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# Overview on Congestion Charging Schemes Available For Kota Kinabalu Sabah

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**Abstract**

Kota Kinabalu is a developing city in the West Coast of Sabah which is facing the consequences of the rapid increase in population and motorisation. This increased severity of the congestion, which causes a chain reaction that not only will damage the city's traffic flow but will also inevitably cause damage to the environment as well. This study to compare the existing successful implementation of congestion charging scheme in the world for the possibility of implementation in Kota Kinabalu. Congestion charging is a method to control traffic congestion by reducing the demand of side of road usage, instead of increasing the supply side. There are several cities in the world such as London, Milan and, neighbouring Singapore that has successfully implemented the congestion charging system. These cities have also proved that congestion charging can reduce the amount of vehicle on the road. In this study, it is discovered that the most suitable scheme available for Malaysia, in general, is following the Singapore Model. ***Keywords:*** *Congestion Charging, Traffic Congestion, Traffic Engineering, Kota Kinabalu.*

## 1. Introduction

According to a survey conducted by the Nielsen Global Survey of Automotive Demand (2014), among the southeast Asian countries, Malaysia is ranked first for household possessing cars at 93%. Indonesia and the Philippines are at 54% and 53% respectively. The same study also showed that 54% of Malaysian households possess more than one car, with 85% of Malaysian stating that the primary purpose was for the ease of daily commuting.

Kota Kinabalu is the capital city of Sabah, located at the Northern part of the Borneo Island. In recent years, it can be seen that the number of vehicles in Sabah has been increasing at a rapid rate. Part of the reason for this increase in number is the poor condition of public transportation in Kota Kinabalu. This does not only reflect in Kota Kinabalu, in fact in Kuala Lumpur, the capital of Malaysia, even with its public transit system that is lightyears ahead of Kota Kinabalu, but traffic congestion is also still a prime concern. The Malaysia Automotive Association (MAA), as of 2017, the total number of vehicles registered in Malaysia is at 28.2 million units. With the Federal Territories – Kuala Lumpur, Putrajaya and Labuan – contributing a total of 6,320,329 units, and Sabah just shy of 1.3 million units.

According to Mohammad and Shakir (2013), most people prefer to use their vehicle as compared to public transportation due to the convenience, comfort, speed and flexibility that public transportation does not offer. However, the preference to use private vehicle is similar to a double edge sword, although the advantages stated previously is true, should enough people ignore the downside, it will cause the most well-known issue that cars have ever produced, which is traffic congestion. To illustrate this, in 2012, Cycling Promotion Fund gathered 69 people on the road to compare between the amount of space taken by 69 people in one bus, in 60 cars, and on 69 bicycles. This is shown in Figure 1 below.


Fig. 1 Space taken by 69 people in different modes of transportation.

As shown in the figure above, as more people are choosing to drive, the amount of space taken increases, thus creating traffic congestion. Not only traffic congestion causes unpredictable travel time, but it is also affecting the drivers themselves. Accidents and road rage due to traffic congestion is not an uncommon sight. This places unwanted stress to the commuters, which is one of the causes of road rage. It is important to note that not all drivers will react erratically; however, it is easy to fall into the cycle of emotion where the drivers are talking to themselves or think deeply on the traffic condition. This is according to a study conducted by James and Nahl (2000).

In the same study, the authors also noted that the leading cause of road rage and erratic behaviour is due to impatience of the drivers as it can quickly spiral into resentment or anger if not dealt with in the beginning.

It is a common misconception that the solution to traffic congestion is to increase the size or number of roads. Although it is a solution, it depends on the condition of the existing roads and the area it serves. The Katy Freeway expansion project in Houston that was completed in 2011, which cost $2.8 billion with the primary reason to alleviate traffic congestion, failed to show the results of traffic congestion reduction. This freeway at its widest point has 26 lanes, yet after it was widened, Houston's official traffic monitoring agency recorded that the travel times increase by 30% in the morning, while the evening commute increase by 55% between 2011 and 2014. Economist call this phenomenon as induced demand. As more of something is provided or provided cheaper, more people are likely to use it. In 1962, Anthony Downs coined the term Law of Peak-Hour Traffic Congestion. It states that, on an urban commuter expressway, peak-hour traffic congestion rises to meet the maximum capacity.

