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Prospect of Electronic Road Pricing in Hong kong

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ABSTRACT: To cope with the urban congestion problem resulted from rapid urbanization some cities are successfully using Electronic Road Pricing policy as a demand management measure. In 1982, Hong Kong Government took initiative to experiment electronic road pricing in Hong Kong. Though, the project outcome reveals that Electronic Road Pricing could bring tremendous economic, social and environmental benefit for the city, it was not possible to run Electronic Road Pricing successfully due to huge public protest. Present paper aims to reveal the reasons of Electronic Road Pricing not being implemented in Hong Kong. This paper also scrutinizes the impact of Electronic Road Pricing in Hong Kong and will also suggest some policy guidelines for the government for the successful execution of Electronic Road Pricing in Hong Kong. This paper ends with a concluding remarks of Electronic Road Pricing can be an effective solution for long term success but the government need to take some public inclusion strategies to gain public support in favor of Electronic Road Pricing.

Keywords: *Prospect, Electronic Road Pricing (EPR), Hong Kong.*

INTRODUCTION

Hong Kong is located at the mouth of Pearl River Delta (PRD) and has a total area of 1,103 km2, occupied by 7.1 million populations with an annual growth rate of 0.6%. The population density is over 6.5 thousand persons per km2 and population mainly concentrates in the main urban areas. (Census and Statistical Department (CSD), 2012). Such a large population and concentrated development generate much traffic demand within the city in the limited space which leads traffic congestion in the city.

To maintain at reasonable limit of congestion and to increase the efficient use of the road space, various supply side and demand side traffic management measures have been applied in Hong Kong. The supply side measures taken so far are; road expansion, improvement of public transport system, developments of traffic control devices. Two types demand side measures have been taken; administrative measures and economic measures. Administrative measures are; parking control, restricting road side activities and public transport priority measures and economic measures are; vehicle tax, First Registration Tax (FRT) and Annual License Fee (ALF), fuel tax and road pricing (1983-1985).

Road expansion is a direct method for dealing with congestion. But, building roads may generate much unforeseen travel demands (Organization for Economic Cooperation and Development (OECD), 1994). Developing public transport system is also a good way to relieve congestion pressure but Hong Kong public transport system has already extensively used and the scope for further improvements in this aspect is quite small (Kam, 1993). Improving traffic controls can relieve congestion pressure by streamlining traffic flows and keep it within reasonable limits (Kam, 1993). Nevertheless, under the continuous traffic growth situation, this measure cannot solve the root of the problem. Administrative measures, such as parking controls and roadside activities restrictions, are effective ways in directly combating with the congestion. Yet, these measures incur much enforcement forces and too rigid controls are not applicable to Hong Kong. Raising the FRT, ALF and petrol tax could be used to deal with the congestion but as Lee (1993) commented, they should be raised with the inflation rates. However, these fiscal measures cannot be overused. If they are raised to be too high level, there will be many side-effects. For instance, too high FRT may lead to possible increase in the number of second-hand imported vehicles (Lee, 1993). It will also spoil the low tax environment of Hong Kong. Electronic Road Pricing is often regarded as a long-term solution for relieving congestion in Hong Kong. It is proven technically feasible and practical. Also, its implementation and system operating costs are in decline. However, as reflected by

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the failure of adopting the ERPS in the 1980s, it is important for it to earn more public support before it is effectively carried out (Hau, 2001).

In Hong Kong, the space is limited and further reclamation of land is very tough due to the strict harbor protection ordinance. So, expanding roads is obviously not a long term solution for dealing with continuous traffic growth and as discussed above other supply side measures to relieve congestion has limited scope in the long run. So, government needs to depend on the demand side measures. Among the demand side measures, it can assume from the above discussion that Electronic Road Pricing (ERP) is more feasible and practical solution. Some similar cities like Singapore and London have applied ERP to solve their traffic problems and the projects are running successfully.

