A CASE STUDY ON THE ELECTRONIC TOLL COLLECTION (ETC) SYSTEM IN THE KLANG VALLEY

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Abstract: Congestion at toll plazas has been the common scenario in Malaysian expressways. In view of the delay, toll operators have introduced two ways of transaction in Electronic Toll Collection (ETC) system which is the contact-less smart card toll lane and the non-stop with barrier lane. Despite having the system introduced, traffic congestion at toll plazas still occurs. 800 questionnaires had been randomly distributed to road users and commuters to evaluate their views on the system based on their experience. As a conclusion, we can say that the road user’s level income has a slight impact on the number of users using the ETC system. However, there a significant number of non-ETC users that actually earned a high income and still would prefer to use the manual payment system due to some dissatisfactions to the system. Problems aroused related to ETC system includes the pricing and the reload system.

Key Words: expressways, electronic toll collection system, congestion

1. INTRODUCTION

Congestion in Malaysian highways, most predominantly in the urban areas, is a serious problem that is growing steadily worse. Although the government and private authorities has tried their best to overcome the situation, problems will never stops arises as more and more new motor vehicle on the road registered each year. In 1990, 392,220 motor vehicles have been registered on the road and the number increases dramatically in the year of 2004 whereby the amount changes to 932,363. Statistics by the Road Transport Department show that the incremental number of vehicle from year 1999 to 2004 is 57.93%. The average daily traffic from Kuala Lumpur to Seremban Expressway for example, has changes dramatically from 147,823 vehicles in the year 1995 to 208,656 in the year 2004 and this would increase the delay experienced by drivers at toll plazas.
In view of the delay, toll operators have introduced two ways of transaction in electronic toll collection (ETC) which are the contact-less smart card toll lane (The Touch ‘n’ Go lane) and the non-stop with barrier lane (The Smart Tag lane). To reduce the amount of time wasted in queues; this system promises to increase efficiency in collecting toll fee during transactions and could avoid traffic congestion at toll plazas during peak and off peak hours. Both of the two transactions have the same basic principal that uses the smartcard in order to be functional. The ETC system was handled by Rangkaian Segar Sdn. Bhd. (RSSB) while manual toll collection was handled by the expressway’s operators such as Projek Lebuh Raya Utara Selatan (PLUS) etc.

a. Touch ‘n’ Go card
In Touch ‘n’ Go Card system, users have to ensure that they have a sufficient credit in the card before doing a transaction at the toll plaza. Once the vehicle enter the entry loop, users has to stop and touch the Touch ‘n’ Go card to the reader and the barrier will open as the transaction is successfully completed. The credit balance will be shown on the toll fare indicator as users exit the exit loop. Overall transaction for Touch ‘n’ Go is approximately 4 to 5 seconds.

b. Smart Tag
Users using Smart Tags takes approximately 2 to 3 seconds to complete their transaction at toll plazas. It has the same concept as Touch ‘n’ Go cards but it used an infrared transceiver mounted on the wind screen in order to function. The smart card, which is basically the same Touch ‘n’ Go card, has to be inserted fully in the on board unit (OBU) device, and the display panel shows the current balance in the card and also will show the battery level for a few seconds. The flexibilities of this system is that all SmartTag users could also use the Touch ‘n’ Go lane by just removing their Touch ‘n’ Go card from the OBU and scan it at the reader. However, drivers must ensure a sufficient credit balance before entering the Smart Tag lane at toll plaza. Transaction will be executed upon approaching the entry loop and is completed upon leaving the exit loop. The OBU will emit a beeping sound when transaction is successful and the automatic lane barrier will open. At the exit toll plaza, toll fare will be deducted from the Touch ‘n’ Go card. The toll fare and the new remaining balance will be shown on the Toll Fare Indicator at the toll lane as users exit the exit loop.

2. NUMBER OF ROAD USERS USING THE SYSTEM
Traffic volume were gathered with the help from PLUS and RSSB and the data collection period was from the 8th of July 2005 until 7th of August 2005 from 7am to 7pm at different locations. Figure 1 elucidate the total amount of traffic at selected toll plazas around Malaysian highways for a 30-day period and it is shown that total traffic at Cash lanes were higher when compared to Touch ‘n’ Go and SmartTag lanes.

