Are you getting all you should? appropriate levels of bus service

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Abstract:

The paper reviews the framework developed for establishing levels of appropriate bus service in the Sydney Metrotropolitan area.

The approach considers (and eventually merges) aspects of demand (existing needs of the population) with those of supply (characteristics of commercial bus operations).

A novel approach to quantifying appropriate levels of service from the supply side was to examine "best industry practice" in two sample areas and compare demand with service levels achieved. Service levels were modelled using regression analysis and the model applied to all private bus operations in Sydney to predict appropriate levels of service. The policy implications of this approach are discussed.

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Introduction

Bus service provision in different areas varies immensely. What level of service should you get? This paper reflects research into the "minimum" and "appropriate" levels of bus service to help establish levels of service standards in the Sydney Metropolitan area.

The work undertaken went through four main stages:

* a literature review, social research and discussions with bus operators leading to a definition of "minimum" service levels. This work was carried out by Ove Arup Transportation Planning in association with Ampt Applied Research;
* investigation of "appropriate" levels of service through analysis of key characteristics of service levels, population and public transport trip rates in two areas regarded by the industry, as having good levels of service. This research built on the earlier work and was carried out by Colston Budd Hunt and Twiney in association with Ampt Applied Research;
* development of a statistical model formalising the relationship between variations in level of bus service in the two study areas and key variables previously identified. This work was carried out by the Department of Transport;
* integration of research results into Government policy and planning.

Definitions

"Minimum" Service Levels: Early on it became clear that there were no agreed definitions of what was a "minimum" or indeed what was a "service level". Two approaches are apparent.

A supply side approach (generally produced by public transport operators) tends to define minimum service levels with criteria including frequencies, duration of service, distance of stops from residents and sometimes seat availability. Commonly a particular passenger loading in a particular service is also seen as a minimum below which a service should not be run.

An approach from the demand side suggests that "need for travel" is the arbiter of minimum public transport service levels and that need is concerned with a judgement about the socially acceptable level of hardship that people must face without available transport.

"Appropriate" Service Levels: Avoidance of hardship depends upon a value judgement as to what is hardship but tends to lead to comparatively low levels of service provision compared with current practise. Perhaps a more useful concept is the appropriate level of service or that level of service which may reasonably

be expected by people living in an area of particular economic and land use characteristics. In other words the industry standard for public transport service supply in different operating conditions but driven from a demand side focus.

Background

Approaches to Levels of Service in other Jurisdictions

The level of service that can be supplied in any situation depends upon a trade-off between services, and costs/revenues of supply. Some research in Canada (Dawson, 1982) suggest that resolution of this trade-off can be carried out on an iterative basis and that a desirable approach is

> ".....first by setting desirable financial targets. A set of minimum service standards is selected and desirable service standards identified for each type of service. The services are then evaluated and adjustments made to either the financial targets, minimum service standards or feasible service areas....."

The Canadian study suggested that "those areas of continuous development with population densities in excess of 1500 population per square kilometre and which are large enough to warrant transit services internal to the community" observed a base condition of .06 daily bus trips per capita.

An American approach to estimating expected fixed route bus service levels (Jarzab and Meralitz, 1983) reviewed the Northeastern Illinois Planning Commission (NIPC) sketch planning approach to public transport planning. The NIPC 1974 study concluded that "a demand level of 400 bus trips per square mile per day was necessary to support a minimal fixed route bus service (ten runs per day in each direction) and that population densities of 4000 per square mile or more could be expected to generate sufficient patronage to meet this criterion".

Some British research found that bus trip rates rise with increasing bus service frequency and fall with increasing walking time to the nearest bus stop. The deterrent effect of a longer walk also seems to increase as service frequency falls. In addition, "In the urban areas it is apparent that service frequency has a far more pronounced effect than walking distances (see Figure 1)".

In Australia the majority of the literature, particularly that which emanates from public service operators, approaches the question of minimum service levels by determining the supply parameters for a minimum level of service. Early attempts at solutions (e.g. Wilbur Smith and Associates, 1970) for Brisbane were based on three objectives:

* to shorten the journey time;
* to enhance the passengers' comfort and convenience; and
* to maintain a reasonable cost.

