



An advanced demand management instrument in urban transport

Electronic road pricing in Singapore

Foo Tuan Seik*

School of Building and Real Estate, National University of Singapore, 10 Kent Ridge Crescent, Singapore 119260

Road pricing is a demand management instrument that has been effectively used in Singapore to help alleviate traffic congestion beginning with the Area Licensing Scheme (ALS) in 1975 and, subsequently, the Electronic Road Pricing (ERP) system in 1998. The paper discusses the level of motorisation in the city-state, the traffic problems faced and the development of the ERP system. The operational and technical features of the system, its impacts, advantages and limitations are then carefully examined. Valuable lessons are drawn on how to successfully implement an electronic road pricing system. © 2000 Elsevier Science Ltd. All rights reserved

Keywords: Urban transport, demand management, electronic road pricing, Singapore

Introduction

Singapore, an island city-state with a land area of 647.8 km² and a population of 3.1 million in 1997, is a very densely populated city with over 4700 persons per km², a density which is one of the highest in the world. The island, which lies 137 km north of the equator, faces a severe constraint of land scarcity. In 1997, the total built-up area in Singapore totalled 322.2 km², which is a huge 49.7% of its total land area. Road infrastructure occupied some 11.0% of the total land area.

Despite its physical constraints, Singapore has climbed rapidly from being a developing country with a GNP per capita income of US\$800 in 1965 to a newly industrialising economy in 1997 with an estimated GNP per capita income of US\$26 475, a figure which ranks highly among Asian countries. In 1997, the transport and communications sector of the economy contributed a significant 11.1% of GDP, employed some 210 000 people and absorbed 18.1% of annual consumer expenditure.

Singapore's land transport policy

Singapore has prospered from its excellent air and sea communication links with the outside world. Since it gained independence in 1965, the government has realised that the value of its strategic location as a regional hub could be severely compromised by traffic congestion problems. In the early 1970s, the first comprehensive transportation study completed by Wilber Smith and Associates (1974) highlighted the danger of uncontrolled private car ownership and usage in the context of Singapore's limited land resources. This key study helped shape the key element of Singapore's land transport policy that has remained till today: reducing traffic congestion. The alleviation of traffic congestion was and is still seen as invaluable in helping to make Singapore an attractive destination for foreign investment, trade and tourism. The main land transport strategies which were formulated on the basis of this policy are (LTA, 1996):

- (1) integrated and coordinated land use and transportation planning so as to minimise travel demand and maximise use of road space;
- (2) expanding the road network, maximising its capacity and providing accessibility to all parts of the city;

*Tel.: + 65-874-6901; fax: + 65-775-5502; e-mail: bemfoots@nus.edu.sg

- (3) improving the efficiency of the public transport system and integrating rail, bus and taxi services;
- (4) effective travel demand management by managing vehicle ownership and usage;
- (5) improving traffic management measures.

Prior to 1995, the management and administration of the transport sector in Singapore was fragmented and run by several transport-related agencies. The task is now handled by a single amalgamated agency called the Land Transport Authority (LTA).

Traffic congestion and road pricing

In the demand management of urban transport, the main objective of which is to alleviate traffic congestion and improve traffic flow efficiency, various policy instruments such as economic instruments, regulatory measures and physical restraints can be used. Road pricing is an economic instrument which directly affects the cost of road usage while there are more indirect ones such as taxes and charges which are levied on vehicle ownership and parking. In road pricing, externalities such as congestion, accidents and pollution can be internalised by imposing charges on road users.

Road pricing is traditionally acknowledged by economists as a first-best solution or benchmark for containing externalities and optimizing traffic flow (Verhoef, 1996). Alternative approaches such as more indirect economic instruments (road taxes, parking fees, etc.), regulatory measures (parking regulations, land use controls, etc.) and physical restraints (traffic cells, traffic collars, etc.) vary in their degree of efficiency in dealing with externalities depending on how closely they meet the ideal economic criteria of charging vehicles according to their amount of contribution to congestion at a particular place and time. Although less efficient than road pricing, these alternative approaches may however be socially and politically more feasible and thus may be more commonly implemented.

A simple and manual road pricing instrument is area licensing, which is a scheme where a permit must be purchased to take a vehicle into a designated urban area during peak traffic hours. Economists view it as a form of traffic congestion tax while transport planners see it as a type of cordon pricing which charges motorists who enter a cordoned-off area.

Singapore's manual road pricing system, the Area Licensing Scheme (ALS), has been highlighted by Foo (1997) as a key factor in earning Singapore its reputation as one of the most efficient urban transport systems in the world. The ALS is one of a range of demand management instruments used in the city-state where the need for managing urban transport demand is of utmost significance since there are limits to road network expansion in a small island such as Singapore.

The predecessor: the Area Licensing Scheme (ALS)

Table 1 shows that from 1961 to 1970, private car population in Singapore doubled from 70 108 to 142 568. Traffic density in terms of number of vehicles per km of public roads rose from 82.1 to 149.9. By 1975, cars represented half of Singapore's total vehicle population and traffic congestion problems started to appear in the CBD. It was found that average travel speed had fallen to around 20 km h⁻¹ (Toh, 1992, p 290). Apart from tightening price restraints on vehicle ownership, for instance by raising taxes on vehicles, the government introduced an innovation called the Area Licensing Scheme (ALS) in June 1975.

Under the ALS (Fig. 1) a permit must be purchased to take a vehicle into a designated "Restricted Zone" during peak traffic periods. The ALS was used together with more conventional usage restraint measures such as high petrol taxes and high parking charges. In 1975, motorists driving cars and taxis had to purchase a daily license of S\$3 (or S\$60/month) to enter the restricted zone from 7.30 am to 10.15 am from Monday to Saturday.¹ No charges need to be paid for off-peak hours, Sundays and other public holidays.

The boundaries of the ALS were located within the Central Area of Singapore (which contained the CBD). The cordon covered an area of over 7 km² and included almost all of the roads in the Central Area. Soon after its introduction, rush-hour traffic was reduced by 45%, traffic speeds increased by 20% and accidents fell by 25% (UNCHS, 1995, p 35).

In 1991, it was found that the number of vehicles entering the restricted zone during the morning peak period was 46 000 compared with over 74 000 in March 1975, just before the ALS was implemented (Yap, 1993, p 41). This is a remarkable feat considering the 93.4% growth in vehicle population and 45.9% rise in traffic density during the 1975–1990 period (see Table 1). An extensive discussion of the ALS and its impacts can be found in Foo (1997).

Though the ALS was successful in curbing traffic congestion in the Central Area by restraining traffic flow volumes during peak hours, it did not curb vehicle population growth. Nor did price restraints in the form of deterrent taxes such as high import duties and registration fees deter vehicle purchases. In the 1975–1990 period, vehicle population and traffic density in Singapore increased by 93.4% and 45.9%, respectively. In 1990, faced with the long term prospects of rising traffic volumes and increased congestion, the government imposed a quantity or quota

¹More than two decades later, under the 1998 set of charges and prior to the conversion to the ERP system, licenses for private cars remained at S\$3 per vehicle and were valid for use from 7.30 a.m. to 6.30 p.m. on Mondays to Fridays and 7.30 a.m. to 3.00 p.m. on Saturdays.

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات