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Control of private vehicles in urban areas

1. GENERAL INFORMATION

1.1 Title of practice or experience

Control of private vehicles in urban areas: the Vehicle Quota System and the Area Licensing Scheme in Singapore

1.2 Category of practice/experience and brief description

The Singapore government has implemented significant measures to control the problem of traffic congestion in this city-state. The two notable schemes which will be studied here are: the Vehicle Quota System, which directly controls the supply and population of private vehicles in Singapore; and the Area Licensing Scheme, whereby surcharges are payable for the use of private vehicles in congested areas, during congested hours.

1.3 Name of person or institution responsible for the practice or experience

Land Transport Authority, Singapore

1.4 Name and position of key or relevant persons or officials involved

Not applicable

1.5 Details of institution

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2. THE PROBLEM OR SITUATION BEING ADDRESSED BY THE PRACTICE/INNOVATIVE EXPERIENCE

The transport needs in Singapore have translated into an escalating use of the private motorised vehicle. In 1981, the rate of car ownership was one in every 15 persons. Today, that rate is one in every 10 persons. In 1981, approximately 33% of all motorised trips in Singapore were by private transport. This figure increased to 37% in 1991. Private cars are inefficient road users in terms of the road space they occupy and the number of people that can be transported at any one time. With increasing incomes and the benefits that this confers on the comfort of people's lives, however, the task of persuading commuters to rely more on public transportation becomes increasingly difficult.

In Singapore, the effects of all this have serious repercussions. Land is an extremely scarce commodity at approximately 640 square kilometres. In 1990, with a population of 3.02 million people, the population density of this small island was about 5,000 people per square kilometre. The density of vehicles per mile of road is the highest in the world at 300 vehicles per mile of road. Approximately 12% of land in Singapore is already devoted to land transportation use, and there is precious little space left for any expansion in road capacity. The process of decentralising its population concentration and economic centres has also led to an increased demand for transportation needs.

The consequences of excessive usage of private motorised vehicles are many. Incidences of traffic accidents are due mostly to human error. With increased use of private vehicles, the incidences of human error are thus compounded. Traffic congestion along main roads also encourages motorists to use alternative routes and short cuts along narrow residential streets. This

nuisance also inadvertently affects the relative safety of residential areas.

However, it is traffic congestion with its resulting effects that is the chief concern for policy-makers in Singapore. Traffic congestion causes delay. This translates into, among others, a loss in productivity of the labour force, deteriorating health due to the stress of traffic congestion, and a lower quality of life as a result of the amount of time wasted idling in traffic.

Atmospheric pollution is also increased due to traffic congestion as compared to regular usage of a vehicle, moving steadily at moderate speeds. Vehicles caught in traffic congestion are at their most polluting. Virtually all vehicles are run by burning fossil fuels. Vehicles idling in traffic exacerbate the wastage of already scarce fossil fuels. Carbon dioxide, sulphur dioxide, carbon monoxide, oxides of nitrogen, volatile organic compounds, lead and particulates are spewed into the atmosphere. They exacerbate health and respiratory problems. Sulphur dioxide and oxides of nitrogen could be contributory factors to acid rain. Carbon monoxide and lead are toxic compounds. Carbon dioxide is also the main contributor to global warming.

In large cities, road traffic is estimated to contribute to about 70% of noise. Excessive noise interferes with the performance of physical and mental tasks. It also contributes to the decline in the quality of our environment.

3. DESCRIPTION OF THE PRACTICE/INNOVATIVE EXPERIENCE AND ITS MAIN FEATURES

(a) Vehicle Quota System

The Vehicle Quota System (VQS) fixes an annual ceiling on the number of vehicles that can be bought. Thus, the government can directly control the vehicle population in Singapore in order to achieve its target vehicle population in line with road capacity and traffic conditions, instead of allowing the free market to dictate the optimal number of vehicles. The target growth rate of the vehicle population is reviewed annually on the advice of the Public Works Department. This rate is the level at which traffic is able to flow smoothly given the current and projected expansion in infrastructure.

