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OPTIONS FOR SUBURBAN PARATRANSIT SYSTEMS

WENDY M. ADAM
Planning Associate
Planning Workshop Pty Ltd

ABSTRACT: Once a public authority has decided on a paratransit service for suburban public transport, it has valuable lessons to learn from overseas experience. This is particularly true of the "second generation" demand responsive systems that followed early Dial-a-Rides. These are less flexible in scheduling, but maintain route flexibility which raises dependability, eases co-ordination with other services, and lowers despatching costs.

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INTRODUCTION

Public transport authorities across the country are considering various forms of paratransit as innovations to improve their performance. This paper addresses itself to designing a suburban paratransit system, and the lessons of overseas experience. It does not debate the issue of whether paratransit is an appropriate course to pursue. Early U S. systems are described, and how their experience led to a "second generation" of paratransit services, less demand responsive, but more compatible with conventional transport. This second generation in the U.S. corresponds with recent British services, and together they suggest to Australian operators the characteristics of systems suitable to local conditions.

THE SUBURBAN CONTEXT FOR PARATRANSIT

The outer suburbs that surround our central cities are founded as firmly on the automobile as the structure of the central city was based on rail and train routes. The transport mode of the day has a persuasive influence on the form of residential areas, and the relationship of the car to the low density suburb is seminal and self perpetuating. However, several factors have entered that relationship, starting a reappraisal of the dependence of suburban dwellers on their automobiles.

The first factor is petroleum. The price the motorist pays at the fuel pump is increasing, and his ability to obtain petrol at any price is decreasing. This may not affect his short term behaviour, but it is affecting his belief in his car. It is no longer regarded as fully dependable, as its future reliability has been undermined by the occasional difficulty.

The second factor is the heavy deficit run up by public transport operations. As the per capita tax revenues spent to meet the debts mount (in New South Wales it is over $200 annually), the public outcry from tax payers in areas receiving little or no transport service will grow As a public service, Public Transport Commissions across Australia will face the dilemma of either reducing service to cut down on deficits or expanding service to more areas to increase benefits.

However the impetus arises, there is a growing pressure on public transport authorities to extend service into low density areas, where cursory service on major arterials was the most previously offered. The failure of conventional transport in these areas is well documented. In order to get to rail service, most users had to drive. It then became easier to continue driving than suffer a

transfer. Bus service is more flexible, but still cannot integrate with suburban land use. The arterial roads tend to be removed from residential areas, and are more often the location of commercial enterprises. The cul-de-sac and winding street configuration of the road system is not conducive to navigation by standard transit buses. The noise of the brakes and diesel engine of the bus is unpleasant to some, as is having a bus stop in front of their home to others.

These factors, as well as the high levels of car ownership and the diffusion of trip destinations for suburban travellers, have made conventional public transport in low density suburbs a failure. The search for another mode, something new, roughly between bus service and taxi service, has been carried out under the label of "paratransit". To sort out the characteristics of such systems, the graph below has been devised with one axis representing space (the flexibility of routing) and the other time (demand responsiveness in scheduling).