Literature Review

International Experience of Electronic Road Pricing Policy

Singapore

Singapore has done outstanding road pricing policies for reducing congestion. In 1975, an area licensing scheme (ALS) based on road pricing concept was introduced. Under this scheme, vehicles entering the restricted zone bounded by 28 cordons in the central area during the operation hours had to display a pre-purchased license on their windshields and the license charge was S$3 per day (Richards, 1990; Hau, 2001, quoted in Hon, 2005, 42). In 1998, Singapore transformed its ALS into the electronic version, known as electronic road pricing (ERP). Under the EPR, drivers are charged with using smart cards and its technologies provide an easy adjustment on the charging. Singapore ERP is small and it is more rigorous because charges are paid for each entry, but not for the whole day unlimited access (Blow et al., 2003, quoted in Hon, 2005). The ERP had effectively reduced daily traffic volume in the central area by 10-15% (Chin, 2002, quoted in Hon, 2005, 43).

London

London started conducting the studies and proposals for congestion charging since the early 1960s. But any formal approach was missing till nineties. Concerns about London's traffic congestion in the 1990s led the national Department of Transport to create the London Congestion Charging Research Program. Its MVA Consultancy report (1995) concluded that a congestion charge would reduce congestion as well as offer rapid payback of the initial setup costs, and generate net revenues as well as broader net economic benefits as traffic speeds in central London had fallen more than 20 percent since the 1960s, from an average 12.7 mph for the morning peak period in 1968 (and a high of 14.2 mph in 1975) to 10 mph in 1998. By 2002, the all-day average travel speed in central London was just 8.6 mph (14.3km/hour), compared to an uncongested (night-time or "free flow") average speed of around 20 mph (32 km/hour) (Deparment. of the environment, Transport and the regions, 1998). In 2000, London's political system was restructured to manage the city's transport system and raise taxes to fund transport improvements by Mayor Ken Livingstone (2001). Since February 2003, the city of London has charged £5 daily for private automobiles for entering the central London during weekdays as a way to reduce traffic congestion and raise revenues to fund transport improvements. People were supposed to pay at selected retail outlets, payment machines located in the area, by Internet and cellular telephone messaging, any time during that day. A good network of video cameras were set to capture the entries of vehicle, deduct the charge from the user, store the data to the central server and send a successful operation message to the driver. It has effectively reduced traffic by 16% during the operation hours (Transport for London, TfL, 2003, quoted in Hon, 2005, 39). After 17 February 2003 a charge of £5 are imposed increasing to £8 in July 2005.

The important and attractive policy of London congestion charging is that, the charge is exempted for motorcycles, licensed taxis, vehicles used by disabled people, some alternative fuel vehicles, buses and emergency vehicles. Area residents receive a 90 percent discount for their vehicles. The charging area is indicated by roadside signs and symbols painted on the roadway. Due to this attractive policy and due to the significantly reduction of traffic congestion as well as improvement of bus and taxi services along with generating substantial revenues, public acceptance has grown and there is now support to expand the program to other parts of London and other cities in the UK.

MATERIALS AND METHODS

Literature review and case study are the main source of information of this study. In this paper, after introductory section, some international experiences of Electronic Road Pricing policy are described and after that, experience of ERP in Hong Kong is presented. In this section, the causes of ERP failure were also described. After describing previous experience of ERP in Hong Kong their prospects are asserted.

RESULTS AND DISCUSSION

Electronic Road Pricing (ERP) in Hong Kong

Previous Experiences

Early 1980's is marked by steady growth of urban population of Hong Kong due to immigration of population from Mainland China. It resulted in the doubling of real income of Hong Kong and consequent increase of private car ownership. As a result, road congestion and environmental pollution mainly during peak hours, stared to worsen while road length increased only by 17 percent. It was found that private car comprised almost two-third of the total vehicle fleet of Hong Kong and occupied three-fourth of road space while catered to only one-fourth of total passenger (Hau, 1990). Therefore, it lead to the conclusion that private car ownership was the main culprit behind road congestion and the Hong Kong Government decided to take

demand side measures to curb increase in private car owner.

