SOCIAL EXPERIMENT ON DISTANCE-BASED TOLLING SYSTEM FOR METROPOLITAN EXPRESSWAY

Kouichi SAKAI
Senior Member
Planning & Environment Department
Metropolitan Expressway Company Limited
1-4-1, Kasumigaseki, Chiyoda-ku, Tokyo
100-8930 Japan
Fax: +81-3-3502-2412
E-mail: k.sakai67@shutoko.jp

Masahiro SHIMAZAKI
Team Leader
Infrastructure Information Department
Pacific Consultants Company Limited
2-7-1, Nishi-Shinjuku, Shinjuku-ku, Tokyo
163-0730 Japan
Fax: +81-3-3344-1887
E-mail: Masahiro.Shimazaki@tk.pacific.co.jp

Abstract: Tokyo Metropolitan Expressway (MEX) advances the examination for the introduction of a new toll system of use charge corresponding to the distance from a flat rate system that continued for 45 years aiming at fiscal year 2008. Therefore, user's behavior change when a part of charge social experiment was executed in the section in December, 2006, and the traffic charge was changed trying it depending on the use distance and the change in a traffic situation were measured. The use traffic in the experiment section increased by about 20 percent along the route, and the congestion easing and the running speed improvement of the public road that goes side by side were seen. The examination of the toll system according to the distance in which effective use on the network in the metropolitan area is based will be advanced in the future.

Key Words: social experiment, distance-based tolling system, increase in expressway usage

1. OUTLINE OF METROPOLITAN EXPRESSWAY

287km in a present business distance, and it is 36km in the distance when under construction, and fare receipts are about 260 billion Japanese yen a year, MEX has been used as an aorta in the metropolitan area in which it centered on Tokyo by 1.15 million of every day and two million customers.

MEX starts from the establishment of Metropolitan Expressway Public Corporation in 1959, and the opening to traffic of the first section (about 4.5km) in 1962 after the three years. The network had been expanded to the whole area of the metropolitan area since then. 35% of the whole has been allotted by the entire 28% in the running stand km about the amount of the freight transportation though MEX is only 13% of the whole in the road extension in the investigation in 2001 among the main roads (national road, regional road, and MEX) in the Tokyo mind part (23 districts).

Moreover, it became Metropolitan Expressway Ltd. of four public corporations related to the road privatization in October, 2005. Our company is to conclude the Japan Expressway Hold and Debt Repayment Agency (JEHDRA) and the agreement, to receive lending the road property from JEHDRA, to pay the lending fee (about 12.8 trillion Japanese yen in total for 45 years) provided in the agreement, and to repay the having interest debt surely within 45 years after JEHDRA succeed the having interest debt of the road property and about 4.4 trillion Japanese yen that the public corporation had by privatization.
Figure 1 Metropolitan expressway network

Figure 2 Comparison between MEX and main roads in the Tokyo mind part (23 districts)

Figure 3 Scheme of implementation of expressway business by the agency and the companies
2. PROBLEM CONCERNING PRESENT TOLL SYSTEM

After the necessary capital is hired beforehand, and the road opens, the toll way system of Japan that collects the traffic charge from the user and repays it has been used when it undertakes the construction of a road. A flat rate system according to the sphere of the charge has been adopted from the smooth processing of a large amount of traffic of the city part and the toll gate installation at the exit difficult in constructional and traffic processing about the charge of MEX.

On the other hand, the difference of the use distance where it can run by the flat rate extending the network extends, and the review of a drastic fee system is needed in the current state from which enough use is not attempted in the suburbs part of the increase of the unfair feeling between users, and the network that are the terminal sections. As for this, it was the government and the ruling parties agreement “It attempts from now on of the distance charge system based on the idea of load according to the level of use aiming at fiscal year 2008 attempting securing appropriate fare receipts necessary for paying the lending fee.” in December, 2003.

