

Best practice demand-responsive transport (DRT) policy

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Abstract

People living in regional cities and towns around the world expect governments to deliver reasonable levels of public transport services in their local area. They understand that a small population base can limit the frequency and span of public transport, but want and deserve an acceptable minimum level of service that offers travel choices. Low patronage bases in these regional centres mean that many fixed-route bus services are unsustainable and greatly strain the public purse. Queensland public transport administrators and service providers are addressing this trend by considering changing the planning and decision-making focus to include demand responsive solutions to address unsustainable public transport scenarios. This paper presents recent demand-responsive transport research and seeks to identify public transport delivery trends and best practice planning and decision-making approaches that could be applied in the Queensland context. The research indicates that this change in policy focus can be consistent with improved public transport service delivery in regional areas and can enhance community prosperity, safety and lifestyle in rural and regional areas.

Refereed Paper

This paper has been critically reviewed by at least two recognised experts in the field.

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INTRODUCTION

Demand-responsive transport (DRT) is not a new concept. In fact, DRT services have been in operation for over 25 years and are playing an ever-increasing role in public transport network planning. The relevance of DRT in public transport planning and service delivery is increasing as rural and urban areas expand and government agencies continue to experience fiscal difficulty in relation to the provision of adequate public transport services.

This paper reports on some of the trends in current DRT planning and service delivery and suggests a DRT policy framework that may be useful to service providers and administrators of DRT services. The paper particularly focuses on a DRT framework for the Queensland context, as more DRT services are trialled in Queensland and a robust supporting policy framework is needed.

HISTORY OF PUBLIC TRANSPORT PROVISION

Public transport policy and service delivery was historically based on overarching concepts such as geographical area coverage, minimum service levels, primary and secondary routes and operational efficiency. One basis for this thinking was the 'systems concept', which focuses on the component parts of transport networks – vehicles, passages or roadways and attractors. This systems concept contributed to public transport planners and service providers adopting the 'hub and spoke' principle of service provision (Shaw 1993).

The hub and spoke and other public transport concepts were developed on the principle that the routes of bus services were fixed, and that urban and community design would adapt to the fixed-route concept. This type of thinking was widely introduced in cities, urban areas and regional towns, and is reflected in current urban and regional public transport networks.

Unfortunately, real estate developers did not comply with the fixed-route theory, people did not want to live on main trunk routes, not everyone can walk 400 m to a fixed route, the population is ageing, the urban environment is experiencing sprawl, affluence levels have risen and the car remains the dominant means of transportation.

CHANGING TRENDS

Societal factors such as ageing communities, protection of the environment, problems associated with social isolation, increased need for access and mobility and regional economic growth are affecting thinking about public transport worldwide. New challenges for public transport administrators and service providers include maintaining the quality of life and economic sustainability of our outer urban and regional areas, making traditional public transport relevant to people's needs, addressing regulatory restrictions that impede responsiveness to community needs, changing the culture of public transportation organisations to embrace change, improving the quality of customer service on public transportation and more effectively using technology to maximise efficiency and market penetration (Stanley 2003).

One of the ways in which public transport administrators and service providers are addressing these challenges is by the introduction of DRT services.

In fact, Professor Graham Currie, who is the chair of public transport at Monash University was quoted (Breusch 2005) as saying that:

Demand-responsive transport is the future of public transport, experts say, especially in the outer suburbs of low density cities. I've got nothing but praise for it.

WHAT IS DEMAND-RESPONSIVE TRANSPORT (DRT)?

DRT is an intermediate form of transport, somewhere between bus and taxi and covers a wide range of transport services ranging from less formal community transport through to area-wide networks (Rajé, Brand and Preston 2003).

When referring to DRT this paper will be describing a type of passenger transport that deviates in response to demand and fills the gap between inflexible, fixed-route services and single hire, totally on demand taxi services. DRT can provide the accessibility and personal safety benefits of taxi services at a reasonable cost to the user.