One of the solutions that are capable of reducing traffic congestion is the implementation of congestion charging. Congestion charging essentially controls the demand for road usage instead of increasing the supply of roads. The objective of congestion charging is to use the pricing mechanism to alert the users the cost that they are imposing to each other for using the service during peak demands, and they should pay for the congestion that they are creating. For this to work, the city must have an alternative to private transportation before the implementation. Small and Verhoef (2007) stated that for road congestion charging, the implementation would encourage the public to switch from driving to public transportation.

Therefore, in order to improve the condition in Kota Kinabalu and to provide a sustainable solution, a shift from private transport bias to public transport must be achieved. To achieve this, the city must undergo a total overhaul on its public transport system, as well as policies related to private vehicle usage. One of the supplements to help boost public transport usage is by restricting the usage of private vehicle within the central business district. This can be achieved by implementing what neighbouring Singapore did, which is a congestion charging system.

## 2. Road Congestion Charging

One of the earliest implementations of road congestion charging was the Singapore Area Licensing Scheme. It was introduced in 1975 up to 1998 until it was upgraded to the Electronic Road Pricing (ERP). A similar system is then implemented in various cities around the world. Rome introduced its Limited Traffic Zones in 2001, London introduced its congestion pricing system in 2003 and later expanded it in 2007. Stockholm started its congestion pricing system in 2006 as a trial for seven months before continuing it permanently. Milan made a different approach in 2008, a one year trial named Ecopass was implemented. The scheme charges low emission standard vehicles while exempting the cleaner and also alternative fuel vehicles. However, in 2012, after the Ecopass trial was extended until 2011, the program was replaced by a congestion-based charging scheme instead of a pollution-based charging.

### 2.1 Singapore

Singapore is the first country in the world to implement a congestion pricing scheme. It was first introduced in 1975, named Singapore Area Licensing Scheme (ALS). It was used within the Central Business District (CBD), and the areas covered by this scheme is designated as the Restricted Zone (Holland & Watson, 1978).

During the early 1970s in Singapore, traffic congestion started to become a severe problem, especially in the CBD during peak hours. This is due to the growth of vehicle ownership in Singapore, as well as the small land area of Singapore. It is predicted that this would further worsen the traffic condition in the CBD during peak hours (Holland & Watson, 1978). In a newspaper article from The Straits Times (1975), the then Singapore Minister of Communications, Yong Nyuk Lin warned that the state of traffic congestion is a frustrating and wasteful problem that is slowly eroding the economic well-being of Singapore. As the stalled traffic is affecting the business in the CBD, and motorists burn more fuel as they are stuck in prolonged traffic congestion.

The ALS proved to be successful as it reduced the traffic volume entering the city during morning peak hours. The number of cars entering the CBD significantly drops from 42,790 in March 1975 to an average of 11,363 in September and October. The percentage of people carpooling also increased and the usage of buses into the CBD also massively increased after the implementation of the ALS. Average speed within the CBD also improved from just 27 kph to 33kph (Holland & Watson, 1978).

After 23 years of operation, the ALS was finally replaced by the Electronic Road Pricing (ERP) system on April 1st, 1998. The ERP uses radio communication, cameras, and sensors to detect a vehicle passing through its gantries. Every vehicle is equipped with an in-vehicle unit (IU), which is detected by the radio on the gantries as the vehicle approaches the ERP zones. A smart card known as CashCard is slotted into the UI for toll deduction. It is mounted on the bottom right-hand corner of the windscreen of all vehicle and is fitted on the handlebars if used on a motorcycle. The pricing of ERP is based on the vehicle type and also the time of entering the RZ. For foreign-registered vehicle, to drive within a road with ERP gantries, there are two options. Either pay the fee on a per pass basis or a flat rate of S$5 per day. For motorists that prefer to pay on a per pass basis, the IU must be installed within the vehicle along with the CashCard.

The introduction of the ERP solves several issues of the ALS, mainly the unfair price for motorists. As the ERP is charged based on a per entry basis, while the ALS is based on a daily or monthly pass. Which means it cheaper and fairer as motorists who use the road less does not pay the same charge as those who uses it more frequently. If a vehicle with an insufficient balance in the CashCard passes through the gantry, within a few days of the violation, a letter will be issued, and payment must be made. Payment must be made for the ERP charge plus an administrative fee of S$10. Payment made electronically using the accepted channels are given a S$2 discount on the administrative fee (Singapore Land Transport Authority, 2017).

