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Evaluating the impact of bus network planning changes in Sydney, Australia

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ABSTRACT

The paper analyses the impact of the bus reform package implemented in Sydney, Australia from 2005 onwards, focusing on the impact of bus network planning changes. The network planning changes included the concentration of services into corridors, more direct services, and greater network connectivity. Bus supply and patronage data are analysed for the 15 metropolitan bus contract regions in Sydney to test whether network planning changes increased patronage and whether the trade-offs in service planning had greater benefits than losses. Results show that changes in bus boardings are mainly driven by changes in km supplied, and that there are significant differences between the contract regions operated by State Transit Authority and private operators. The network reviews have a significant impact on boardings in several contract regions over and above the additional km supplied. The paper provides input into the policy evaluation surrounding the impact of network planning on supply and demand in the metropolitan area of Sydney.

1. Introduction

From 2005 onwards, the New South Wales government embarked on a major programme of bus reform by accepting most of the recommendations of a review which it had commissioned to improve the viability of the bus industry (Unsworth, 2004). The initial focus of bus reform to stabilise the bus industry in this review was extended to considering how to increase public transport use, consistent with other government policy. The package of bus reform included changes to planning of bus services, contracting and funding. This research focuses on the impact of the network planning changes undertaken as part of the bus reform and other major impacts on bus supply.

Based on the service planning guidelines for metropolitan bus regions (NSW Government, 2006 Ministry of Transport), new bus networks in each of the 15 metropolitan bus contract regions in Sydney were progressively implemented which focused on strategic bus corridors, simplification of services, and integration of services with adjoining bus contract regions. The principles of network planning suggest these changes should increase patronage. However budget constraints mean trade-offs are made, particularly between frequency and coverage. The research examines whether the network changes increased bus patronage, recognising a number of related changes such as physical and electronic bus priority, fare reform and interchange improvements to increase bus use. Analysis is based on the 15 metropolitan bus contract regions in Sydney, which have had various combinations of network planning and other changes.

The evaluation of the impact of bus reform will help inform the development of the next round of bus service contracts which were due for renewal from December 2011 onwards. A press release on 1 May 2012 (TfNSW, 2012) indicated that this round of bus contracts are to be granted following competitive tender in July 2012 for four contract regions. The first four contracts have now been awarded for the existing network in these contract areas although it is believed (neither the tender documents nor the contracts are in the public domain) that the successful tenderers and/or the government can propose changes to the operating network. However, although the Service Planning guidelines were in the process of being reviewed in 2011, it is still not yet clear (in 2013) how the planning responsibilities will be divided between the NSW Government and the successful tenderer, as the new contracts are implemented.

The paper is structured as follows: Section 2 provides background on network planning principles and the bus planning environment in Sydney. Section 3 looks at supply and demand at an aggregate level whilst Section 4 presents an evaluation on a contract region by contract region basis. Section 5 models demand and supply and discusses the implications of this model, and Section 6 makes conclusions.

2. Background

2.1. Network planning principles and increasing patronage

The principles of bus network planning include simplicity, legibility, frequency and spatial coverage, although they may be

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phrased differently (Neilsen et al., 2005). These principles guide planning in many jurisdictions. For instance, Mees and Dodson (2011) reviewed public transport planning principles in Australian cities (although the Service Planning Guidelines which guide bus service planning in Sydney are not referenced) and Mees et al. (2010) reviewed public transport network planning principles in New Zealand.

Research indicates that focusing on these principles of network planning should increase patronage (Neilsen et al., 2005; Currie and Wallis, 2008; Parker, 2011), although quantitative evidence, particularly on the nature of trade-offs, is often unclear. Trade-offs are made between frequency and coverage, and between direct services and coverage in response to budget constraints. In addition, the response to network change depends on the previous level of service, and different characteristics of users. Whilst network planning changes are made at the route level, the impact is more evident at the network level where route level changes can influence the degree of connectivity within the network. As a result, an aggregate analysis is more suitable in which travel demand and supply data are sought and used to provide quantitative evidence of the effect of change to the bus network (Oum, 1989).

The concentration of resources into corridors, simplifying routes to be direct routes ('straightening out wiggly routes') and providing a 'forget the timetable' level of frequency (of approximately 10–15 min) all help to create and support a network effect in the provision of public transport and increase patronage. The network effect is where higher than expected patronage for a single route follows seamlessly interconnected routes into a network. However, the efficiency and simplicity of direct routes and concentration of frequency often brings with it a need for passengers to interchange to achieve their desired journey. Whilst all journeys where an interchange is necessary will result in the interchange being seen as a penalty, strategies to minimise this penalty is properly part of network design (Neilsen et al., 2005).