There are two important distinctions between DRT and taxi services:

- 1 DRT vehicles cannot be hired at the exclusive behest of one user.
- 2 DRT services typically travel from pick up locations to fixed destinations, rather than anywhere to anywhere.

DRT operates successfully in Europe, Australia, UK and the US, and has been the subject of a number of substantial studies including the Intermode Study, the FAMS project, the VIRGIL project and the SAMPO project. The general finding of these major studies is that DRT is a workable transport option in suitable operating areas and can deliver social inclusion and rural community building objectives.

Research evidence exists to confirm that DRT is particularly useful for connecting isolated communities to essential services, such as health care, cost effectively and thereby contributing greatly to community wellbeing (Rajé, Brand and Preston 2003).

Government agencies are introducing DRT in a variety of mainly semi-urban and rural situations where ridership levels cannot support acceptable levels of traditional bus services, or where social isolation or accessibility are issues. Public transport planners are increasingly including DRT in network plans and considering DRT as a legitimate tier of the hierarchy of services in a modern public transport network (ARTS 2002).

Although there are numerous examples of successful DRT services playing a secondary role by filling the gaps in semi-urban and urban settings and providing service coverage in rural areas, some passenger transport planners see a more primary role for DRT in the public transport network.

Bunting (2004) has a vision for making public transit work, which focuses on the DRT provider or agency playing a lead role in the provision of public transport in rural, semi-urban and urban areas. In Bunting's model the DRT provider acts as a broker for public transport services and has modal partners (bus, rail, taxi and car pooling) that are called upon to undertake transport tasks. This leaves government authorities free to oversee larger public transport issues such as environmental, service funding, social equity and safety.

CURRENT STATUS OF AUSTRALIAN DRT PROJECTS

The most established mainstream DRT service in Australia is the Invicta Telebus that services the Mooroolbark, Lilydale, Croydon Hills, Chirnside Park and Rowville areas of outer eastern Melbourne. This ground-breaking DRT service was established more than 22 years ago to service new areas that were difficult to access or had low demand.

With the introduction of the Travelcard in the 1980s there was a need for passengers to connect with bus/rail and bus/bus interchanges and for a greater level of mode integration. The Telebus services provided this mode integration for these new areas and also helped provide services as low demand estates developed. John Usher (1994) developed the Telebus services and says that some of the onus is on operators to develop innovative public transport solutions like this in order to provide an appropriate standard of public transport at a local level.

Another successful example of using DRT for specific public transport planning and service delivery gains is the Adelaide Metro Roam Zone services. Roam Zone routes were established to provide fixed local area routes during daylight hours to local shopping centres and public transport hubs. After 7 pm these services are on demand and wherever possible will drop passengers to their door. This concept greatly enhances the personal safety of passengers after dark. The concept was introduced in the Hallett Cove area of Adelaide and continues to expand into new areas.

The Mackay Taxi Transit service was established in 1993 to service the low demand areas of Shoal Point, Slade Point and Bucasia. This DRT service was innovative because it utilised spare capacity in the Mackay taxi fleet to provide some of the urban public transport network. In this way Queensland Transport was able to provide an hourly frequency to geographically dispersed areas that were difficult to service with traditional public transport at a reasonable cost.

In the past 5 years more DRT services have been trialled by Queensland Transport to address low demand service provision and to more effectively address the population boom and urban sprawl that the state has experienced. DRT trials are currently operating in Mount Tamborine, Hervey Bay and Toowoomba.

Yellow Cabs also operate DRT services called Council Cab under contract to the Brisbane City Council. These Council Cabs provide access for eligible residents of Brisbane (those over 60 years of age or people with a disability pension) to their local shopping centre at least one day per week. The service provides a significant community service for elderly residents and people with a disability.