Every year, the government announces the number of vehicles that it is prepared to allow. This is decided by considering prevailing traffic conditions and the number of vehicles taken off the roads permanently. Monthly, for each tender exercise, the government announces the number of Certificates of Entitlement (COEs) available in the various categories and would-be buyers bid for a COE for the particular category of vehicle which they wish to purchase. There are certain vehicles which are exempt from this scheme, for example, buses, emergency vehicles, trailers, vehicles belonging to the disa-

bled, and diplomatic vehicles.

There are seven categories of vehicles: cars with engine capacities of 1,000 cc or less, cars between 1,001 and 1,600cc and taxis, cars between 1,601 and 2,000 cc, cars with engine capacities greater than 2,000 cc, goods vehicles and buses, motorcycles and an open category which does not restrict the type of vehicle. The open category allows for any change in economic conditions and also for a change in preferences. The proportion of COEs allocated to each category of vehicles, apart from the open category, is determined by historical records. The proportion allocated to the open category is maintained at 20%.

Each bidder is only allowed to submit one bid. Anyone found making more than one bid will find their applications rejected. Companies, however, are exempt from this ruling. The bid must be accompanied by a 50% deposit. On 1 November 1995, the bidding for COEs went fully electronic. Prospective buyers can now submit their bid through Automated Teller Machines of various banks.

Based on the quota available for a particular category that month, the highest bidders within that category will secure the COEs. The amount that the successful bidders will have to pay is the amount of the lowest successful bid in the particular category. Successful bidders for company registered cars and heavy goods vehicles are required to pay twice the amount in their respective categories.

The successful bidder now has the right to own a vehicle. Only COEs of goods vehicles and buses and the open category are transferable. The COE has to be registered within three months for transferable categories and six months for non-transferable categories. Every COE is tagged to a vehicle and is valid for a period of ten years from the date of the vehicle's registration.

The COE stays with the vehicle if the car is sold before the COE expires. To continue using a vehicle after ten years, a COE can be revalidated for a period of five or ten years. The prevailing quota price, which is the average price over the last 12 months in that vehicle category, has to be paid for a renewal of ten years while half that amount has to be paid for a five-year renewal. However, upon the expiry of a five-year COE, the vehicle has to be deregistered while a ten-year COE can be further renewed depending on the vehicle's statutory life span.

If a car owner decides to scrap or export a car before the expiration of ten years, the owner will be entitled to a non-cash rebate that can be used to offset the COE price of a new car or any tax/fee payable for the registration of a new vehicle. The rebate will be prorated according to the amount of time left on the COE. In addition, the rebate can be used to offset the revalidation of another vehicle under the same name or be taken over by any person or com-

pany nominated by the owner.

However, if a vehicle is deregistered for export within two years of registration, the COE rebate will be set at 80% of the COE premium paid unless the COE was purchased in the open category. In that instance, the rebate will be based on the COE premium of the corresponding vehicle category or the open category, whichever is less.

(b) Area Licensing Scheme

The objective of the Area Licensing Scheme (ALS) is to improve accessibility and mobility within the Central Business District (CBD) in Singapore as this is of paramount importance to the area's economic life and vitality. The ALS was introduced to alleviate traffic congestion in the CBD on 2 June 1975. The ALS was the first road pricing scheme to be introduced in the country. There are also other road pricing schemes that operate along specific stretches of expressways.

The CBD is a 'Restricted Zone' in relation to traffic. It covers an area of about 720 hectares of the most congested parts of the city and is demarcated by 27 overhead gantry signs. The words 'In Operation' are lit up in amber during restricted hours. Initially, these were manned by traffic personnel from 7.30am to 10.15am, Monday to Saturday and excluding public holidays. Then, on 1 June 1989, the ALS underwent a major revision. The ALS was extended to also be operational during the evening rush hour, from 4.30pm to 6.30pm on weekdays. At present, the ALS has been extended to a full-day scheme, from 7.30am to 7pm. On Saturdays and on the eve of the five major public holidays, the scheme operates from 7.30am to 2pm. Apart-day licence is now available between 9.30am and 4.30pm on weekdays and between 9.30am and 2pm on Saturdays and on the eve of the five major public holidays. The whole-day licence can still be used during this time.