The tough going continues from the increase of amount of the investment necessary for maintaining a new route to the company's management years how many to leave untouched and to assume the charge from the reason why the traffic charge is large amount of money for MEX. Then, it is necessary to introduce impartial and an easy-to-use fee system to the user, and to attempt a further promotion of utilization. When it undertakes the introduction of the fee system according to the distance, the grasp of the use distance and the use time etc. becomes possible by using ETC(Electronic Toll Collection system) that began operating in March, 2001. In MEX, the ETC lane was maintained to 11 toll gates when beginning to operate it in March, 2001, and the ETC maintenance was completed in all almost toll gates (160 toll gates) by April, 2004. The ETC availability (proportion of the number of the ETC use) has been exceeded 50% in June, 2005, now exceeding 75% (May, 2007). Various charge discounts that use the function of ETC are executed along with the introduction of ETC. The charge discount according to time zone according to a day of the week is executed, and 3~20% discount on the weekday (Include it on Saturday) and Sunday and holiday are discounts 20% according to the time used all day in October, 2005. Moreover, receiving a further discount according to the charge for one month total traffic becomes possible about the user with high use frequency of MEX. In addition, a specific charge is set in the terminal section etc. of the route in the direction of the radiation where the use frequency is low.

![Figure 4 ETC system](image-url)
3. OUTLINE OF CHARGE SOCIAL EXPERIMENT

Now our company introduction schedule distance charge detailed toll system construction, examination certain debt repayment and further promotion of utilization, introduce social experiment (social big influence cause think measure introduction precede experiment, Japan similar trial evaluation called “social experiment”) execute toll system change, traffic change congestion situation of the occurrence, public roads given influence, assume effect measure important.

If the average of gaining the weight is done, a standard traffic charge for one becomes 770 yen if the use state of present MEX is seen, the charge for the Tokyo line traffic is a standard car 700 yen, and is large-sized car 1,400 yen. When here is assumed to be a reference point of the charge setting according to the distance, and the charge for each km is assumed to be 31 yen per km, similar to the expressway between peripheral cities, the cut becomes 210 yen because a central value of the use distance is about 18km. This 210+31L (L: use distance (km)) is assumed as a basic design image of the charge according to the distance. As a result,
it is assumed that the charge according to the distance when introducing it in full scale is examined through a social experiment because the driver who newly additionally uses high speed and the driver who refrains from high-speed use are assumed, too though half of short distance users become lower the charge, and half of long distance users become the load increases.

The social experiment reported this time is an experiment to understand short distance user's behavior change chiefly. Many of routes in the direction of the radiation connect with the expressway between cities, and there is comparatively room in the road capacity in MEX. From terminal to standard car roughly and grasp of 100 yen off and large-sized car of influence etc. on use state of MEX and public road by setting charge to become 200 yen off then in addition to present, specific charge section roughly set at 6km as for short distance use up to 10km, 17〜34% discount on the weekday (Include it on Saturday) and Sunday and holiday becomes 34% discounts from 700 yen usually for the standard car as for the charge in the object section under the experiment all day because it becomes the charge discount and repetition application according to time zone according to a day of the week described ahead. Object routes are eight routes, seven of routes in Tokyo area and one of routes in Kanagawa area and only the vehicle by the ETC wireless traffic applies the discount.

**Toll list of experiment section in Tokyo area (ordinary vehicle)**

<table>
<thead>
<tr>
<th></th>
<th>before experiment</th>
<th>during experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>non-ETC user</td>
<td>700 yen</td>
<td>700 yen</td>
</tr>
<tr>
<td>ETC user</td>
<td></td>
<td></td>
</tr>
<tr>
<td>weekday 6〜11,15〜18</td>
<td>680 yen</td>
<td>580 yen</td>
</tr>
<tr>
<td>weekday 11〜15,18〜22</td>
<td>630 yen</td>
<td>530 yen</td>
</tr>
<tr>
<td>weekday 22〜6</td>
<td>560 yen</td>
<td>460 yen</td>
</tr>
</tbody>
</table>

Figure 7 Social experiment sections
It is necessary to announce the experiment to public positively to obtain effective data because of the experiment. The following were used as the main medium of announcing to public.

- 630 thousand handbills and 400 posters produced, and was the distribution requested to the shipping field and the ETC on-board equipment sales and the installation shop, etc. in addition to distributing or posting it in the public office building, toll gate, rest facilities (PA), our company, and the local authority.
- Making a banner, and total 120 locations noticed in expressway and public road.
- The contents of a social experiment added to our company homepage.
- It published in the magazine of announcing to public of our company and the local public group issue.

The experiment was executed at from 0:00 AM on Sunday, December 3, 2006.