POLICY PROBLEM AND THE QUEENSLAND CONTEXT

Public transport regulators worldwide are now taking a pro-active approach and embracing innovative, people friendly public transport solutions such as DRT. The literature reveals, however, that these DRT solutions are seldom supported by robust, formalised policy.

Queensland Transport is the state government agency responsible for providing public transport (train, bus, taxi, limousine, ferry and air) services to the residents of Queensland. Forward thinkers within Queensland Transport have included plans for DRT services in network plans and are conducting the service trials mentioned previously. Comprehensive policies outlining planning, decision-making and service delivery frameworks are needed to facilitate this innovative approach. These frameworks then need to be tested qualitatively and quantitatively with public transport stakeholders, and should be underpinned by DRT procedural guidelines that address legislative, contractual, service delivery and technology aspects of DRT provision.

PLANNING

Progressive transport planners in Australia are now addressing the need to reduce car travel, enhance personal safety and improve access and mobility by looking less at the supply side of public transport planning. Adding extra traditional fixed-route services is not always best practice travel demand management. Transport planners are now focusing more on programs that allow people to organise their travel options and behaviour. These programs provide public transport options that empower communities to 'think globally, act locally' when travelling (Taylor and Ampt 2003).

The American Public Transport Association has a planning vision:

A transportation system that meets the needs for mobility and accessibility while balancing the current and long term goals of economic growth, environmental quality, and social equity. (Hemily 2004)

This vision is indicative of the planning approach in the US, with concepts such as customer-oriented approaches to service provision and enhanced transit-community links emerging (TRB 1999). In rural and low-density areas in the US, planners are now also changing the planning approach. New planning methods are now required as more business moves to outer urban areas and growth pushes farther into rural areas. Sustainable transport networks that integrate economic, environmental and social goals are now being reflected in US transport planning (Nagurney 2000).

European transport planners are moving away from a 'silo' approach in which each local region provides public transport for residents. Integration of transport systems and modes is now a priority, with seamless interchange and integrated ticketing considered more relevant than the proliferation of separate systems of facilities and infrastructure. This approach is being enacted successfully in the Netherlands with the Treintaxi concept that connects rural residents with the long-distance passenger train services across the country to enable 'chain mobility' between modes using integrated ticketing (VIRGIL 2000).

Public transport regulation in the UK is separated into transport arrangements for London (Transport for London) and a largely deregulated service provision regime for areas outside London. Service providers in rural areas are eligible for a number of federal government funding schemes for the provision of public transport in their communities. Local councils have a legislative responsibility to produce and manage local transportation plans and to oversee the provision of federal funding in the local area. This is an attempt to separate heavy-density urban and rural public transport planning.

This approach has produced some very innovative public transport ideas in rural areas and a proliferation of multimodal DRT schemes. The resulting local transport plans and services now in place in the UK

have local community input, and focus on issues such as social exclusion, access and mobility, economic prosperity and access to employment and essential services. DRT services have played a role in local transport plans by providing greater area coverage and service frequencies in rural and semi-rural areas of Great Britain (ARTS 2002).

Planning and policy trends worldwide reflect a shift from the three layers of public transport management (strategic, tactical and operational) to a scenario where organisations understand the needs of the customer and act as a mobility manager in assigning the most appropriate type of service and vehicle mode (Stanley 2003).

Most recent Queensland public transport plans contain principles that focus on efficient system planning and management, community responsiveness, offering an attractive alternative to the private vehicle, addressing the challenges of growth, providing access and mobility, keeping service provision to a reasonable cost and promoting integration (Queensland Transport 2003, 2005). These principles are consistent with the changing planning focus in the US and Western Europe, and require supportive customer-orientated or 'transit-community' policy.