All vehicles have to display a valid licence, costing **S\$1**, **S\$6** and **S\$3** a day for motorcycles, company registered cars and all other vehicles respectively, during restricted peak hours. The corresponding monthly fees are **S\$20**, **S\$120** and **S\$60** respectively. During less congested hours, from 9.30am to 4.30pm (2pm on Saturdays), the part-day licences cost **S\$0.70**, **S\$4** and **S\$2** respectively, with the corresponding monthly fees at **S\$14**, **S\$80** and **S\$40**. These licences are differentiated by their distinctive shapes and colours.

At first, only privately-owned cars were subject to this scheme, while cars with at least four passengers including the driver were exempted from the restriction. Now, only ambulances, fire engines, police and military vehicles and public buses are exempt from this scheme. Cars with four passengers are also no longer exempted from this scheme. Taxis were also liable to pay

the licence fees as far back as August 1975.

Traffic personnel stationed at the entry points record the registration number, make and colour of offending vehicles without stopping the vehicles. A ticket is then dispatched through the mail for a fine of S\$30 to be paid within two weeks, or the alternative of claiming trial.

The main objective of this scheme is to limit road traffic and alleviate traffic congestion when and where the most severe traffic congestion occurs. Raising the cost of commuting to the CBD in privately-owned cars acts as a disincentive to doing so.

4. DESCRIPTION OF THE INSTITUTION RESPONSIBLE AND ITS ORGANISATIONAL ASPECTS

The Land Transport Authority (LTA) is a statutory board under the Ministry of Communications and was established on 1 September 1995. The LTA was formed as a result of a merger between four existing bodies, namely the Registry of Vehicles, the Mass Rapid Transit Corporation, the Roads and Transportation Division of the Public Works Department, and the Land Transport Division of the Ministry of Communications. This has brought the activities of the various organisations involved in the planning, development and management of land transport policies and infrastructures under one central, integrated body.

Before the LTA evolved, the inter-ministerial Road Transport Action Committee which was set up in 1973 was responsible for the implementation of the ALS. The Committee was supported by technical-level staff in the Public Works Department of the Ministry of National Development.

5. PROBLEMS OR OBSTACLES ENCOUNTERED AND HOW THEY WERE OVERCOME

(a) Vehicle Quota System

As a result of speculation on COEs and numerous complaints regarding the effect that this had on COE prices, the government decided to make COEs non-transferable. This effectively dipped the demand for, and thus the prices of, COEs. Speculation on COEs causes the genuine bidder to be forced to place even higher bids and buy at much higher prices, as the speculative bidder places arbitrarily high bids, causing the prices of COEs to be artificially high.

Speculation is only profitable when there are buyers in the secondary market who are willing to pay a premium for COEs. Buyers in the secondary

market consist of unsuccessful bidders who do not want to wait for the subsequent round of biddings and vehicle purchasers who cannot be bothered to bid for the COEs themselves.

When making their bids, speculators need to forecast the resale price in the secondary market in order to calculate their expected returns. Car buyers also have to gauge the resale price in the event that they are unsuccessful and unwilling to wait for the next round of bidding. This forecasting is based largely on past COE prices. In general, the higher the past COE prices, and the greater the price increase in subsequent auctions, the higher the resale price in the secondary market. This means that speculators can command a higher premium, thus giving them an incentive to push up COE prices when bidding.

However, despite the initial dip in COE prices, they continued to increase rapidly due to a number of factors. As long as there is a quota in place, and a strong and increasing demand for private vehicles, the prices for COEs will continue to increase. With the secondary market removed, car buyers and car dealers bidding on behalf of prospective car buyers had to intensify their bidding in the primary market in order to secure COEs. In addition, many car dealers have begun to bid to secure more COEs which are then registered in another person's name and tagged to a car. These cars are then sold off to buyers as 'used cars'.

(b) Area Licensing Scheme

Although effective, the manual road pricing system has its shortcomings. Much labour is required to produce, administer and sell the licence coupons. Enforcement is also a problem as the work is tedious and susceptible to human error. In addition, the need to simplify enforcement limits the ability to differentiate between charges based on time of travel, level of congestion and actual road usage. As a result, the Electronic Road Pricing Scheme has been recently implemented. This scheme will be discussed in further detail below.