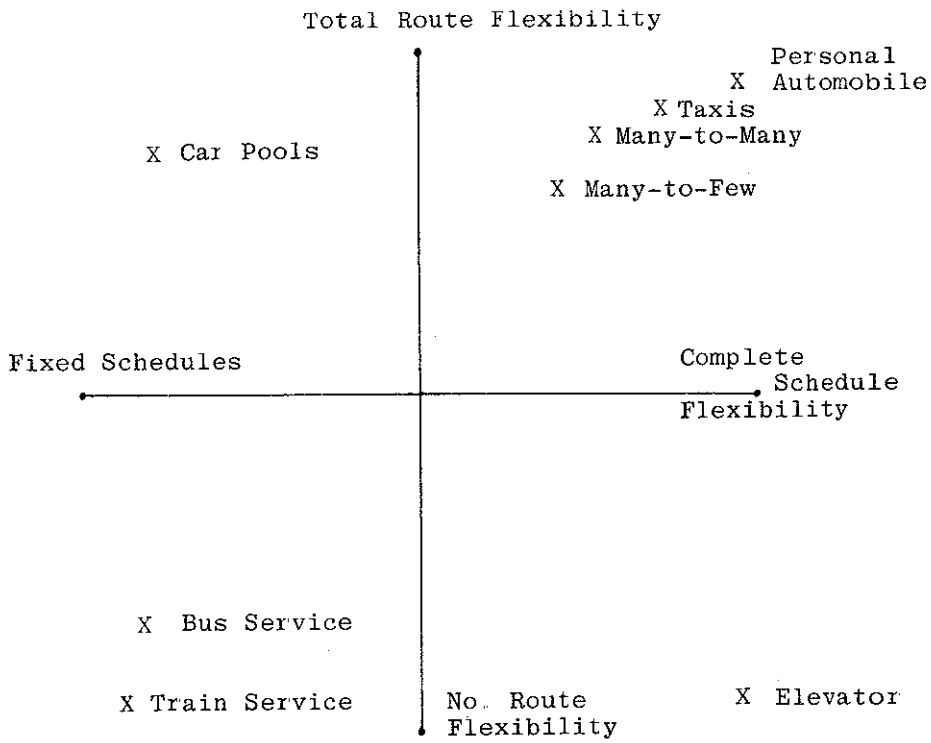

Figure 1
A Descriptive Structure for Paratransit

For comparison, examples have been added to each section. Obviously, the gradations along the axes are not discrete units of measurement, but rather show relative differences. This paper is only concerned with those systems described in the upper right hand quadrant. These are flexibly routed with some elements of demand responsiveness.

THE EVOLUTION OF DEMAND RESPONSIVE SYSTEMS

The services in this quadrant were the exclusive concern of this paper because the characteristics described were those approximating the automobile. Ignoring what made a car useful to suburban dwellers doomed a transport service from the start. At the same time, full equivalence was not feasible, and needed to be recognised at once. What was not yet determined was the optimal trade-off between demand responsiveness and predictability, between flexibility and organisation

Experiments with these forms of paratransit in low density areas are fairly recent as an organised part of a city's public transport system. The first modern attempts at this type of service were undertaken in North America in the 1960's. These early systems arose as local governments tried to reconcile their new commitment to support local transport with attempts to improve service and lower costs. At the same time, automotive companies were seeking new markets for their vans and buses. Most of these vehicles were built on delivery van or recreational vehicle chassis, and represented greater market penetration for these lines. Academic research used computer applications to develop more efficient public transport, and demand responsive service appeared to hold the greatest promise for simplification through automation.

From this pool of interests, the plans were drawn for the first generation of "dial-a-ride" systems. "Dial-a-Ride" meant a system where the customer activated service by calling a control room and describing his desired trip. The control room fed that trip into one of the vehicles duties and then estimated a pick-up time for the customer. Radio communication was used for dynamic rescheduling of vehicles as trip demands were received. In the larger suburban areas, particularly those where a state or federal government, or on occasion, an auto company, was paying for or providing the vehicles, the plans tended to be for an intensive system, offering doorstep service to residents in the defined service area. The plans often took account of the diffuse nature of tripmaking in low density areas, and allowed for unrestricted destinations within the service area. Although final plans often looked like a publicly run taxi service, the vehicles tended to be small buses with seating capacities around 25, and modified vans with seating for about 10.

The first group to notice the similarity to taxi service were the taxi companies. Many services never went beyond the planning stage because of successful court action on the part of taxi companies, usually under claims of unfair competition. Laws varied from state to state on whether public authorities could compete with private operators, and if they had to eliminate subsidies from their fares. The areas where the service did go ahead, the taxi industry was usually very weak, or even non-existent.