## 2.2 London

Congestion pricing in London is implemented slightly different from the system found in Singapore. Instead of gantries and an in-vehicle unit, the system in London uses cameras to scan the plate number of the vehicle entering the congestion charge zone (CCZ). While the government agency Transport for London (TfL) is responsible for the scheme, the operation of it is sub-contracted to various companies.

The company PIPs Technology manufactures the automatic number plate recognition (ANPR) cameras used to record the vehicles entering and exiting the CCZ. The camera system used has an accuracy of 9 out of 10 or 90% as claimed by TfL. The camera captures two still images and then uses infrared technology to identify the number plates. The identified numbers are then cross-checked against a list of payers overnight by computers. In cases where the number plates that are not recognized, it is checked manually. Those that have paid but are not detected entering the CCZ are not be refunded; however, those that have not paid will be fined (Symonds, 2003).

Reports by TfL in June 2007 discovered that the number of chargeable vehicles entering the zones decreased by 30%, and an overall increase in the number of taxis, buses, and bicycles. The daily traffic flows changed as less traffic after 9:30 am and increases before and after the charging period. However, the overall number of traffic entering the zone during morning peak hours was not reduced as much as at other times. Overall, the traffic level entering the CCZ was consistently lower by 16% in 2006 as compared to during pre-charge in 2002. Within the charging zone, the traffic volumes are unchanged, suggesting that residents and businesses within the zone are generally unaffected.

During the date of the initial introduction of the scheme, a total of 300 extra busses was added (“UK | England”, 2003). The bus routes were also changed to take advantage of the presumed higher demand for public transport and faster traffic speed. A new route was added, while three others were extended. The frequency of buses on the routes was also increased (“London - Travel”, 2008). Tfl reported in 2007 that the Bus users in the central London area increased from under 90,000 during pre-charge to an average of 116,000 journeys per day by 2007 after the implementation.

## 2.3 Milan

Area C, the congestion charging scheme in Milan, Italy, was introduced on January 16 2012. It replaces the previously enforced pollution charge scheme, Ecopass. The areas covered are the same as its predecessor, and is named Zona a Traffico Limitato (ZTL), which translate to limited traffic zone (“Area C”, 2012). Ecopass was first introduced in January 2008 by the mayor of Milan, Letizia Moratti, with the expectation of reducing pollution by 30% and cutting down traffic by 10% (Ciancio, 2008). The implementation was due to the air pollution issue faced by Milan as reported by several environmental groups that have ranked Milan third among the large European cities in terms of airborne particulate matter (Bertacche, 2008).

Although the Ecopass gives more incentive for motorists to buy a lower emission vehicle, free access does little to combat the growing traffic congestion problem. Over time, there are fewer vehicles that do not meet the emission standards on the road. However, the reduction was balanced out by the increase of newer, more environmentally friendly vehicle. Thus, returning the traffic congestion to the previous level as well as reducing the amount of revenue collected from the scheme, making

the operation of the system to be obsolete (Santucci, 2009). As a result of that, Area C was introduced as an 18-month pilot program with partial implementation. The program aimed to reduce the severe traffic congestion problem within Milan, promoting sustainable mobility and public transport, and most importantly, to decrease the current level of smog that has become unsustainable towards public health.

Enforcement of Area C is almost similar to the London Congestion Charge, whereby cameras are set up at each entry points towards the ZTL. The charge applies to all vehicles entering the city centre on weekdays excluding public holidays, starting from 7:30 am until 7:30 pm, while on Thursday, the operation is only up until 6:00 pm ("Area C", 2012). Unlike Ecopass, all vehicles entering the ZTL regardless of its emission level must pay €5 according to the Area C scheme. Residents living inside the ZTL are also required to pay the fee if they are using vehicles to enter the ZTL. However, they are given a discounted rate of €2 and additional free access up to 40 times per year. There are also several vehicles that are exempted, and also some that are banned from entering the ZTL.