According to the above decision, in 1982, Hong Kong Government takes initiative to experiment electronic road pricing in Hong Kong. The objectives of the project were; to increase efficiency in speed and travel time during peak hours, to make better economic use of existing road infrastructure and to curtail increase of private car ownership. Three different zoning schemes to deal with radial movements to the Central District were proposed and analyzed (Transpotech, 1985; Dawson & Catling, 1986 quoted in Hau, 1990). The three zones have peak charges for most of the day and shoulder charges are set at half the peak charge. In all three schemes, the off-peak periods without congestion- such as night-time and Sundays - are not charged (Hau, 1990). The charging periods were; the morning peak period (8:00 -9:30 a.m.), the inter-peak period (9:30 am - 5:00 pm), the afternoon peak period (5:00pm - 7:00 pm) and the shoulder periods immediately before and after the morning and afternoon peak (7:30-8:00 am and 7:00- 7:30 pm). The preliminary estimate of the project cost of the ERP system was HK$ 350 million anticipating that the pilot stage would cost a tenth of that figure. In terms of standard benefit-cost analysis, the benefit-cost ratio for ERP was at least 14 to 1 (Hau, 1990). In March 1983, Alan Scott (then Secretary of Transport) announced that the Hong Kong Government would commit itself Electronic Road Pricing System as a pilot project to limit, private car ownership in Hong Kong. The experiment would test the technical, economic and administrative viability of ERP (Hau, 2001).

The technology used for experimenting Electronic Road Pricing in Hong Kong in 1982 is known as Automatic Vehicle Identification (AVI). A total of 2500 cars vehicles were fitted with an electronic number plate on the underside of a vehicle and video-cassette sized transponder permits radio wave communication with the electronic loops embedded below the road surface. Road Side microcomputers installed at selected charging points in turn relay the vehicle's identification code to a control center. Car owners are then sent monthly billing statements listing the amount of actual road use subject to ERP. Non complying vehicles without electronic number plates or with defective ones are photographed by closed-circuit television cameras (Catling, & Harbord, 1985). There were some benefits of that project such as; savings in travel time to those who stay and pay under ERP and the vehicles operating cost savings from less congestion as well as there were some dis-benefits to those who are priced off the route to avert the ERP charge (Hau, 1997). The ERP pilot experiment proved to be an overwhelming technical success at 99.7% reliability, which well exceeded the 99% accuracy requirement specified by the Government.

In 1997 a Feasibility Study of ERP system was commissioned by the Government of Hong Kong to examine measures to tackle road congestion. The objectives of the study were, to examining the practicability of implementing an ERP system in Hong Kong and to assess the need for such a system to meet transport objectives (Transport Department of Hong Kong, 2001). Mainly Two options were assessed by the study; Dedicated Short-Range Communications (DSRC) System and the Vehicle Positioning System (VPS).

The DSRC system is based on an interchange of information between roadside readers and in-vehicle units (IVU) using low power microwave communication. This is similar to the operation of the existing Auto toll System at various toll facilities in Hong Kong and The VPS effects charges by an IVU based on the location of the vehicle using the satellite based Global Positioning System (GPS). No roadside equipment is required at charge points but violation enforcement stations are required at strategic locations. A wireless data communication network is provided between the vehicles and the control centre for transaction data transmissions, database updating and enforcement verification (Transport Department of Hong Kong, 2001). (Fig 1 and 2)

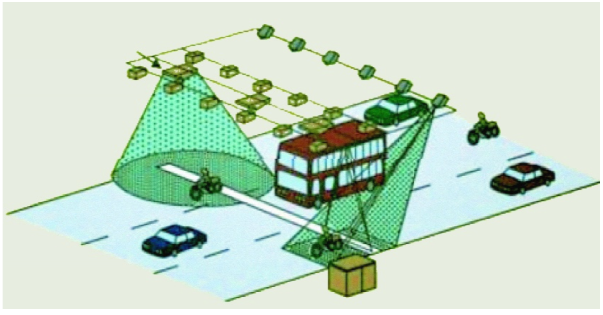

Fig. 1: The Dedicated Short-Range Communications (DSRC) system
(Source: Transport Department of Hong Kong Government, 2001)