These large many-to-many services were generally a disappointment to their planners. While some were not actually disasters, they did fail to generate the travel expected of them. Their market was not significantly different from that for conventional transport, most riders were women without a car available for that trip. Seats were often empty, because the average passenger count was seldom more than three. Yet passengers found the experience of travelling out of their way to pick up or deliver other passengers exhausting if there were more than two or three. The flexibility of demand responsiveness seemed to be lost in its unpredictability Passengers were never sure how long a dial-a-ride trip would take because they did not know if there would be any one else on the bus, or not. This made the mode unsatisfactory for time constrained trips such as work, and medical appointments. Of course, if the passenger had no option it did not matter; but if the passenger could drive or call a taxi, then the dial-a-ride did not attract a new market for transit. It simply satisfied the existing one

Smaller areas of low density, often small country towns, did not have the opportunities to experiment granted to larger areas. The smaller areas could not afford specially designed bus fleets, radio equipment, or extensive planning programs. They usually faced an area that did not support a fixed route bus service, except perhaps at the peak period. Trip patterns also tended to concentrate on the town centre, or if it was a satellite suburb, on the major transport link with the nearby city. A many-to-many service was not feasible for the small town areas, so they settled for a modified system of a centre based bus service. Instead of having routes to serve the large city that pass through the small town on the way, the town rationalised service in terms of its needs. The town centre became the focus of the service, and routes radiated from there to the fringe areas of the community. Towns which operated with old transit buses found themselves constrained to main roads by their vehicles; so they tried to run the buses on a loose schedule to the end of the line, with the potential to deviate from the fixed route to nearby streets of sufficient width in order to pick up, or drop off,

passengers.

Towns where the local taxi company operated the service found that the taxi companies usually preferred petroleum to distillate fuelled engines because of maintenance arrangements. These towns invested in small vehicles, usually converted vans. Service design tended to develop away from a pure many-to-many service so the taxi company would not be competing with itself, and the service became looped runs into a section of the community from the centre as illustrated

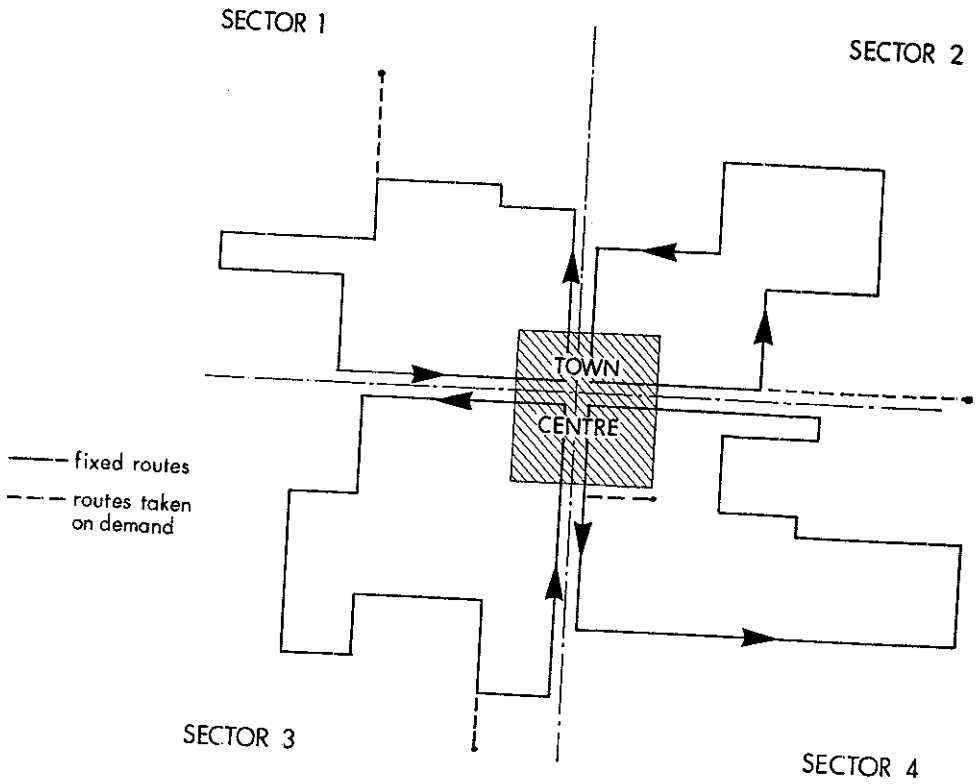

Figure 2
Schematic Diagram of Fixed/Flexible Systems

Alterations could be made to these routes on demand, but the bus would return to the defined route and continue so that potential passengers could hail the service at bus stops as they would a conventional service. If more than one vehicle was operating down town, the routes would often be scheduled to rendezvous regularly at the centre to facilitate customer transfers and permit any lay over to take place at a main loading area.