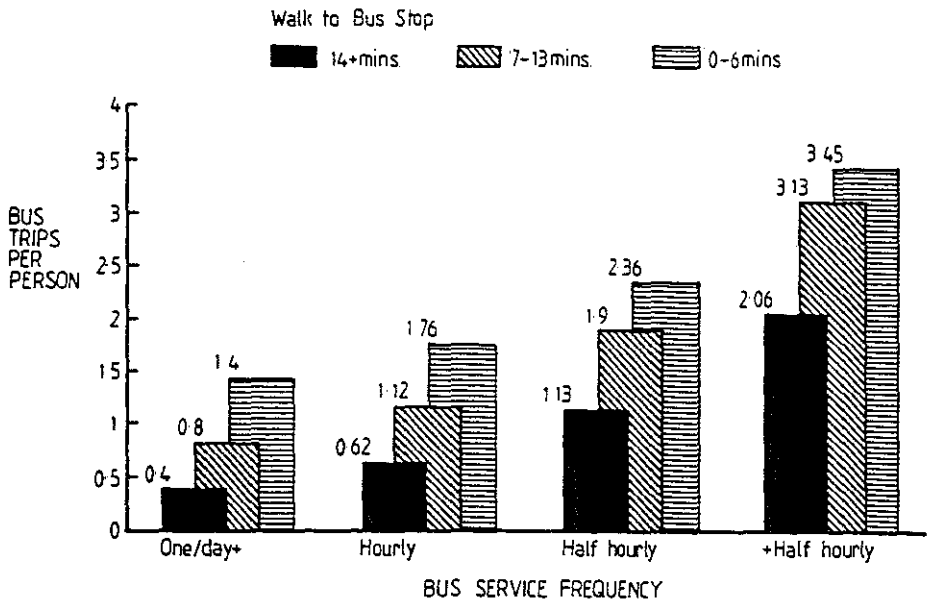

Fig.1: BUS TRIP RATES BY SERVICE LEVEL
Source: HOPKINS, JONES & STOKES (1988)

On the other hand, there are cases (e.g. Department of Territories and Local Government, 1983) where very quantifiable objectives are specified (e.g. bus stops should be 400 m from 95% of residents and 400 m from 85% of employment centres). Other studies have suggested factors such as the percentage of the transit-dependent who are served, or passengers per service area of population, or transfer opportunities per route kilometre.

"Minimum" Service Levels

Certain types of trip are needed to avoid hardship. Examples are: unemployed seeking work or visiting social security offices, housewives and aged doing family shopping, and people travelling to and from work. Since society decides where facilities such as shops/schools/employment etc. are located (through planning and other controls), there is clearly a societal responsibility to provide some level of public transport for those without car access.

Transport needs vary with different types of person, their circumstances and the types of trip they must undertake. Unfortunately, there is little widespread data available to help identify local area or groups of individuals with transport needs. Therefore, analysis must be undertaken using Census data and "proxy" variables such as age, personal income and car ownership.

Through comparison of service standards in Australia and overseas and social research in Sydney, the Consultants examined the concept of minimum levels of service to meet needs, and prepared a draft set of minimum service levels to meet the needs of the Sydney Metropolitan area. The service levels include criteria to represent both demand (i.e. who is "needy") and supply (what sort of service should be provided) and their successful application relies on the merging of both types of variable. Draft minimum service levels represent a compromise between a number of trips likely to be really needed at a given population density and the number of services that can be provided and are likely to attract sufficient patronage to require a bus.

To meet the overall needs of urban Sydney investigations suggested that the following 'minimum' supply variables apply:

*	Coverage:	95% of households within 400 m - 600 m of a route for developed areas in weekday peak periods.	
*	Route Directness:	Direct during peak periods but less direct during off-peak times.	
*	Minimum Frequency:	weekday peaks	- 2 - 3 services
		weekday off-peak morning	- 1 return trip per morning
		weekday off-peak afternoon	- 1 return trip per afternoon
		weekday evening	- 1 return trip per evening
*	Minimum Loading Standards:	dependent upon individual route/cost returns.	
*	Hours of Operation:	Weekdays/Saturday	- 6.00 am - 10.00 pm
		Sunday	- 8.00 am - 8.00 pm
*	Bus Stop Spacing:	300 m or on request.	
*	Dependability and Reliability:	99% of services to actually run and 95% to run within 3 minutes of time - never early.	