The total volume of traffic at Cash and SmartTag lane at Damansara toll plaza has shown a good balance of utilization between the ETC and cash lanes. This shows that road users and commuters that uses Damansara toll plaza are adapting well with the system provided. Figure 1 may also conclude that road users at urban areas (Damansara and Jalan Duta toll plaza) are accepting the system and the technology in ETC if to compare to other suburban areas in this study which are still focusing on manual transaction at toll plazas.
As an average, we can see that 51% of road users and commuters have chosen cash for transaction while approximately 24% are those who have chosen Touch ‘n’ Go and SmartTag respectively for transaction at toll plazas. (Table 1)

<table>
<thead>
<tr>
<th>Plaza</th>
<th>Cash users</th>
<th>Touch ‘n’ Go users</th>
<th>Smart Tag users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damansara</td>
<td>36.1%</td>
<td>24.3%</td>
<td>39.6%</td>
</tr>
<tr>
<td>Jalan Duta</td>
<td>49.1%</td>
<td>24.6%</td>
<td>26.4%</td>
</tr>
<tr>
<td>Batu Tiga</td>
<td>53.5%</td>
<td>22.9%</td>
<td>23.6%</td>
</tr>
<tr>
<td>Sungei Besi</td>
<td>57.8%</td>
<td>22.6%</td>
<td>19.6%</td>
</tr>
<tr>
<td>Kajang</td>
<td>50.4%</td>
<td>37.5%</td>
<td>12.1%</td>
</tr>
<tr>
<td>Total</td>
<td>51.4%</td>
<td>24.4%</td>
<td>24.2%</td>
</tr>
</tbody>
</table>

3. AVERAGE DELAYS FOR THREE DIFFERENT LOCATIONS AND LANES

Average delay (time spent for toll payment) for different lanes and locations has been summarized as shown in Figure 2 below. SmartTag lanes proved to have the fastest time in transaction followed by Touch ‘n’ Go lanes and the longest time taken during transaction is the Cash lanes. Delay on Cash lanes is more twice that of the ETC lanes. The above results prove the effectiveness of the existing system by RSSB especially when using SmartTag system to overcome traffic congestion at toll plazas with only 2 to 5 seconds per vehicle per transaction. In view of the trend, it is intriguing to identify the reasons for most of the users that prefer the manual payment system. If the number of users that uses the manual payment system can be reduced, then it is most probably that congestion at toll plazas can be reduced. In order to achieve less congestion at toll plazas, it is important that we ensure that the number of vehicle that uses the ETC system is significantly higher than the number of the manual system users.
4. DATA COLLECTION

For the reason of this study, data had been collected by the means of interview and questionnaires. 800 questionnaires had been randomly distributed to road users and commuters for the author’s data collections. Feedbacks of the questionnaires are 62%. The survey has shown that most of the road users and commuters prefer using the Touch ‘n’ Go and SmartTag system at toll plazas in Malaysian highways in order to overcome traffic congestion at toll plazas. 66% of the sample size has chosen Touch ‘n’ Go and SmartTag system as a solution to reduce traffic congestion at toll plaza whilst the rest of 34% of the road users decline the use of the system. Out of 310 ETC users, 204 are the Touch ‘n’ Go card holder and only 105 are SmartTag users. ETC users includes both Touch ‘n’ Go and SmartTag users.
5. RESULTS

5.1 Comparison of income between ETC Users and Non-ETC Users

a. Users
Individual income has been one of the major issues in the use of the system. It is observed that those who have a higher income use Touch ‘n’ Go and SmartTag system more often than those who have less income. Table 2 summarizes information of individual income for the 310 ETC users. It can be distinguished that respondents who earned around RM3000-RM4999 are those who use the system the most. Respondents that earned less than RM1000 have the lowest usage number. 90% of the ETC users earned an income of more than RM2000.

<table>
<thead>
<tr>
<th>Age</th>
<th>Income &lt;1000</th>
<th>1000-1999</th>
<th>2000-2999</th>
<th>3000-4999</th>
<th>5000&gt;</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-29</td>
<td>1</td>
<td>10</td>
<td>27</td>
<td>19</td>
<td>5</td>
<td>62</td>
</tr>
<tr>
<td>30-39</td>
<td>2</td>
<td>7</td>
<td>27</td>
<td>22</td>
<td>8</td>
<td>65</td>
</tr>
<tr>
<td>40-49</td>
<td>0</td>
<td>9</td>
<td>29</td>
<td>36</td>
<td>25</td>
<td>99</td>
</tr>
<tr>
<td>50+</td>
<td>0</td>
<td>5</td>
<td>21</td>
<td>37</td>
<td>21</td>
<td>84</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>31</td>
<td>104</td>
<td>113</td>
<td>59</td>
<td>310</td>
</tr>
<tr>
<td>Percentage</td>
<td>1%</td>
<td>10%</td>
<td>33%</td>
<td>37%</td>
<td>19%</td>
<td></td>
</tr>
</tbody>
</table>

Among the popular responds between users that are using the system are:

i. Stable income
Stable income permits user to spare some money for reloading their Touch ‘n’ Go card every now and then. Furthermore, they could afford to buy SmartTag for the price of RM180 per set that is being seen as costly to lower income individuals.
ii. Time saving  
Respondent will use highways during working time for fast journey and to avoid traffic congestion in city centre or at toll plazas. The system saves time and money and users do not have to worry for being late to their destinations.