When the large areas came to evaluate their systems, they found the record of the smaller area services often surpassed their design in demands per square mile and vehicle utilisation. More importantly, large area costs were much higher for items such as despatching, vehicle maintenance, and fuel. Suburbs which tried to operate two service areas or two types of service found it very difficult to co-ordinate transfers from their vehicles to intercommunity service and from one dial-a-ride service to another. Analyses generally concluded that :

* Less flexibility encouraged savings on mileage and increased dependability.

* Operating costs had to be reduced because farebox recovery was much worse than anticipated.

* Seating capacity could be limited to 10 or 12 when the vehicles were only used for demand responsive service, and sometimes standard sedans were adequate.

* The experimental small vehicle had serious design problems, and could not be deemed reliable for transit purposes.

* Use of the service as feeder for inter-community services provides a good market, and should be further exploited.

* The user of the many-to-many service was not significantly different from the user of fixed route service in that, or demographically similar, areas.

As a result of these findings, a second generation of dial-a-ride services is being introduced in the U.S. Services are less dependent on the telephone, and accept passengers at bus stops as well as telephoned requests such as that described by Meyer (1977). Flexibility in routing is restrained by the introduction of scheduled tours along specific streets, where special requests for deviations from that route are accepted. A central terminal area is identified where vehicles begin their tours, and casual passengers may board the buses. This

terminal is located in the most popular commercial area, and if possible, at an inter-community transport stop. Smaller vehicles are specified, combining the comfort and manoeuverability of an automobile with its smaller fuel consumption and maintenance requirements. Taxi companies are frequently contracted to operate the service rather than a transport authority, to take advantage of shared despatching and lower driver wages. The transport authority is then spared the strains of a vehicle type usually incompatible with the standard transit vehicle.

The smaller towns are also seeking to improve upon their first efforts. Those with fleets of big buses are planning for some smaller vehicles, perhaps to be garaged on a contract from a car leasing operation. The larger vehicles are pressed into more conventional peak time operations, so their schedule dependability is even greater; they revert to few-to-few service in off-peak times. Towns operating with small buses may consider modifying a few of them for use by the wheelchair bound, if there appears to be a market in their community. These areas make efforts to improve their information service, concentrating on better schedule accuracy. One low density community in the Eastern United States (Westport, Connecticutt as described by Alschuler (1978)) has formed its transport authority into a complete "transport provider" It operates small buses on fixed routes, and vans in a many-to-many service at night. Westport recently began to offer short term car rentals so that a resident could sell, or decide not to purchase, a car, knowing that he had access to every type of transport he needed through the local authority.

It is interesting to note that the second generation systems of the U.S. show a convergence of design with many of the systems operating in the United Kingdom. While the bases of the designs were often different, the outcomes are quite similar. The English transport planners took the small suburban towns and tried to apply the dial-a-ride pattern to their communities, and were forced to reject it. The main obstacle causing them to reject the pure demand responsive mode was the low average rate of telephone possession by English homes. Instead of the 95% or better coverage by telephones in the U.S. communities, English authorities faced rates as low as 30%. Means other than telephone bookings had to be available to the residents; so a system of loops, or circuits, was assigned to an area every hour, and residents were able to hail the bus as it passed. Special requests for doorstep pickup were taken over the telephone, and incorporated into the route. The relative occurrence of these requests was so small that dynamic scheduling (where the dispatcher could immediately radio the driver about the request) was found to involve excessive technology. This was described by Marlin and Moncrieff

(1978) and Turnbridge (1977) when detailing otherwise dissimilar services. Such requests could easily be relayed instead to the driver as he passed through the centre of town, where the control room, and a waiting room for passengers, were usually located.