DECISION MAKING

Decision-making frameworks offer substantial benefits for public transport policy developers, particularly when considering the introduction of innovative concepts such as DRT. Decision-making frameworks improve the quality of investment and policy decisions, allow comparisons of alternative project proposals, help in understanding community need and provide a basis for monitoring and review of results. They are influenced by a number of factors, including the government's overarching strategic direction, the perceived public transport service place in the network plan, legislative and contractual restraints, community needs and funding considerations (Hunt Eastwitch 2005). The research indicates that best practice decision making is a process that involves the following steps.

Step 1: Developing strategy

Decision makers need strategies to guide the decision-making process. Some of the strategic themes related to decision making include addressing urban sprawl cost effectively, addressing social-exclusion issues in

communities, community building and economic prosperity, providing equitable access for all, making public transport safer and enhancing network design and effectiveness (Grieco 2003).

Step 2: Modelling outcomes

Strategies and priorities, community need, economic viability, liveability, stakeholder needs and aspirations and the needs of interest and community groups are elements of the analysis-consultation mix when modelling likely outcomes of decision making (Ellerman 1990).

Step 3: Undertaking consultation

Consultation is used to assist the outcome modelling process by eliciting feedback from stakeholders, interest groups and the community. Some instruments used in this process include focus groups, individual interviews (mainly with stakeholders), mail and telephone surveys, and feedback mechanisms such as the Internet and questionnaires.

These tools can then be used to test the robustness of the modelling outcomes before moving to the community need assessment stage.

Step 4: Assessing community need

One of the theoretical aspects vital to assessing community need is the notion of predicting potential demand levels rather than reflecting actual demand levels. Supply-side assessments measure current travel data and are useful for forming an opinion on the ability of the service to meet current demand and need. Demand-side assessments measure potential travel data and provide quantitative predictions of demand and community need. These tools should be used in tandem when assessing the potential for projects or services to fulfil community need (Phillips 2003).

Step 5: Developing and analysing options

Options for best addressing strategic goals need to be formally developed, evaluated and tested prior to making decisions. Comprehensive methodologies for evaluating public transport options were developed by the US Department of Transportation in 1978 (Phillips 2003), and are just as relevant today. The methodology includes the following elements:

- assessing the impacts of each alternative
- examining the distribution of benefits and costs across the community

- identifying the best option in terms of the use of public funds
- promoting the most economically sustainable options
- establishing the legal and administrative feasibility of proposals.

When evaluating options for DRT transport delivery, other relevant issues include the ability of each option to address government and community objectives, contribution to liveability, impact on quality of life, and ability to stimulate economic growth in regional communities.

Step 6: Measuring performance

Developing performance measures is an ongoing and dynamic process that is driven by the strategic goals of the project. The measures must be integrated into the decision-making process and will reflect the information needs of the decision makers (University of Queensland and QUT 2004). Stakeholders should be involved in developing performance measures, and data selection should reflect (a) data that are available and (b) data that will lead to service improvements.

Performance measures applicable to the evaluation and monitoring of DRT include:

- service attributes – how effectively the service meets the needs of the community in terms of area coverage, frequency, hours of operation, ease of booking and general on-board satisfaction
- operations and labour attributes – how efficient the service is in terms of operational efficiency, resource allocation, kilometres travelled, appropriateness of technology and vehicle choices, cost per operating hour and return on operating costs
- administrative attributes – degree of administrative support, data collection, effectiveness of marketing, use of information technology and compliance with contractual arrangements
- governance attributes – contribution to strategic goals, funding requirements, capital costs and equipment required, future sustainability and transference to other operations (AECOM 2003).

Step 7: Evaluation, monitoring and review

Evaluation criteria should be developed, tested and formalised prior to the introduction of any DRT service. Responsibilities of all parties in relation to data collection and provision, service monitoring, and compliance with standards or benchmarks should also be formalised in advance of the commencement of the project. Evaluation criteria vary depending on the objective of the service or strategy; however, some common criteria appropriate for evaluating and monitoring DRT services are outlined in *Table 1*.