To determine specific minimum service levels which may apply to the "needy", three demand variables should be examined:

* the proportion of persons with an income less than $18,000 per annum;
* the proportion of persons 65 years of age and over; and
* the proportion of non-car owning households.

Appropriate Service Levels

It must be stressed again that the supply levels above are minimums and are below the set of services which one may expect in Metropolitan Sydney to meet normal commercial travelling demand. Indeed, while there are some areas/operators which fall below the above levels, in most areas these minimums are more than being met. In some cases private operators may cross-subsidise poorly used services, at particularly "needed" times for better used peak services. However, efficient operators also decide to provide high frequency, long duration services to reinforce commercial route operations, considering that a (cross)-subsidised passenger using a late night bus service may well add to the overall commercial market on another day. In summary, given the current level of recompense, a good operator is able, in "normal" population densities, to get a commercial return on outlay by providing a service far in excess of what is recommended as the minimum above. It follows that, if the recompense is not affected, in most cases there is no viable argument why the level of service provided should not be well above the "social" minimum level discussed here which is more applicable to isolated urban areas.

The second stage of the study was to investigate key characteristics of the levels of service being supplied in Sydney in areas generally regarded as having "good" levels of service.

Determining an Appropriate Level of Service Model

The criteria for "good" levels of service were defined in conjunction with industry and Government representatives. In general the characteristics, for weekday commuter/shopper routes, could be described as follows:

* Coverage - >85% of households within 400 metres of route;
* Hours of Operation - 5 am inbound; to 11 pm outbound;
* Frequency - minimum 30 or 60 minutes;
* AM Peak Services - minimum 2 to 4+ services;
* Route Directness - 1.1 - 1.3 times shortest road distance.

The two areas chosen were Mount Druitt and the Hills District. In these areas industry leaders are providing a full-time, seven days a week service on a commercial basis.

Trip Rate Model

The Case Studies: In practice, the dimensions of demand (or current patronage) are extremely complex and comprise many socio-demographic variables as well as requiring an understanding of the types of factor which produce and attract

trips (such as employment opportunities and residential areas). For the purposes of the current study, however, it was considered more important to gain an overall understanding of issues rather than to pursue all dimensions in-depth, and only the age and sex of patrons were considered.

Data were collected by carrying out 'classification counts' on a representative sample of services throughout the day. Surveyors travelled on buses and classified boardings by sex and age (5-15, 16-20, 21-65, and 65+).

It was possible to categorise the characteristics of the bus operations by using details from timetables and operators. These consisted of the number of runs (ins and outs) per peak, off-peak, and per day, as well as route coverage and loading estimates.

Using the classification/count data and amalgamating it with information about loading estimates and the proportion of routes actually sampled, it was possible to estimate the actual bus usage by route by age and sex. This is described in detail in the next section.

Model Development

Only Mount Druitt data will be discussed in this section.

Surveys were designed to sample as many services as possible within the study areas over different times of a weekday. Sample rates varied between 10% and 50% of services being operated. Sampled survey data were then expanded to the total population based on loading data from operators.

Operators also estimated the number of school children being carried on special school services within the study areas so that the overall private bus passenger market could be assessed.

Survey Results: The expanded results of these surveys are shown for Mount Druitt in Table 1.

The population being served by the surveyed services was estimated from maps of the area and then matched as closely as possible by Census Collector District (CD) maps. The CD's for the areas of study were then listed and the populations of each area (split by age and sex) calculated by addition of individual CD information.

The results of this process are shown in Table 2.

Trip Rates: By simple division of bus boardings by population the private bus trip rates of people are calculated as shown in Table 3.

The surveyed trip rates generally supported earlier reviews of overall Sydney data indicating that:

* an overall rate of 0.12 - 0.15 private bus trips per person (over 4 years of age) is made on a weekday on scheduled private bus services
* the aged have a higher trip rate than average
* adults between 21 and 65 have a lower than average trip rate
* females generally have a higher private bus trip rate than males.