The U.K. systems also found the small bus an appropriate method to reach areas previously excluded from public transport. The road system was much older than the U.S. pattern, and consequently, the streets were narrower. A conventional U.K. transit vehicle, the double decker bus, also faced height limits on overpasses, wires and trees. Furthermore, England was made up of higher density suburbs along these narrower roads, offering a greater potential market, and a better justification for less flexible routing and demand responsiveness.

The low U.K. car ownership rates also played a part. Reports on several of the English systems suggest that users of dial-a-ride there appeared to be more tolerant of low frequency service than in the U.S. Headways were often an hour; and on occasion, the service would only enter an area once or twice a week. The fact that many of the users were casual hailers is surprising. At the same time, the majority of users in systems of this design appeared to board the bus at the town centre terminal. Most requests for special stops would also come from these passengers. A very logical pattern of use was seen: the passenger would often walk to the centre to catch an inter-community service or to do some local shopping, and then would catch a bus to get back home when there were parcels to carry, or he was simply tired. The central terminal usually contained a comfortable waiting area, and the buses were very punctual on leaving there. The variations in time were introduced later as it altered its course.

The English also report disappointing revenue recovery of costs. Seldom had the rate of recovery been better than 20%. Cost cutting in communication equipment and control room staff improved the rate, but did not eliminate the loss. The philosophy of fare pricing has usually been based on other public transport services, not on taxi or similar, flexible modes. Therefore, all decisions to continue paratransit operations have resulted from the decision that transport facilities are a public service, and deserve subsidization

The situation in Australia undoubtedly differs from both the U.S. and the U.K. examples, but there are a great number of communities here considering a new approach to public transport in their areas. This paper is not intended to advise them if they should proceed towards a paratransit option; it rather suggests if they decide to

design such a system, what they may learn from overseas experience. These features may be characterised by styles of transport authorities, demand patterns, and relative operating costs

Differing Styles of the Transport Authorities

Australia has one of the longest histories in the world for public ownership of transport facilities. In the U.S. the widespread ownership of intra-city bus lines is a phenomenum of the last decade. As private companies fail, the public authorities are generally created to continue operations of the central city bus lines. Often the charters of these authorities specifically preclude them from operating at a loss. Subsidization of public transport as a social service is a subject for vigorous debate in the U.S. The federal government has begun to use highway funds to purchase capital equipment for public transport, but the operating costs are escalating. Wages in particular have been affected by the switch to public ownership; and cases of increased costs with decreasing patronage are making many communities accept with regret the need for subsidies. Several of the U.S. paratransit experiments discussed earlier were attempted, in order to cut costs. The rationale was that unprofitable conventional service would cease, and be replaced by a higher quality, higher fare, service which would attract new markets. This did not generally happen. Revenue per vehicle hour frequently declined on the new services.

However, if a public authority wishes to enter the demand responsive field, and realises that the service will require subsidy and may result in a higher overall cost per passenger, the second generation services can give public transport to areas not previously served by conventional means. Second generation designs can provide a higher quality of service; they are feasible to operate; and they do seem to satisfy passengers even at a higher fare than other transport modes.

The U.S. experience suggests that one of the most effective means to minimise costs is by contracting with a private operator to run the service. Usually this is a taxi company, but a limousine company, or even a small bus company, can also be considered. The U.S. federally funded systems have been effectively prohibited from doing this by legislation protecting the sovereignty of the bus drivers' unions. Local authorities are usually forced to negotiate with the metropolitan chapter of the union in order to avert industrial action. It is difficult to envisage Australian authorities having a greater success rate bargaining with unions than those in the U.S. where the unions are relatively weaker. The unemployment issue among U.S. transport workers is not as critical, and the

work rules are defined more clearly than in Australia. Suburban demand responsive systems are labour intensive, and that is a critical decision factor for any authority considering implementation.