6. EFFECTS OF THE PRACTICE/INNOVATIVE EXPERIENCE

(a) Vehicle Quota System

The objective of the government in directly controlling the quantity of vehicles and in regulating the targeted rate of increase each year has certainly been achieved. This directly impacts the volume of traffic on the road. However, all this has adversely affected the vehicle-purchasing public.

The price of COEs has continued to rise dramatically, correspondingly **so** also has the cost of vehicle ownership. The prices of cars in Singapore are already severely inflated due to the high taxes levied on cars. The average price of a vehicle is about five times the open-market value. The demand for cars will increase as incomes increase. However, with the VQS, this is not met by an increase in quantity. **As** a result, a large portion of this increase in demand will translate into an increase in price. This directly benefits the government as it absorbs the price increase as increased revenue, but the welfare implications of the VQS are less certain. Since the government has absorbed the increase in price, the welfare of the public would depend on how it spends its money.

The reduction in welfare due to the imposition of the quota and its effect on supply and prices should be less than the supposed increase in welfare due to the reduction in traffic congestion, in order to produce a net increase in welfare. In practice, this may not necessarily be the case.

Car buyers are worse off due to the increase in prices. Potential car buyers may also be worse off as they may now be unable to afford to purchase a car. The COE scheme is also, in a sense, regressive as buyers of larger cars are taxed proportionately less than buyers of smaller cars.

(b) Area Licensing Scheme

The **ALS** has been successful in keeping the CBD relatively free from traffic congestion. On its own, it has been the single most effective measure **in** alleviating traffic congestion. Commuters also rely increasingly on public transport, which in turn enables the operators to upgrade their services. There has been a reduction in cross-town travel through the Restricted Zone, and a more even distribution of traffic into the CBD. It discourages unnecessary trips and has the eventual effect of lowering investment in road infrastructure.

When the **ALS** was initially implemented, the number **of** cars entering the CBD during operational hours fell drastically by 73% (comparing the figures in March 1975 with September and October 1975). However, the number of cars entering the CBD from 7 to 7.30 am in order to avoid the surcharge rose by 23%. Car-pooling increased by 30%. The net result was a 44% decrease in total traffic. There was an increase in bus commuters from 35.9% to 43.9% of all commuters as people switched to modes of transport that were not subject to the area licensing fee. Car drivers also decreased from 32.8% **to** 28.2% of all commuters.

The main changes in June 1989 caused an increase in car traffic into the CBD during morning rush hour by about 30%. This was a result of the decrease in the licence fee for automobiles to **S\$3** as the fee had steadily in-

creased to S\$5 a day for cars. However, the number of motorcycles and other commercial vehicles which previously had not been subject to the licensing fee decreased. The overall effect, however, was still a decrease of about 40% in traffic as the licence fee was now payable during evening peak hours as well. This caused the volume of cars in the evening to decrease by 70% while that of commercial vehicles fell by 60%.

A more long-term effect of this scheme has been to encourage businesses and other urban activities to relocate to areas outside the CBD. Initially, there was some concern over the impact of the ALS on the economic viability of the CBD. However, studies conducted were not unfavourable (Tay, 1996). There has not been any great impact on sales, labour availability, commercial-space cost and availability, and land use. In addition, there was no significant correlation between rents and the location of property within or beyond the CBD. In fact, due to the reduction in peak-hour congestion, the CBD has actually benefited in terms of increased attractiveness as a financial and service centre.

Nevertheless, studies conducted have shown that social welfare in general may have actually decreased due to the scheduling and switching costs incurred by commuters (Tay, 1996). The policy designed to alleviate congestion and reduce travel time has curiously resulted in a net increase in commuters' travel time in general. It has been estimated that 44.1% of commuters experienced an increase in travel time while 36.1% experienced a decrease (Tay, 1996).