In Melbourne, Parker (2011) evaluated the impact of bus planning changes and concluded 'service planning quality advanced slower than service quantity' with a reluctance to apply the network planning principles described above. Currie and Loader (2010) reviewed bus transfer behaviour, identifying half of bus users make transfers, mostly to rail. Currie and Loader conclude that high transfer volumes occur where at least one route has a frequency of 10 min or better, but conclusive proof of the network effect remains elusive.

In Sydney, travel time and frequency are concerns for public transport users and policy-makers. Daniels and Mulley (2011) showed that travel time for all trip purposes in Sydney is markedly longer for trips made by public transport than by car. This finding is supported by Emerson and Parolin (2011). A customer satisfaction survey of Sydney bus users showed that dissatisfaction was high for frequency of the bus service (23% of all bus users dissatisfied), third highest behind bus being on time and being informed of service changes (BTS, 2011).

The service planning guidelines in Sydney outline both the principles of planning services, and the process of change. The philosophy behind network changes is discussed in the next section.

2.2. Bus services in Sydney

In Australia, there is considerable interest at national and state Government levels and also at the community level in improving public transport accessibility. The NSW Government strategic planning documents including the *Metropolitan Plan* (NSW Government, 2010a), and *State Plan* (NSW Government, 2006, 2010b, 2011) have targets for improving public transport use and accessibility, and related objectives such as reducing obesity which also rely on increased public transport use. In Sydney, more trips are undertaken by bus than by rail (TDC, 2010) and bus services are an important part of the public transport mix due to their flexibility, low costs and local role. The federal government also supports increased public transport in its urban policy documents (Australian Government, 2011). The Institute of Transport and Logistics Studies (ITLS) Transport Opinion Survey (TOPS) shows strong community support for public transport improvements ahead of road improvements in NSW (Daniels and Hensher, 2011).

In Sydney, over the period covered by this research, bus services have been provided by operators contracted to the NSW government. There are 15 metropolitan bus contract regions (as shown in Fig. 1), with the government-owned operator, the State Transit Authority (STA), providing services in four regions, and privately-owned operators providing services in the remaining 11 regions. All operators are paid a per km rate, and all fare revenue is retained by government. The bus contracts are worth $5.6 billion over 7 years (NSW Audit Office, 2010). Under the bus reform process introduced in 2005, the number of bus contract regions was reduced from 87 to 15, and services are planned by the operators and government following the principles and processes in the Service Planning Guidelines (NSW Government, 2006). The characteristics at the time of bus reform for the different contract areas for the metropolitan area of Sydney are presented in Table 1 with Fig. 1 providing more information on the location of these bus contract regions and their operating environment.

Fig. 1 shows the population density is much higher in the inner areas where bus services are operated by STA. Density reduces gradually to outer areas which are served by private operators. Sydney's train network, also shown in Fig. 1, is radial and extends from the Central Business District (CBD) and covers an extensive area which also has an impact on the bus performance of the individual contract regions. With a dense network of rail in the inner area, bus services are more likely to act as a feeder routes in contrast to many outer suburban areas where bus services cater for both local and inter-suburban travel demand.

The Service Planning Guidelines outline the process for making network changes including a process of public consultation which involves annual planning forums and public brochures. These principles underpin the philosophy behind the network reviews which were progressively undertaken as part of the bus reform package. Different contract areas placed different emphasis on elements of network planning principles, as indicated by the descriptions in the public consultation brochures. For example, in the more established networks in Eastern Sydney (operated by State Transit Authority), the aim was to simplify comprehensive networks, whereas in contract regions with lower density or newer areas where previously there were multiple smaller networks as legacy from the previous contracts, the emphasis was on synthesising to provide a single network. The analysis of the nature and impact of network planning changes in Sydney, as presented in this paper, will contribute to a better understanding of how network planning can lead to public transport being provided more effectively to increase patronage.

2.3. Significant events for bus services in the metropolitan area of Sydney

A key element of this evaluation of bus reform is to identify the relationship between changes in bus km and patronage, whether this relationship varies by contract region and whether the introduction of networks embracing the strategic corridors and concentration of resources with simpler and more direct routes led to higher patronage.