The issue of competition with taxi service has been brought before the courts in the U.S., and they have stopped several plans for dial-a-ride systems. Most notable has been the Santa Clara County system, which is very large compared to most other systems attempted. It had been operating and popular when the court ordered it either to buy out the local taxi companies or to cease operation. Unable, and unwilling, to purchase the taxi services, the Santa Clara Dial-a-Ride stopped running. Dial-a-ride service however is not a taxi service. It is much slower, less dependable, and less private; but when it is offered at a considerable financial savings over taxi fares, then some of the taxi market will switch It is more likely that passengers will come from existing fixed routes in the area, if these exist, and from private vehicles driven by their parents or spouse (Walking also loses some patrons, especially in the less temperate seasons.) Surveys in the U.K. at Harlow, Martin (1977), and in the U.S. at Rochester, showed the diversion to be larger than predicted. Yet, the issue of competition by a demand responsive service operated by a public authority needs to be examined in any potential sites with taxi and private bus service.

Large scale demand responsive service in Australia also requires the operator to purchase vehicles from a manufacturer not currently producing in Australia. The small operator has an advantage; big orders may be difficult to fill. Early operators in the U.S. found to their dismay the problems of trying to operate a dependable service with unreliable vehicles. Customers rapidly lose confidence in the service, and it becomes suitable only as a backup service in an emergency.

Operators need to be aware that public authorities have extreme difficulty in discontinuing unsatisfactory experiments. When an experiment is undertaken without specific goals to be achieved, the system cannot easily be evaluated. Should a system operate in an area where no other transport service exists, some members of the community come to depend upon it, no matter how inefficient or disappointing its record. The operational goals should not only be expressed, but they should be public so that the outcome of the experiment can be decided by the entire community; otherwise, the operator appears to be acting capriciously. Many local authorities in the U.S. have sought a direct decision from the public by referendum on a special tax levy to subsidise the service The typical Australian local authority does not have access to that process, and residents in areas not receiving

service are often harshly critical of expenditures on experiments elsewhere for which they pay.

Similarities in Demand Between Countries

The experience on demand patterns in the U.S. and England is clear: demand responsive systems still rely on the traditional users of public transport, those frequently called "captive passengers". In all systems under study, the majority of users have been female. Usually there is no private car available to the patron. Either the family does not own a car, or the car is being used for another purpose. In Rochester, New York, the car owning rate is about 90% of all households, but the majority of users have no car available to them for when they travel by dial-a-ride. In a survey on the Carterton dial-a-bus service in England, Watts (1976) revealed that only 6% of all parties travelling together had a member with a driving licence. It does appear that the conventional measures of transport service utility apply equally well to dial-a-ride and conventional bus systems.

The elderly are great users of demand responsive systems, as they tend to be for all transport services. Since the smaller buses can travel on the narrower English local streets, the elderly who cannot walk great distances find them easier to use, and generally like the doorstep delivery options. Income for the elderly depends heavily on old age pensions, so this group also has a lower car ownership rate and reacts more strongly to the savings offered by public transport compared to a taxi service. The elderly in general have a greater tolerance of waiting time, shared riding time, and variable delivery times. One survey of patrons in Rochester, New York, revealed that they liked the extended travel through their community as a chance to "get around and see the sights". The popularity of dial-a-ride service with the elderly can be used to incorporate demand responsive service in a wider improved social service delivery system for pensioners.

Better service for the disabled is another social goal provided by the demand responsive system. In the U.S., federal law requires that any authority receiving funds from the government to operate its service must have a program for assisting the handicapped. While the issue of necessary degree of compliance is still debated, communities are beginning to use doorstep dial-a-ride as an alternative to adapting their standard transit vehicles for use by the severely disabled. Cost estimates of the two programs often favour dial-a-ride. Some services are run with the usual small bus or van; but often specially modified vans are used with features designed to help those confined to a wheelchair on and off the vehicle. The cost of adapting the smaller vans used in dial-a-ride service is lower than standard vehicles, and the special

fleet can be used more efficiently by responding only to special requests for this type of service. Were conventional transport to be modified, the entire fleet would need adjustment to pick up the relatively rare handicapped user requiring such specialised equipment.