The combination of these two policies with other traffic-management policies has been extremely effective in curtailing traffic congestion in Singapore. The average speed in the CBD during peak hours is three times that in New York or Bangkok. Studies conducted between 1978-81 reveal that in cities in North America and Western Europe, between 3 and 26% of all trips in urban areas are made by public transport (Phang, 1997). In 1980 in Singapore, that figure was 56% and remained unchanged in 1990.

There are also benefits in terms of noise and air pollution, fuel usage and traffic safety. However, Singaporeans have paid and are always paying a high premium to keep future congestion from arising. In addition, these schemes have had the effect of decreasing welfare.

7. SUITABILITY AND POSSIBILITY FOR UPSCALING

The Electronic Road Pricing (ERP) Scheme has been very recently implemented to gradually phase out and replace the ALS. It will initially automate the existing road pricing schemes, and will then be used to further extend road pricing to other expressways and arterial roads.

Under the ERP system, motorists will be charged every time they pass under an ERP gantry. A stored-value card is inserted into an electronic device known as the In-Vehicle Unit (IU) which is fixed onto every vehicle. Every time a motorist travels under an ERP gantry, the gantry antennae will communicate with the IU and the appropriate charges will be deducted from the stored-value card. This eliminates the need for personnel to be stationed at gantries and makes for a more convenient system. Motorists no longer have to purchase daily or monthly licences, and the stored-value cards only have to be topped up when necessary.

8. SIGNIFICANCE FOR (AND IMPACT ON) POLICY-MAKING

These schemes were very unpopular when they were introduced. They were viewed as infringing on people's rights to vehicle ownership and use, or, at best, as a necessary nuisance (Tay, 1996). The Singapore government had great political courage when introducing these controversial schemes as no other city in the world has established a truly functioning road pricing system yet.

The **ALS** is politically more viable as its objective is clearer and the causal linkage more explicit. The **VQS** is more sensitive as it infringes on rights and can only be justified on the basis that there is a high correlation between ownership and usage. In addition, because of the large sums of money involved, it arguably discriminates against those who can **ill afford to** pay for a **COE**, much less a car.

In order to implement these schemes effectively and with minimal impact on commuters' lives, a comprehensive and efficient system of public transportation must be a priority. Most of the travel-management policies have focused on curtailing demand by raising prices and costs of private travel. Not enough has been done, however, to address the demand-creation process. Better public transportation would be a positive measure in this respect. The revenue raised from various taxes on vehicles could easily be used for this purpose, while the linkage between the two would improve public sentiment towards these taxes.

Singapore's transport policies have been highly successful, but often at a very high cost to the commuter and to the public in general. On the other hand, they have proved extremely lucrative for the government. Over the period between 1975 and 1989, the estimated net financial rate **of** return was 1,590% (Tay, 1996).

It is also important to view the whole of Singapore's highly effective transportation strategy in **its** totality. This has been stated (Menon, 1995) as being:

- (a) integrated land use and transportation planning;
- (b) the construction of a modest and efficient road network;
- (c) good traffic management;
- (d) public transport as the dominant mode of travel; and
- (e) road pricing to curtail excessive demand for travel.

In addition, there has been a concerted effort to decentralise commercial centres to sub-regional centres outside of the main CBD. This is meant to complement the effective transportation system and is not intended to be a separate strategy to alleviate traffic congestion. The deregulation of land and housing markets in order to facilitate a closer proximity between workplace and residence has also contributed to the effective transport policy.

9. POSSIBILITY AND SCOPE OF TRANSFERRING TO OTHER COMMUNITIES OR COUNTRIES

In Singapore, there are no domestic automobile manufacturers or oil producers that stand to be adversely affected by tough policies to reduce vehicle ownership and usage. The ALS and the VQS are currently being considered in plans for the reconstruction of Beirut. Hong Kong is also currently considering a modified version of the VQS, while Santiago will be implementing a scheme somewhat similar to the ALS.

The VQS may not be as relevant in other bigger cities which have a higher road capacity. A more localised solution to the problem of traffic congestion may be the adoption of a road pricing scheme.

If the ALS and the VQS are to be implemented in other countries, every particular will have to be carefully selected for the city in question. Such schemes must of course be highly attractive to developing countries with burgeoning urban centres and which face an escalating use of private vehicles as people's income increases.

References

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