4. EXECUTION CONDITION OF CHARGE SOCIAL EXPERIMENT

The change in a traffic situation by the social experiment execution was surveyed and the expressway and the public road were surveyed respectively. It investigated in November, 2006 before the experiment was executed, and the investigation under the experiment was executed in March, 2007. Traffic in which ETC was used increased by 9.2% in the experiment section when a traffic situation of the expressway was first seen, and it expanded more greatly than 4.9% of the entire MEX (Tokyo area) except the experiment section. The traffic of the discount object of eight routes in experiment section total increased by 4,232 cars a day and it increased in two routes of 1,000 cars a day or more.
Moreover, the continuous use traffic with the expressway between cities connected with MEX increased. It was an increase of 3〜20% in all of the eight routes to be experimented according to the charge discount of MEX though a separate charge was collected from both to use it continuously because the fee system was different. The short distance use for MEX was promoted as a result of the charge discount by the experiment, and the tendency that traffic that continuously used the expressway increased was admitted.

![Figure 10 Traffic for which the expressway between cities and MEX continuously used](image)

When it was investigated whether the change in the use gateway in MEX ,in a word, the change in the use distance was seen, it was understood that the traffic of 2〜11% had converted to the gateway use in the experiment section in each route from the charge discount. Especially, the tendency that the traffic used for the central area of Tokyo on the tip of the experiment section before it experimented had changed to use in the experiment section while experimenting was seen. It is thought that the advantage of avoiding getting congested because congestion occurs constantly in the direction of going up toward the central area of Tokyo in MEX and discounting the charge, too has been received.
Next, the influence on the public road was investigated. Here, it analyzed it for the direction of the center of a city of No.14 in the national road and MEX No.7 Komatsugawa line where the Chiba district on the east side of the metropolitan area was connected with the central area of Tokyo. The use traffic increased by 8,528 cars and as much as 20.1% from 7,099 cars in the Kinshicho exit in a high-speed experiment section. The allotment rate of the expressway increased by as much as 5.6% at 4.1% on 24 hour average increase and 6〜11 o'clock in the morning when the traffic of both was measured in the same point, and the allotment relation was calculated. In addition, it was a speed of each measurement section at about 1〜8 km/h improvement at 6〜20 o'clock in daytime when the travel speed of No.14 national road was measured by using the probe car. The effect was understood for the traffic of high-speed use to increase by the charge discount of the expressway, and to be demonstrated in the congestion easing in the public road.
Figure 14 Improvement of average travel speed about No.14 national road (6 a.m. to 8 p.m.)

5. CONCLUSION AND SCHEDULE FOR THE FUTURE

This experiment is a social experiment because of understand the behavior change of the short distance user that the traffic charge becomes lower from a past flat rate system by the charge introduction according to the distance. After a part of MEX charge was discounted in the section trying it, a cancellation of the unfair feeling between users by the flat rate, effective use on the expressway network, and constant congestion easing in the direction of the center of a city were measured in the effect after the advantage that ETC possessed had been used. When it compared before it experimented with the data under the experiment, a constant effect has become visible about the traffic situation improvement in the public road that goes side by side with an increase of the use traffic in the experiment section. The general road user was understood for traffic that shortened the use distance to have increased from avoiding congestion that made the central area of Tokyo a head and becoming the charge discount, for the charge resistance to decrease by the charge discount, and to have converted to the expressway use about the expressway. It is thought that a traffic situation improves it from seeing uptrend of the public road that goes side by side at the travel speed in the direction of the center of a city especially, and the rise of the allotment rate of the expressway.

It is also important it is not only a short distance user but also to be going to understand long distance user's behavior change in the future. After it discriminates to classify the user into three stages (the short distance, the medium range, and the long distance) by the difference of the use distance, to reduce the discount rate of the long distance user, and to expand the discount rate of the short distance user, user's behavior change is measured. It is scheduled to apply even if it continues and it puts it on Sunday and holiday though it precedes on weekdays and it applies. Additionally, what behavior change occurs is scheduled to recruit the monitor intended for the long distance user, to apply the charge according to the distance to the monitor virtual, and to be experimented. The difference is expected to be about sensitivity even if the absolute value of the amount of the change is the same when occasioning for the charge to become higher and lower, and I want to do an enough examination from these experiment results when the charge according to a final distance is set.