Table 1: Average Weekday Bus Boardings by Age/Sex Mount Druitt Area.

	5-15	16-20	21-65	65+	TOTAL
Males	675	416	1197	149	2437
Females	622	576	1877	133	3208
TOTAL	1297 (23%)	992 (18%)	3074 (54%)	282 (5%)	5645 (100%)

Table 2: Population by Age/Sex - Mount Drultt Area (1986)

	5-15	16-20	21-65	65+	TOTAL
Males	5844	3391	12925	528	22688
Females	5648	3064	13662	780	23154
TOTAL	11492 (25%)	6455 (14%)	26587 (58%)	1308 (3%)	45842 (100%)

Table 3: Bus Boardings/Person/Weekday - Mount Druitt Area

	5-15	16-20	21-65	65+	TOTAL
Males	0.116	0.123	0.093	0.282	0.107
Females	0.110	0.188	0.137	0.171	0.139
TOTAL	0.113	0.154	0.116	0.216	0.123

In order to obtain a basis for analysis, these trip rates were then combined for both the Mount Druitt area and the Hills District to give the starting point for a trip rate model. The combined data are in Table 4.

Table 4 shows the base trip rate model used for investigating levels of service in different areas.

Table 4: Bus Boardings/Person/Weekday

	5-15	16-20	21-65	65+	TOTAL
Males	0.178	0.136	0.076	0.284	0.117
Females	0.157	0.207	0.133	0.416	0.163
TOTAL	0.168	0.170	0.105	0.362	0.140

Several points were noteworthy regarding this model:

* there was a comparatively low sample of aged people within the surveys and as a result the trip rate for this group may be subject to relatively large error (and appears to be high for aged females)
* the overall trip rate is 0.14 boardings per person (over the age of 4 years) per weekday for scheduled private bus services
* trip rates vary between different classifications of person type with a general range of 0.10 - 0.20.

Application of Trip Rate Model: After designing the first iteration of the model, based on the two key areas, it was applied to 3 other areas in Sydney and tested for robustness. This meant that in the three other areas, the model was used to calculate expected trip rates based on the population of the area by age and sex.

Then, information from the operators on loading counts, (and, in one case, further classification counts by the study team), was used to check its predictive ability. In cases where unexpected results occurred, an attempt was made to deal with external circumstances which led to variations. This final stage made it possible to document the factors which influence patronage (e.g. car ownership) and include these in the final version of the model.

Matched Supply:Demand Model

It was assumed that in the Mount Druitt area and Hills District demand and supply have been matched and this second method describes the mathematical relationship between these.

Selection of Supply Variable: A major difficulty was in defining a single supply variable. Such a variable needs to take account of those factors previously mentioned which determine the quality of a bus service. (These include frequency, coverage of area and directness of route.) The variable selected was weekly bus kilometres. This variable is not ideal as it does not take directly into account the "quality" of the service but it is probably the single best measure.

Further, it could be argued that for an operator to provide a level of service (in terms of weekly bus kilometres) commensurate with that in the Mount Druitt area and the Hills District, kilometres would have to be of good quality or the services will not be commercially viable.

Selection of Demand Variables: The demand variables were:

* population: only persons aged 5 or more years and living more than 500m from a railway station were included. (It may seem that residents living up to some distance greater than 500m should be excluded. However, distances of 750m and 1000m were also tried and the best fitting model was obtained when 500m was used.)
* car ownership: this was the average number of cars owned per family.
* attractions: this variable could be conceptualised as a measure of the ability of an area to either attract bus services or have bus services pass through it independent of the population of that area. The value of this variable was based on the importance of railway stations and retail centres in or close to the area.
* "blue collar" workers: this was the proportion of workers living in the area employed in jobs classified as "blue collar".

The value of these variables for the Mount Druitt area and the Hills District are summarised in Table 5. These statistics also demonstrate the difference in socio-economic status between the two areas.

Some important points regarding the choice of demand variables are:

* other variables may have been preferable but for ease of use of the model it was decided to restrict variables to those that are readily available. (For example, other measures of accessibility to a motor vehicle may possibly be more appropriate than car ownership but are not readily available.)
* some variables that intuitively should be included in the model did not have sufficient variability across the areas examined to be usefully included. Such a variable was population density.