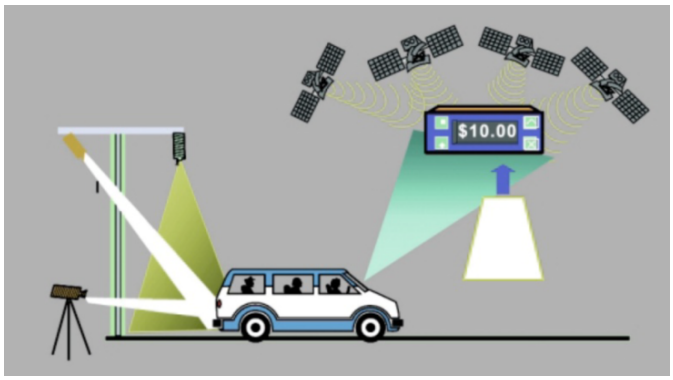

Fig. 2: The Vehicle Positioning System (VPS)
(Source: Transport Department of Hong Kong Government, 2001)

However, finally, ERP does not implement in Hong Kong. There are several contributing reasons for the failure of ERP in 1985. Firstly, The stock and property market crashes in 1982 affect on decline of real income to considerably below the average real GDP growth rate of 8% which leads peoples to become sensitive regarding expenses. Secondly, The introduction of ERP came in the form of the fiscal restraints measures in 1982 but at that time due to the introduction of Annual License Fee (ALF) and First Registration Tax (FRT) the number of private cars and other vehicles decline which lead the improvement of traffic average speed in urban area from 20 Km to 28 Km per hour in 1979 to 1984, its remarkable 40% improvement. This situation has now worsened and average of traffic flow speed in the area has dropped to 24 Km per hour. Thirdly, Private car drivers felt signed out and discriminated against, because Taxis create more congestion compare to private car and they free from ERP charges. Fourthly, it was expected that the opening of the Mass transit Railway to connect Island line route, will carried out about 1/4 of the total public transport boarding in 1988. Fifthly, some people thought that ERP was unnecessarily expensive and is not a financially viable option. Sixthly, ERP was introduced in 1984 of the joint Sino-British declaration, under which Hong Kong was to be handover to china in 1997. Naturally the invasion of privacy and fear of Big brother government were foremost among the peoples mind. Lewis. (1994), listed below reasons for ERP not being implemented at Hong Kong:

The stock and property market crashes in 1982 had led to a decline in real income;.

The fiscal restraint measures were still being felt in 1985;

A private car owners felt severely discriminated against and considered ERP as being punitive;

Political indecision remained with the signing of the Sino-British declaration in 1984;

The charging mechanism of the system was considered an invasion of privacy;

The public were doubtful that the introduction of ERP would be accompanied by reduction in annual license fees and first registration taxes;

Construction of the MTR light railway system was lead to improved public transport services;

There were many reservations as to whether the system would actually lead to a reduction in traffic congestion.

So, despite the tremendous benefits to be obtained from the first best demand management measure, the proposal to implement a full-fledged ERP System based on the 1983-85 pilot scheme was rejected by the public. When confronted with the fact that eight-tenths of the population travel by public transport, a tenth by private cars and a tenth by taxis, it appears that Hong Kong possessed the ideal climate for the successful implementation of ERP.