Australian transport authorities are currently under no such requirements, but public concern over the plight of the disabled traveller is growing. The demand responsive system does appear to be the least expensive means to reach every handicapped traveller, but it still is expensive. Again, the most cost-effective systems seem to be those run in conjunction with the local taxi service. Rarely is the driver required to have special skills: he often just assists with loading and unloading. The more sophisticated the modifications to aid loading, the less the driver is required to do. The key to such service is more often the vehicle. Given an appropriate design the handicapped person capable of travelling on his own should be able to enter and leave the vehicle without trouble or additional help.

Telephone connections are a critical feature of dial-a-ride acceptance. In all but one of the U.S. dial-a-ride systems the telephone has been regarded as ubiquitous, available in every home. The exception has been a system run in conjunction with an urban social service program in Cleveland, Ohio. The area had been the poorest of the inner urban communities, populated almost entirely by elderly blacks. So many homes had been deserted, that there was insufficient demand to run a conventional bus through the area. The design then dealt only with the high rise, public housing units where special phones were installed in the lobbies for bookings. In the U.K the situation is different, and the design of demand responsive systems reflects that. In Harrogate, Turnbridge (1977), 70% of homes had telephones, in Carterton, Watts (1976), the figure was 45%. The national average is 51% of homes with a telephone. Australia cannot plan on a ubiquitous telephone system, especially if a particular system is justified as serving pensions, the group least likely to have telephones at home.

The location of the elderly also requires further study. In most Australian suburban areas, the market for housing has driven the costs so high, that the elderly suburbanite may be more likely to sell his home and move, rather than stay in the area. Many U.S. systems, however, go to areas where the elderly person is "trapped" in the suburb because his home will not get enough on the market place to support a move. The Australian market may only be to those elderly persons who have remained in the suburbs out of choice, indicating they probably have access to a car.

The housewife is the major user of demand responsive services, and she is a disappearing market in Australia. Recent surveys have shown the rate of working wives increasing greatly in the last few years, with good projections revealing that by the year 2000, over 60% of wives would be working. This will be one of the highest rates in the world. At the same time, part time work is relatively unusual in Australia. This means that most women are peak hour travellers, tending to travel outside their community to employment centres. This is a move away from the traditional markets of dial-a-ride systems, but it may suggest an increased role for the transport of children who cannot be driven by their mother. This is highly speculative, but it does seem to reflect a changing and unexplored market development, and not one predictable from overseas experience

Comparability of Operating Costs

The costs of operation can readily be obtained for American systems especially those funded by government. Usually, these are annual figures about a year out of date. To compare the structure of these costs to those which can reasonably be expected in Australia, it is necessary to concentrate on certain budget items.

Wages: Bus, train and most taxi drivers are unionized in the larger U.S. cities. However, all three groups usually belong to different unions. In the small towns bus system or even suburban taxi service, drivers tend to be owner-operators, and not organised in the large areas, demand responsive systems either have had union scale drivers or volunteer drivers. Soaring costs of demand responsive service have meant that cities employing union drivers either discontinue service or modify the wage structure. Several cities have negotiated special contracts defining small vehicle operators as a separate, and lower paid, job classification. In Cleveland, salaries for this class of driver are two-thirds union scale for other drivers.

In the small operation case, councils or transport authorities have been able to negotiate directly with management and drivers: this has resulted in a more flexible approach. Taxi operators have generally been able to integrate dial-a-bus with their regular service, and so defray some of the overhead, control room staff and maintenance wages over all their services. Wages, lower to start with, become even lower. In towns where the council operate their own system, drivers are municipal employees, but since the driving is often described as "easy enough for a woman" wages again tend to be lower than for larger areas.

Control room wages also vary, based largely on the complexity of the technology used. In one system, the union has defined "despatcher" as the job classification above "driver", so that drivers advance to the position on seniority, without regard to their aptitude, and at a higher wage. The Rochester, N.Y. system is computer despatched, so trained computer operators must be present, together with back up manual despatchers. Telephone operators are employed to type information into a visual display unit, resulting in higher wages than straight telephonists. Systems where the operator and despatcher are combined, and the despatcher merely provides the driver with requests for special service, minimise the cost of control.