Mathematical Model: The Mount Druitt area and Hills District were divided into twenty seven Traffic Zones as originally defined by the State Transport Study Group of the Ministry of Transport. The supply and demand variables were measured in each of these areas using current bus timetables, 1986 Census data and information held by the State Rail Authority and the Department of Transport. Multiple regression resulted in the selection of a model of the form:

Weekly Bus Kilometres = f (population, car ownership, attractions)

Table 5: Data Used in Modelling and Estimates

Traffic Zone	Population	Car Ownership	Attractions	% Workers "Blue Collar"	Bus Kilometres Actual	Bus Kilometres Estimate
Mount Druitt Area						
384	13,428	1.64	1.9		4,754	4,387
385	4,131	1.56	3.6		3,197	3,430
386	3,562	1.55	2.7		2,528	2,900
408	8,011	1.41	10.2		7,977	7,595
409	3,575	1.69	1.7		1,400	2,213
410	1,412	1.68	0.2		550	1,073
411	3,010	1.75	0.2		940	1,291
412	4,950	1.58	1.8		2,079	2,707
604	8,770	1.64	0.1		2,789	2,582
605	5,030	1.72	0.2		2,762	1,747
614	15,466	1.49	5.2		6,635	6,604
615	12,458	1.40	1.0		4,259	4,127
616	1,729	1.80	0.2		536	954
679	6,294	1.43	0.1		2,676	2,399
Total	**91,826**	**1.56**		**53.7**	**43,082**	**44,009**
Hills District						
427	11,681	1.99	0.5		1,840	2,831
428	4,309	2.06	1.6		2,275	1,750
429	2,070	1.67	0.4		2,094	1,317
430	2,498	1.89	2.6		1,804	2,118
450	4,429	2.04	0.8		2,054	1,423
452	1,463	2.12	0.1		942	365
453	7,355	2.17	1.4		2,334	2,106
454	5,825	2.19	3.5		2,389	2,766
455	7,682	2.07	0.5		1,520	1,896
620	5,412	2.20	3.1		2,853	2,476
621	7,889	2.19	1.6		1,682	2,280
622	6,825	2.06	0.1		1,973	1,546
623	1,389	2.08	0.1		451	411
Total	**68,827**	**2.08**		**25.2**	**24,211**	**23,285**

The statistics associated with testing the null hypothesis that all model parameters are zero are:

$F = 77.44$; d.f. = 3, 23; $p = 0.0001$

Other tests indicated that each of the parameters was significantly different from zero at a 0.002 level of significance. The model has an R^2 value of 0.91.

The model estimates of weekly bus kilometres are summarised in Table 5. It can be seen that for some areas there is considerable difference between actual and estimated weekly bus kilometres. The three traffic zones with the largest standardised residuals and the possible reasons for the apparent lack of fit of the model in these zones are:

* Traffic Zone 409: The model overestimates the level of service in this zone. Access to the zone is limited because apart from the Great Western Highway, which forms the southern boundary of this zone, only one road passes into each of the adjoining zones. Further, many of the roads in the zone are not through roads.
* Traffic Zone 605: The model underestimates the level of service in this zone. There has probably been a large increase in the population of this zone since the 1986 Census. Further, the operator is providing a high level of service that is probably not currently commercially viable but will encourage new residents to use these services rather than purchase a second vehicle.
* Traffic Zone 427: The model overestimates the level of service in this zone. Although this traffic zone lies between Parramatta and West Baulkham Hills, the bus services connecting these two centres generally travel along Windsor Road which is outside the zone.

Distribution of Services Throughout the Week: There remains the need to ensure that adequate bus services are provided during all time periods. A comparison of the distribution of bus kilometres throughout the week in the Mount Druitt area and Hills District (see Table 6) indicated the following:

* On Saturday the distribution of bus kilometres across the three time periods is similar for the two areas. The same is also true for Sunday.
* On weekdays a similar proportion of bus kilometres for the two areas is provided before 9.00 am (approximately 26%), between 9.00 am and 3.30 pm (approximately 37%) and after 3.30 pm (approximately 37%).
* The main differences between the two areas are the distribution of kilometres between the days of the week and the proportion of weekday kilometres early in the morning and late at night.