REVIEW FINDINGS – SERVICE DELIVERY

DRT services are usually introduced to improve access and mobility, make better use of available resources (particularly in rural areas), provide better levels of service for the available funding contribution, be more relevant to changing demand and enhance personal safety and liveability. In order to achieve these objectives DRT services should have the following basic characteristics (VIRGIL 2000):

- make better use of resources than more traditional approaches
- provide access and mobility for users
- have a degree of economic sustainability
- use technology for service effectiveness and efficiency
- connect users with other transport modes and attractors

For service providers of DRT operations the task of effectively managing the service can be divided into two procedural families: service parameters and service functions (Coccosis and Nijkamp 1995). Service parameters include policies and procedures, coordination with other modes and service delivery structures. Service functions include personnel, contractual arrangements and scheduling and dispatching.

Policies and procedures should have a goal of providing consistent policy and procedural direction to employees, passengers, company shareholders (where applicable), government regulators and the general public. These documents should be clear, concise and readily available through prominent display and dissemination. Policies and procedures are very important for a DRT service as consumers and

Table 1
Criteria for evaluating and monitoring DRT services

Objective	Evaluation criteria
Improve availability of services	Frequency, spread of hours, route length, number of daily services, usage and customer satisfaction
Improve access to essential services and employment	Number and quality of services to shops and employment, suitability of times, distance to attractors and customer satisfaction
Improve physical access to services	Average distance to stops, door-to door service, accessibility of vehicles, distance to interchange facility , user satisfaction
Improve efficiency of network through integration	Interchange possibilities, network structure, user awareness, complimentary use of modes, integrated ticketing, fare levels
Improve information supply to users	Awareness among potential users, requests or complaints from users, amount of information material, ease of information access, use of innovative information technology
Improve cost effectiveness of services	Start-up costs, income levels, cost per passenger kilometre, funding required, passenger loads, return on operating costs, capacity

drivers need to understand the levels of freedom and restriction that apply to service characteristics such as pick up or drop off locations, booking procedures, ticketing, interchanging and so on.

Coordination with other modes is essential to the success of DRT services, and managers of these types of services not only need to coordinate with other modes but should also have a 'give and take' relationship with other public transport providers as a legitimate part of the overall public transport network. Effective managers of DRT services have arrangements with the local taxi company in case of overloads and also can assist fixed-route providers when requested. Integrated ticketing arrangements can be difficult, particularly where revenue sharing is involved, but is also vital to providing a successful DRT service.

Service delivery structures have been placed into four categories by DRT service researchers: local area feeder links, network-enhancement DRT, destination-access DRT and replacement DRT (Enoch et al. 2004).

- 1 Local area feeder links** provide demand-responsive feeder services from local urban and rural areas to rail stations, shopping centres and public transport interchanges. These services link local areas with transport and business hubs. DRT is seen as a cost-effective way of providing these links.
- 2 Network-enhancement DRT** services enhance current passenger transport networks at a reasonable cost. DRT in this instance is introduced to provide services to outlying urban areas at off-peak and night hours and in some cases on weekends. These services provide improved service levels and enhance personal safety on public transport.
- 3 Destination-access DRT** services provide demand-responsive services to destinations where customers are valued by the destination management. Commercial destination-access services are generally funded by the destination business and do not require government subsidy. In some cases these commercial DRT services are viable on a stand-alone basis and can survive in

a deregulated market. Community destination access services provide access to health and care facilities and rely heavily on government funding programs.

- 4 **Replacement DRT** services actually replace unviable fixed-route services in rural areas or are selected by transport authorities instead of traditional bus services where low patronage is expected. The use of taxis and private minibus operators is common for the provision of these services.

In the US another type of DRT service is emerging. **Sponsored DRT** services are sponsored by industry for a commercial purpose. For example, some electricity authorities sponsor electric-powered DRT services to provide large corporate customers with connections to transport and business hubs, and charge for the service on the participating company's electricity bill.