Prospects of ERP in Hong Kong

The ERP is an effective instrument in reducing congestion pressure and it is economically and environmentally viable option for Hong Kong. If social acceptance can gain, it could be a sustainable solution. According to the estimate of ERP study report of 1998, it could divert 40% of car trips to public transport, thereby increasing travel speed to at least 20km/h if ERP. was applied. In the Feasibility Study on Electronic Road Pricing by Transport Department of Hong Kong (2012) some transport operate benefits and also some economic and environmental benefits of ERP are identified. The transport operation benefits relate to reduced vehicular traffic, particularly during congested periods, reduced travel times, increase public transport use and higher car and taxi occupancy. The estimated net economic benefit resulting from journey time savings and lower vehicle operating cost is about $2 billion/year. ERP is

Table1: Summary of the effects of ERP (Source: Hau, 1990, 208-209)

Effects	ERP (A,B and C)
I. Behavioral effects:	
Car available for use	275, 000
Changes in car trips	20-24% reduction in congested times/place
	20-25% increase outside congested time/place
Traffic flow	During the day reduced significantly in congested areas, less so elsewhere
	At off peak time increased
Speed	Peak overall 10% increase (for scheme A)
	Peal central 16% increase (for scheme A)
II. Efficiency effects(In 1985 HK dollars):	
Net benefits	$734-919 million/year
Gross revenue generated	$395-540million/year
III. Distributional effects (In 1985 HK dollars):	
Extra costs to motorists (compared with reference monthly costs of about $2000 per month)	
- average use	Less than $20/month
- high use in congested times/places	Typically $ 400/month
- low use in congested times/places	Saving of more than $100/month
- central urban area residents	Average bill upto 30% higher
- New territories residents	Average bill (except Sha Tin and Tsun Wan) 40% lower
IV. Other effects:	
Territory fuel savings	6-9%
Vehicle emissions	Up to 17% reduction
Accident costs	2-4% reduction

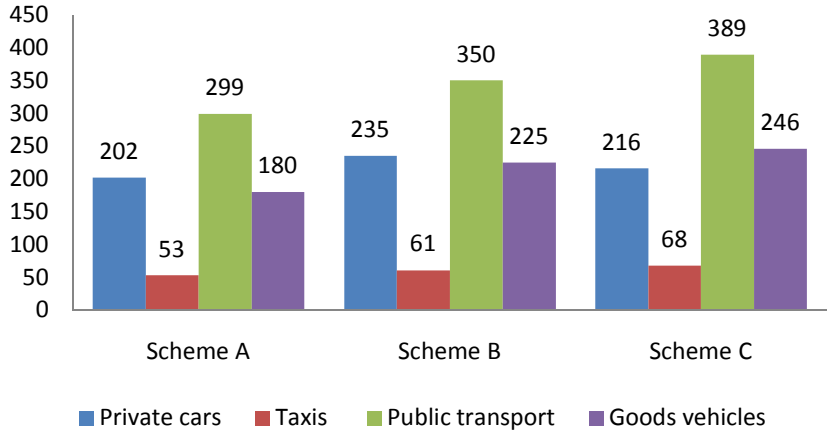

Fig. 3: Annual Net benefits by vehicle class (in millions of 1985 HK dollar)
(Source: Prepared by the authors, data obtain from Hau, 1990, 210)

forecast to generate annual gross revenue of $0.4 to 1.3 billion. If it is decided to adopt a revenue neutral scheme, this revenue can be ploughed back for transport infrastructure investment. The environmental benefits involve reduced vehicle emissions and reduced exposure to traffic noise inside the charging zone. While the ERP may bring about some improvement in the air quality in the charging zone, the environmental condition of other areas show some deterioration due to the overall redistribution of traffic in reaction to the ERP charging zone (Transport Department (TD), 2012, 23). According to Hau (1990), ERP has behavioral, efficiency, distributional and other effects (Table 1). The prospect of ERP can be assumed by observing the annual net benefits of its pilot project (Fig.3). Annual net benefit for all vehicles; from ERP scheme A was 734 million Hong Kong Dollar (HKD) as well as from scheme B was 871 million HKD and from scheme C was 871 million HKD.

CONCLUSION

ERP in Hong Kong: Way Forward

ERP can be a sustainable solution which could be effectively applied in Hong Kong to manage the long term travel demand of this city but the government needs to follow the below mentioned suggestions for its success:

The government needs to do much publicity campaign regarding the benefit of ERP to inform and educate the motorists and citizens. The campaign should include; regular articles in the newspapers, talk show and advertisement in the television channels, broadcast in the radio, organizing public forum discussion, posturing at community centers.