iii. Dislikes facing traffic congestions everyday  
Another common answer from the respondents was that they dislike facing traffic congestions everyday of their life. Work pressure has been giving too much stress and they would want to have a fine and relaxing journey back home.

iv. Easy and no queues  
The convenience brought by ETC has made transaction faster and discard the existence of long queues. The questionnaire has revealed that dedicated lanes for ETC user are among the main reason for respondents with stable income using the system.

b. Non-ETC users  
Not all road users could afford to get a SmartTag OBU or even to reload Touch ‘n’ Go card frequently. According to our questionnaire, individual income has been one of the major problems which contribute the effectiveness of the system and most of the respondents who has limited expenses would not use the system.

<table>
<thead>
<tr>
<th>Age</th>
<th>Income</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;1000</td>
<td>1000-1999</td>
</tr>
<tr>
<td>20-29</td>
<td>28</td>
<td>9</td>
</tr>
<tr>
<td>30-39</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>40-49</td>
<td>16</td>
<td>9</td>
</tr>
<tr>
<td>50+</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>67</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>36%</td>
<td>14%</td>
</tr>
</tbody>
</table>

Table 3 shows summary of individual income for the 186 non-ETC users. It can be seen that individuals who earned less than RM1000 are the ones that are most unlikely to use the system whilst 8% of road users who earned more than RM5000 are among those who still does not use the system. This initially shows that the unstable income affects the usage of Touch ‘n’ Go and SmartTag system among road users in Malaysian highways.

On the other hand, almost 50% of the non-ETC users earned an income of more than RM2000 and this is a significant number of expressway users. If we consider that 90% of users with an income of more than RM2000 can afford to use the ETC system, there must be some other reasons that users are still not using the system. Some information regarding the refusal of road users and commuters when it comes to the usage of Touch ‘n’ Go and SmartTag system in Malaysian highways had been collected. Most of the reasons are related to:

i. Expensive price for OBUs  
Road users and commuters claimed that this system has brought convenience when avoiding traffic congestion at toll plazas. But when it comes to affordability, respondent starts to wonder the reason for the high price on the purchase of SmartTag
on board unit (OBU). Initially, RSSB has issued SmartTag for the price of RM220 and were only used by them who could afford to have one.

On 22 August 2005, RSSB has reduced the SmartTag price to RM180 per set but SmartTag purchases by road users are still low. There were not more than 20% of increments in the number of system users even after the price reduction of SmartTag OBUs. Through the questionnaires, respondent remarked that the price of SmartTag OBU was not reasonable and could be reduced more.

RSSB has recently completed a special promotion whereby road users and commuters could purchase the SmartTag OBU for RM100 per set. Responding to the promotion, non-ETC users began to have interest of purchasing the device. Unfortunately, prospective users still have to initially purchase a minimum RM100 credit for their cards in order to get the discounted SmartTag price of RM100.

ii. Reload affordability
Touch ‘n’ Go system only allow road users to reload with a certain amount of value which is RM20, RM35, RM50, RM100, RM200 and RM500. Card holders do not have the choice to reload any affordable amount they want and this was one of the reasons given by the non-ETC users to the refusal of using the system.

Despite knowing the system could help them to avoid and overcome traffic congestion at toll plazas, their affordability to reload Touch ‘n’ Go card has been the factor which brings the refusal from using the system. The fixed reload amount had given financial problems to road users and commuters who have restricted expenses and by using the system everyday would affect their monthly financial plans.

iii. Toll receipt collection
Toll receipts were mostly used for office claimed or income tax reduction. Although the system does not provide instant toll receipt which is implemented for cash lanes, RSSB has recently introduced ‘e-statement’ through the website which provides card holders with information such as:

- Toll plazas entered
- Toll plazas exited
- Amount deducted
- Amount reloaded
- Date and time entered/exited/deducted/reloaded

Each of the transaction of the card will be uploaded and updated in the online itemized statement within 48 hours from the actual time of occurrence. It shall be available online for a period of 3 months from the date of upload, after which the transaction will be removed from the online itemized statement.