Table 6: Current Service Levels in the Mount Druitt Area and Hills District

PERIOD	MOUNT DRUITT AREA			HILLS DISTRICT		
Monday to Friday	**Kms**	**%**	**%**	**Kms**	**%**	**%**
Before 6.30am	2,970	6.9	8.1	912	3.8	4.2
6.30am to 9.00am	6,862	15.9	18.7	4,721	19.5	21.5
9.00am to 3.30pm	13,256	30.8	36.2	8,473	35.0	38.7
3.30pm to 7.00pm	9,401	21.8	25.7	6,552	27.1	29.9
After 7.00pm	4,145	9.6	11.3	1,253	5.2	5.7
Weekday Total	36,634	85.0	100	21,911	90.5	100
Saturday						
Before 1.00pm	2,193	5.1	50.1	787	3.3	48.0
1.00pm to 7.00pm	1,607	3.7	36.7	676	2.8	41.3
After 7.00pm	578	1.3	13.2	175	0.7	10.7
Saturday Total	4,378	10.2	100	1,638	6.8	100
Sunday						
Before 1.00pm	792	1.8	38.3	265	1.1	40.0
1.00pm to 7.00pm	984	2.3	47.5	300	1.2	45.3
After 7.00pm	294	0.7	14.2	97	0.4	14.7
Sunday Total	2,070	4.8	100	662	2.7	100
WEEKLY TOTAL	**43,082**	**100**		**24,211**	**100**	

It was hypothesised that the variability between the areas in the distribution of weekly bus kilometres across days of the week was related to car ownership. As car ownership increases residents have greater discretionary mobility. This is usually exercised more frequently at weekends when travel is often for recreational purposes. Thus, the relatively high car ownership in the Hills District leads to the smaller proportion of bus kilometres on weekends in this area. Further, it was hypothesised that the variability in bus kilometres before 6.30 am on weekdays was related to the proportion of "blue collar" workers. As the working day for these workers generally starts earlier then they have greater need for services at these times. It was assumed that the relationships between car ownership and weekend services and "blue collar" workers and early morning services are linear.

The kilometres after 7.00 pm on weekdays could not be related to any single factor and it was concluded at least 5% of weekly bus kilometres should be provided during this period.

While the model has some weaknesses it is easy to use and adequately describes the level of bus services (as measured by route bus kilometres) in two areas of vastly differing socio-economic status but acknowledged high standard of bus service.

Application

The dilemma facing the legislator of urban bus services is how to determine the appropriate quantum in situations characterised by loss making government operating authorities or private companies generally facing contracting markets. As indicated above, a number of authorities have simply resorted to arbitrary standards. This study rejected such a path and initially looked at consumer need. It quickly transpired that, at least in the metropolitan context, all operators were providing considerably more service than the need based minimum which would seem to have more relevance to the small country town. As a result, this study has concentrated on dissecting contemporary best industry practice willingly practiced in Sydney on a commercial footing.

The overwhelming advantage of this approach is that it goes some way to avoiding the problem of monopolistic inefficiency leading to loss of market share. The argument is frequently put by operators that non profitable evening or weekend services should be reduced or cut out and it is a simple matter to "prove" this with passenger counts. When only a few nondescript services are left it is hardly surprising they lose money and the stage is set for the usual spiral of ever increasing government assistance. In contrast, the approach adopted here outlines what should be possible for an urban area with given population and locational characteristics and places the onus on the operator to live up to this expectation.

Once the analytical framework was developed it was applied during 1989 to all areas of private bus operation in Sydney. While the results have not been made publicly available a few general points may be of interest. Firstly, there are only a few broad areas where bus kilometres appear unjustifiably low in total, despite a popular misconception that private bus operators generally offer a low level of service. However, support for this view is found in the concentration of services by many operators in the traditional core times. In some instances this has led to a surfeit of services during the off peak with little or no service provision at night and weekends. Coupled with poor marketing on the part of many, and particularly the smaller, companies this creates an environment for significant customer dissatisfaction.