In 2015, the average number of vehicles entering the ZTL within the first six (6) months observed to be 28.6% lower than the same period in 2011 during the Ecopass was enforced. Most users that enter the ZTL during the Area C implementation only a few times within a year and approximately two-thirds of cars enter the ZTL four (4) times or less in 2014. In addition to that, about 71% of the resident living within the ZTL did not fully use the 40 free permits allocated (Carra, 2015). It is estimated that the welfare gain from Area C air pollution reduction is $3 billion, even after taking into account that Milan's vehicle fleet is relatively more environmentally friendly as compared to the rest of the cities in the world (Gibson & Carnovale, 2015).

## 3. Discussion

From this study, it was discovered that Singapore implemented the most advanced system with its Electronic Road Pricing system or ERP. The ERP uses a combination of radio communication, cameras, and sensors to detect vehicles passing to its gantries. While both the European nation uses a network of specially design cameras placed on the boundary of the congestion charging area, these cameras are designed to recognise and record the number plate of the vehicles passing through its entry point.

Although other cities can be taken as an example, these three cities were chosen due to the different method of implementation and historical significance. Milan and London use a similar technology, which is the number plate recognising cameras. Milan started out charging based on the amount of pollution a vehicle is producing. Older vehicle pays more than a newer cleaner vehicle, and an electric vehicle does not pay anything. However, it soon follows the footstep of London as charging based on pollution does not solve the underlying issue of congestion, which in turn still produces more pollution even if there are newer vehicle.

While charging based on congestion will reduce the amount of vehicle, simultaneously reducing the amount of pollution generated. Singapore was chosen as it is one of the most advanced systems used in the world, and the early adopter of congestion charging. Since it has been implemented for a longer timeframe, its system is more matured compared to the other city.

## 4. Conclusion

Should congestion charging scheme is to be proposed in the future for Malaysia, specifically Kota Kinabalu, the Singapore system is much more reasonable. This is because the ERP system in Singapore is almost similar to the SmartTag system used as a toll collection system in the Malaysian Highways. As the infrastructure is almost similar, and the SmartTag system uses the Touch 'n Go, which is a cashless payment system similar to the Ezlink card used in the Singapore ERP system. The SmartTag system will eventually be replaced by the new RFID system from Touch 'n Go, which still fulfil the same purpose, albeit with much newer technology. Since Malaysia has the technology implemented for different purposes, it should be a more feasible and cheaper option to repurpose the same technology for congestion charging use.

## References

[1] Malaysia Automotive Association, Summary of Sales & Production Data, 2019.
[2] Nielsen, Rising Middle Class Will Drive Global Automotive Demand in the Coming Two Years, 2014.
[3] Mohammed & Shaki. Factors That Affect Transport Mode Preference for Graduate Students in the National University of Malaysia by Logit Method. Journal of Engineering Science and Technology. 2013. 8(2): 352
[4] D. Bowen. Road space: Bus vs bikes vs cars – a famous photo recreated in Canberra, 2012.
[5] James, L., & Nahl, D. Road rage and aggressive driving: steering clear of highway warfare. Amherst, NY: Prometheus Books. 2000.
[6] B. Schneider. You Can't Build Your Way Out of Traffic Congestion. Or Can You?. 2018.

ISSN (Online) 2348 – 7968



[7] K. A. Small & E. T. Verhoef. The economics of urban transportation. London: Routledge.2007.
[8] E. P. Holland & P.L. Watson. Traffic restraint in Singapore. Washington, D.C.: World Bank. 1978.
[9] S. M. Muthu. More pool cars in the RZ. The Straits Times, p. 11. 1975.
[10] T. Symonds. Preparing for congestion. BBC News. 2003.
[11] UK | England | First congestion fines to go out. 2003.
[12] London - Travel - Buses increased after congestion extension. 2008.
[13] Area C è partita: calate del 40% le auto in centro dopo l'entrata in vigore del pedaggio. Corriere Della Sera. 2012.
[14] A, Ciancio. Milan drivers face trend-setting pollution charge. Reuters. 2008.
[15] M. Bertacche. Milan Introduces Congestion Charge To Cut Pollution. The New York Sun. 2008.
[16] G. Santucci. Cede l'effetto-diga, 7 mila auto in più. Corriere Della Sera. 2009.
[17] I. Carra, I. Milano, finito l'effetto Area C nel 2014 gli accessi in centro sono ritornati a crescere. La Republica. 2015.
[18] M. Gibson & M. Carnovale. The effects of road pricing on driver behavior and air pollution. Journal of Urban Economics. 2015. 89, 62-73.