Non-ETC users choose to use cash lane at toll plazas for the convenience of instant toll receipt which does not need them to wait for 48 hours to online and print the ‘e-statement’ just to claim for a few journeys. Limited internet access in Malaysian has also been the major factor which contributed to the refusal of using the ETC although it gives convenience when it comes to fast transaction.
iv. On board unit (OBU) theft
In terms of security, road users and commuters believe that by having SmartTag OBU mounted on the wind screen could lead to car break-ins. The doubts proved to be true as a news paper report in 22nd August 2005 reported a car break-in in Puchong has caused a user the lost of the SmartTag device. This would gain doubts to non-ETC users and even users when it comes to the effectiveness of the system. Furthermore, there is no security measures applied to the device and the Touch ‘n’ Go card for avoiding this kind of crime.

v. Reload locations
RSSB has provided several locations for reloading Touch ‘n’ Go cards but users assailed most of the top-up lanes at tool booths for transactions. Long queues at the “top-up lane” have brought complaints by road users and commuters. This phenomenon created traffic congestions at toll plazas whereby only selected toll plazas in Malaysian highways have provided the lane for user’s convenience. Lack of information regarding reload locations has also brought most users to only focus on toll plazas for card reloading. User’s behavior has been one of the major factors which contributed to traffic congestions at the “top-up lane”. Their reluctance of using other reload locations has brought erroneous belief to non-ETC users when experiencing the congestion scene at toll plazas.

vi. Lack of information
Non-ETC users lacks of information from RSSB regarding the latest promotion on Touch ‘n’ Go and SmartTag system. Limited advertising by RSSB could be one of the factors of their ignorance towards the system. This will inflict the increment in total amount of non-ETC users among road users in Malaysian highways.

5.2 Point of Purchases
Points of purchases are location provided by RSSB for active users to reload their card in order to have successful transaction at toll plaza. Locations provided by RSSB for commuters to reload their Touch ‘n’ Go card are:
- Toll booth
- Toll plaza Office
- PETRONAS petrol stations
- Select ATM machines
- Others includes Kiosk and online purchases

a. Toll booths and toll plaza offices
Figure 5 shows the number of cards reloaded at several places provided within a month time period from 25 August 2005 until 24 September 2005. It also illustrates the distribution for card reloading. From the graph, it is obvious that users prefer to reload their Touch ‘n’ Go card at toll booths rather than other places provided. Only 18.6% of the users utilize toll plaza offices to reload their card and other points of purchase/reload have insignificant number of purchases. This is probably due to the open hours of the offices are from 8.00am to 5.00pm daily and it takes more time to reload at the toll plaza office compared to toll booth. Surveys analysis shows that most of the respondent’s reasons to focus at Cash lanes related to the convenience of the drive through concept.
b. Petronas petrol stations
There are more than 5 major petrol stations operations in Malaysia and Petronas is the only petrol station that has been providing this service. Responding to this matter, only ETC users that use Petronas for their car fuel would probably reload their Touch ‘n’ Go card at Petronas petrol station while the others find it very inconvenience as they use other petrol station.

c. Online service and other locations
Other locations for reloading Touch ‘n’ Go cards are at 24-hour shops such as 7Eleven, Kiosk or other online services recorded a mere 0.3% utilization. This is probably due to lack of promotion done at the above locations. To make problems worse, not every main shopping malls or shops such as the 7Eleven provide reloading service.

6. CONCLUSIONS AND RECOMMENDATIONS

As a conclusion, we can say that level income has a slight impact on the number of users using the ETC system. However, there a significant number of non-ETC users that actually earned a high income and still would prefer to use the manual payment system due to some dissatisfactions to the system. Problems aroused related to ETC system includes:

a. Price
The high initial cost of SmartTag on board unit (OBU) has been one of the major reasons resulting to the indisposition of the system. Although the price had been reduced from RM220 to RM100 per unit, it is still seen as expensive by most road user as users still have to reload a minimum amount of RM100; making a total cost of RM200 in their initial purchase. Expensive OBUs also had also made it a target for car break-ins. Apart from that, the limited values of reload amount has also been the obstacle to non-ETC users that sees it as a form of constrain.
b. Reload system
Unsuitable reload locations gave problems to Touch ‘n’ Go card holder to reload their card. The imbalance in number of ‘Top Up Lane’ at toll plazas in Malaysian Highway has caused traffic congestion upon purchasing. On the other hand, user’s unwillingness of using other point of purchase besides toll booth and toll plaza offices has shown that most Malaysian driver’s attitude does play an important role in achieving and implementing ETC in the country. Their reluctance of using the system provided had affected the effectiveness of ETC to overcome congestion at toll plaza. Users also see that there is lack of advertising for consumer to notice that reloading service is available in certain locations.

It is recommended that Rangkaian Segar Sdn. Bhd. made further studies on consumer behaviors to determine the optimum price for the OBU that would benefit both their company and road users. Cheaper OBUs doesn’t necessarily means less income to the company but may also resulting in more users utilizing the system and hence providing company income in the long run and reducing congestion in toll plazas.

Consumers see the limited number of purchase points and reload locations are the major setback to the system. It is suggested that more memorandum of agreements are made by the ETC operator (RSSB) with other companies that wish to participate in offering reload services for Touch ‘n’ Go cards. RSSB also may consider having reload service via SMS or having reload coupons available in all major stores and have it well advertised so that consumer are aware that there are a number of options available for them in reloading their Touch ‘n’ Go cards.

REFERENCES