Despatching: In addition to influencing the wages of the control room staff, despatching procedures affect operating costs in other ways. The degree of demand responsiveness expected by the operating authority is the determining factor in overall communication costs. In the U.K. services described by Turnbridge (1977) and Martin and Moncrieff (1978), the extra expenses of radio communication have not been justified by the public response, and so have represented expenditures on unnecessary capacity. After a period of experimentation, the radio equipment has often been removed to lower costs; but systems in which it had never been installed saved all the expenses. Some demand responsiveness, however has still been available.

If service is to be implemented in Australia, research suggests that several factors affecting despatching should be considered:

* Dispersion of likely trips - if most trips naturally cluster in a narrow range of destinations, little flexibility is required.

* Telephone possession - low rates of telephone ownership limit requests for flexible service. Present national average for telephones per residence is .59, but Telecom predicts this will rise to 1.10 in year 2000. The present rate lies between the U.K. and U.S. averages.

* Cost constraints - a taxi integrated system experiences little increase in cost through radio despatching if the fleet is already on radio. A transport authority must start from scratch. Most do not have radio communication with conventional transit vehicles. Dial-a-ride systems are internal users of radio time, and communication is an expensive budget item.

Vehicles: The performance of small buses has been a great disappointment to many early Dial-a-Ride systems. As reliability has gradually been improved, other factors have come under study. The first has been the high cost of maintaining a mixed fleet. The inventory of spare parts to be supported is prohibitively costly. Mechanics have difficulty mastering the variety of engines and other differing systems. This has been particularly true if diesel and petrol buses are mixed. If vehicles are of different seating capacity, the despatching has often been constrained to ensure a particular model runs on the most appropriate route.

Another aspect of vehicle problems has concerned the appropriate seating capacity. Travellers on pure demand responsive service share less of their in-vehicle time with their fellow travellers than passengers on fixed route service. Therefore, the more flexible the service, the smaller the vehicle required. However, many operators have tried to improve vehicle utilisation by mixing services, such as fixed routes, during the peak hours and demand responsive in the off peak. This pattern forced the operators to purchase larger vehicles, sometimes running two in tandem if demand on a fixed route is high. The more logical step appears to be to run conventional vehicles when operating conventional services, and maintain the smallest vehicle practicable for the service operating the most hours.

When comparing costs elicited from overseas experience, Australian authorities should consider the reliability of small vehicles at their disposal; the maintenance costs of uniform fleets; and the costs of fleets with high load factors on those vehicles the authority feels it is most likely to operate.

SUMMARY

The critical lessons for the public transport authority contemplating suburban paratransit appear to be these:

* Demand responsive services operated by public authorities lose money and are not supported by the farebox.

* Demand responsive services are expensive to provide, but they can achieve social goals unobtainable through conventional public transport, such as access for the disabled, and total area coverage.

* Integration of demand responsive service with conventional service results in greater coverage for both services. The less flexible the scheduling on the demand responsive system, the easier it is to facilitate transfers.

* Patrons of demand responsive services do not vary significantly from users of conventional public transport in similar communities.

* A high degree of flexibility in routing can be achieved without instant communication with the vehicle, but flexible scheduling is sacrificed.

* The availability of sophisticated technology to aid in despatching is a lure to transport planners, but is often unjustified by the community demand.

* Vehicle capacity should not be purchased on over-estimates, but on realistic assessments because the smaller the vehicle, the more potential flexibility in routing

* Reliability is a service characteristic highly valued by paratransit users, and the completely demand responsive service does not supply sufficient predictability on the time axis.

* Drivers are the major cost in demand responsive service, and industrial organisation is different overseas.

* Overseas systems were designed under different constraints and policy objectives. This affects their costs, fare, employment, and evaluation of success. However, they are still valuable "first generation" experiments for the planners of any Australian system.

This is obviously only a partial list. The attractiveness of paratransit is its adaptability to community needs and conditions, and this is at best a guide to further plans. Once the decision to operate a suburban demand responsive system is made, the next step which will answer most of the issues raised here, is a profile of the community's and the operating authority's goals for paratransit.

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