Regarding the charges and the operational mechanism government can take feedback from the motorists and the citizens through group discussion and/or questionnaire survey.

The government should utilize the collected revenue from ERP for the well being of the citizens such as; they can spend the money for making community open space, playground, museums, art galleries.

The government need to conduct a survey to know the peoples preferences regarding the investment of the ERP revenues.

The government needs to engage the community peoples actively at ERP project from the initial stage up to utmost.

For the smooth operation of the ERP gantries/ toll point, automated access control system in order to limit the private vehicles access into the congested areas should be applied.

REFERENCES

Catling, I., & Harbord, B. J. (1985). Electronic road pricing in Hong Kong. II: The technology. *Traffic engineering & control*, 26(12), 608-615.

Census and Statistical Department (CSD). (2012). *Hong Kong 2011 Population Census-Summary Results.* retrieved from: http://www.statistics.gov.hk/publication/stat_report/population/B11200552011XXXXB0100.pdf, on 03 Nov, 2012.

Department of the Environment, Transport and the Regions. (1998). Traffic Speeds in Inner London: 1998. *DETR Statistics Bulletin.* 98:22. Transport Statistics Division, UK, retrieved from: _http://www.dft.gov .uk/stellent/groups/dft_ transstats /documents / downloadable/ dft_ transstats_021875. pdf, retrieved on 04 Nov, 2012.

Hau, T. D. (1990). Electronic road pricing: developments in Hong Kong 1983-1989. *Journal of Transport Economics and Policy.* 203-214.

Hau, T. D. (1997). *Transport for urban development in Hong Kong.* Transport and Communications for Urban Development, National University of Singapore and The United Nations Centre for Human Settlements, Nairobi, Kenya, 267-289.

Hau, T. D. (2001). *Demand-side measures and road pricing.* Anthony, GO. Y., Peter, R.H. and Simon, KWN (eds.), Modern Transport in Hong Kong for the 21st Century, Hong Kong: Centre of Urban Planning and Environmental Management, University of Hong Kong.

Hon, M. L. (2005). *Evaluation of traffic congestion relieving options with using cost-benefit analysis: case study of Central-Wan Chai*. unpublished MSc. Thesis, The University of Hong Kong.

Kam, C.Y. (1993). *Traffic Management: Strategies.* Processes, Techniques and Assessment. In: Liang, H.W. and Anthony, GO.Y. (eds.), Keeping a City Moving: Urban Transport Management in Hong Kong, Tokyo: Asian Productivity Organization.

Lee, E.S.W. (1993). *Vehicle and Driver Licensing.* In: Liang, H.W. and Anthony, GO.Y. (eds.), Keeping a City Moving. Urban Transport Management in Hong Kong, Tokyo: Asian Productivity Organization.

Lewis, N. C. (1994). *Road Pricing Theory and Practice*. Thomas Telford, London, 112-117

Livingstone, K. (2001). "*The Mayor's Transport Strategy, Draft for Public Consultation", The Congestion Charging Scheme for London.* London: Greater London Authority, retrieved from: http://www.london.gov.uk/mayor/ strategies/ transport/pdf/annex4.pdf, on 10 Nov, 2012.

MVA Consultancy. (1995). *The London Congestion Charging Research Programme: Final Report.* London: HMSO.

Organization for Economic Cooperation and Development (OECD). (1994). *Road Transport Research: Congestion Control and Demand Management.* Paris: Organization for Economic Co-operationand Development Scientific Expert Group.

Transport Department of Hong Kong Government. (2001). retrived from: www.td.gov.hk/filemanager/en/publication/ erp_e, retrived on 10 Nov 2012.

Transport Department (TD). (2012). *Feasibility Study on Electronic Road Pricing*. retrieved from: http://www.td.gov.hk/filemanager/en/publication/erp_e.pdf, retrieved on 23 April, 2012.