Widespread practical application of the model has also indicated the difficulties of applying an aggregate approach to particular circumstances. In particular, issues which require addressing are the incidence of poorly connected road systems making effective bus operation impracticable, varying population densities and the revenue base associated with school children.

Poor road connectivity is generally associated with topographical features - for instance the numerous inlets and peninsulas between Sutherland and Cronulla. Each generate some demand for bus services but, in isolation, insufficient to support effective operation. Unfortunately the same type of situation is sometimes generated artificially in new "traffic calmed" subdivisions incrementally attached to the existing urban fabric and preventing through bus operation. This is particularly pervasive in parts of the Baulkham Hills area. Current Department of Transport service planning activity is strongly orientated towards ensuring that a holistic approach is adopted in future urban release areas and the message is being actively promoted to generally very receptive council officers (Department of Planning and Ministry of Transport, 1989). However, care must still be exercised in release area phasing to ensure that critical sections of link road are not omitted until well into the development cycle. By this stage the damage to public transport operation and patronage will have been done.

Varying population densities have not been significant over the largely post 1945 suburbs in which the majority of private buses operate. However, they will impinge on some inner western and south-western operators and will have considerable impact when the technique is extended to those areas served by the State Transit Authority. Variation in the revenue base associated with school student conveyancing is an issue raised by some operators as an explanation for inferior route operations. In the metropolitan area revenue from this source accounts for between 50% and over 70% of operator income and is absolutely smaller in longer settled areas with a more mature population profile. The overall effect this will have on the ability to operate full time route services has yet to be determined. However, it is likely to be minimal. Even the operator with least children in his area is almost certain to find that his total fleet required for general route operation is fully utilised at school times. Any additional school buses bring their own costs such that surplus revenue from this source is tantamount to overcharging. The real advantage of the School Student Transport

Scheme to general service provision is that it provides amortization of the basic fleet, permitting general route operation to more closely reflect marginal cost.

A more pertinent, population profile related argument is that a mature population requires increased core time operation, when older people are more likely to make trips, and correspondingly less late evening services.

The above reservations stress the general nature of the analytical tool that has been developed, which is essentially the Department's starting point in discussions with the operator. However, its great strength is that it does put the onus of proof onto the operator. Previously (s)he was able to demonstrate with relative ease that the existing situation was all that was possible. Financial and patronage records can easily bear this out for at least community service parts of the operation whilst profitable components are put to one side. Now, however, the operator is faced with an independent view of what best industry practice should be able to achieve and has to provide a convincing argument as to why the particular case is different.

This exercise would have little practical validity if the legislative means for changing the erring operator's ways was unavailable. However, during the first part of 1990 new passenger transport legislation was prepared and put through the New South Wales Parliament providing for performance based operator contracts to replace the almost sixty year old system of bus route licensing.

The task now to hand is implementing the new approach in the metropolitan area. The keys to this are simplification of the decision rules involved and effective negotiation by administrators well versed both in the characteristics of the approach adopted and the intricacies of effective bus operation.

Conclusion

The traditional regulated and protected approach to local bus service operation has come under severe challenge in the last few years in the English speaking world. This is easy to understand, given the monopolistic inefficiencies and deficits that the system had produced against a backdrop of falling demand and tightening government budgets. However, the alternative of open competition is not an unmitigated blessing leaving competitive tendering and managed competition as a possible alternative. Often this takes the form of cost only or bottom line bidding. However, in New South Wales, given the overall commercial viability of the urban bus industry afforded by the very broad provision of free school travel, it was possible to identify and require comparatively high levels of commercial bus operation based on existing best industry practice. This paper has documented the background to this approach and the development of the methodology by which it may be achieved.

While situations vary elsewhere the overall concept may well have more general application. By developing an overview of what is practicable by a good operator administrations acquire a reference point which incumbent operators must emulate to maintain an area franchise. Performance based levels of service contracting is set to have considerable currency in New South Wales over the next few years. In this time refinements to the approach developed here are likely to blend the original behaviourally orientated research with an improved understanding of operational cost structures so as to better estimate the real cost and patronage levels required to sustain an appropriate level of service by an efficient operator.

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