Personnel are the most important service aspect of DRT services. Booking, operational and driving personnel are vital to providing quality customer service and require close attention by DRT service providers. Some personnel aspects of particular relevance include training, resource allocation, labour costs, customer service skills, ability to use technology and flexibility of functions.

Contractual arrangements should be aligned with the provision of the DRT service. Contractual restrictions or the lack thereof must be realistic and allow the service provider to operate a sustainable service, and allow for market protection for the operator where necessary. Contractual requirements for the operation of the service protect users and the general public, but must be formulated in a collaborative way between regulators and the service provider. Most of the energy of the operator should be focused on providing quality service rather than complying with overzealous contractual requirements.

Scheduling and dispatching are functions largely taken for granted in a fixed-route operation or taxi service; however, these functions are more complex in a DRT operation and integral to providing quality service at a reasonable cost. Factors such as the use of route optimisation and dispatch technology, handling service variations such as no shows and wrong addresses, effective vehicle allocation for varying load

requirements and responsiveness to customer requirements complicate the scheduling and dispatch functions.

In the Queensland public transport environment, operators have been providing fixed-route bus services and fully responsive taxi services under contract to the Queensland government for many years and have operated as totally separate networks in exclusive environments, protected by contractual arrangements. In these environments companies have developed service characteristics and management structures that are tailored to the type of service they provide.

Public transport administrators and service providers collaboratively need to develop new policies and contractual arrangements for more responsive and innovative approaches to service provision. New policies need to be developed in relation to minimum service levels, use of technology, regulatory restrictions or lack thereof, management practices, contractual requirements and ways to promote connectivity and integration of available public transport resources.

FINAL COMMENT

Coccosis and Nijkamp (1995) have a vision for network policy that is designed to provide a unified public transport approach for European countries. It is based on the following tenets:

- integration between layers of the network – long-distance networks with local networks
- intermodality of competing and complimentary modes
- quality of nodal centres for interchanging and as attractors
- standardisation of frequency between different types of transport.

These concepts are repeated throughout DRT theory and practice. Future DRT policy for Queensland should reflect the vision of Coccosis and Nijkamp (1995) in the areas of a layered approach to public transport delivery and integration of the layers, intermodality and best use of complimentary modes, better servicing of attractors and standardisation of service levels.

Additional concepts such as customer focus, understanding community needs, enhancing

liveability (access, mobility, safety) and providing a framework for economic vitality should also be introduced into a DRT policy for Queensland.

CONCLUSION

DRT service planning has become an important part of integrated local transport plans in the USA, Great Britain, Europe and Australia. The concept is now also establishing a niche in major city network plans to fill the gaps in difficult to access areas and for outer urban, semi-urban and semi-rural fringe districts.

Public transport administrators could look more at multi-modal solutions to public transport problems and allow organisations and service providers to act as brokers for the procurement of cost-effective and appropriate solutions. Effective use of emerging route optimisation and call-centre technology will help facilitate this process.

Operators should be looking more to building partnerships with the other modes in their local area and thinking complimentary rather than competitive when it comes to the public transport service mix. Offering funding agencies cost-effective and people-friendly service provision proposals will maximise the financial return to the service provider and will encourage further funding for service expansion in the future.

As public transport services become more responsive to demand, the market potential of public transport is increased. Mobility-challenged individuals can travel more often and feel safer using the services provided. Geographic areas can be more widely serviced, and service frequencies can be increased cost effectively through innovative multi-modal service provision partnerships and the efficient use of technology.

Is DRT the future of public transport? Many people believe that it is, especially in outer urban and rural areas. There certainly is no denying that DRT has a place in public transport planning and service delivery and continues to offer people friendly and cost-effective transport solutions in certain operational situations.

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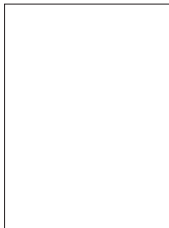
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