $ mill	1966 Cars per 1000	Total resident work force	Jobs in L.G.A.		Main Bus Service
Name	sq.m.	1947	1961	1966				Total	Taken by Residents	
Ashfield	3.2	44.7	39.7	41.9	40.1	217	19,965	10,333	2,977	Gov
Auburn	12.2	41.8	49.0	48.7	76.9	231	21,967	37,332	8,277	Priv
Bankstown	30.0	42.6	152.3	160.0	204.2	248	69,324	50,904	23,047	Priv
Baulkham Hills	147.1	6.8	16.6	33.5	53.7	338	13,266	5,275	2,387	Priv
Blacktown	99.4	10.2	65.5	111.5	92.4	241	42,255	17,161	11,192	Priv
Botany	6.9	27.4	28.9	31.8	67.3	240	15,867	30,626	5,471	Gov
Burwood	2.8	34.3	31.1	31.8	56.3	216	14,419	10,553	2,452	Gov
Canterbury	12.9	99.4	113.8	115.7	141.8	262	53,940	25,204	10,502	Gov
Concord	4.2	29.4	27.4	27.0	45.4	244	12,220	14,425	3,151	Gov
Drummoyne	3.1	33.0	30.2	30.6	39.7	265	14,557	9,817	3,061	Gov
Fairfield	37.2	27.0	80.7	101.2	72.7	224	41,210	15,415	8,478	Priv
Holroyd	15.2	24.1	56.4	65.8	71.0	254	28,228	12,976	4,532	Priv
Hornsby	198.0	27.7	54.3	81.2	136.6	303	31,144	10,763	6,605	Priv
Hunters Hill	2.2	11.5	13.5	14.2	13.3	277	5,599	3,154	871	Priv
Hurstville	9.6	33.9	61.0	64.9	98.4	297	28,902	16,653	5,623	Priv
Kogarah	7.5	39.3	46.6	47.6	94.7	320	21,637	7,918	2,968	Priv
Ku-ring-gai	31.6	39.9	74.8	86.7	160.1	359	32,315	12,146	6,248	Priv
Lane Cove	4.0	19.8	23.7	25.1	45.1	324	10,955	7,154	1,758	Gov
Leichhardt*	3.9	70.3	62.0	59.3	38.0	162	27,240	24,708	8,567	Gov
Liverpool	121.2	13.7	26.3	68.9	71.1	185	23,619	15,241	7,692	Priv
Manly	5.9	33.8	36.0	38.1	83.7	273	16,257	7,853	3,890	Gov
M'ville*	5.7	88.7	75.3	76.8	95.5	167	37,416	31,619	9,080	Gov
Mosman	3.4	27.6	26.1	28.1	57.6	299	13,483	5,608	2,537	Gov
Nth.Sydney	4.0	60.4	53.0	51.7	75.0	245	26,928	25,348	6,520	Gov
Parramatta	19.1	61.7	104.0	107.0	179.1	241	44,767	49,663	15,101	Priv
Randwick	13.3	100.9	108.8	113.6	109.1	228	52,210	24,247	12,813	Gov
Rockdale	11.3	74.2	79.1	81.5	124.4	285	38,265	19,316	7,773	Gov
Ryde	15.5	40.5	75.6	81.3	93.0	285	34,279	19,451	8,710	Gov
Strathfield	5.4	24.3	26.4	26.7	39.3	274	11,668	15,665	2,014	Gov
Sydney*	11.2	213.9	172.2	159.2	566.3	113	73,582	389,109	51,384	Gov
Warringah	101.8	32.9	94.4	121.5	203.6	323	49,391	23,801	18,899	Gov
Waverley	3.5	74.8	65.0	63.6	102.1	230	31,838	9,136	5,321	Gov
Willoughby	8.6	51.9	53.7	54.5	77.9	301	24,419	22,638	6,635	Gov
Woollahra	4.2	54.3	48.0	47.3	117.8	313	22,786	11,543	4,675	Gov

* 1966 figures prior to boundary change

Source: 1966 Journey to Work Tabulation 1a (7)
N.S.W. Statistical Bulletin March 1967 (8)

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