

# UTILIZATION AND EFFECT OF HANARO TRAFFIC CARD IN PUBLIC TRANSPORTATION SYSTEMS AT PUSAN METROPOLITAN CITY

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## **Transportation Condition in Pusan**

The Pusan Metropolitan City is Korea's the second biggest city, with a population of 3.8 million. It is known for being one of the top 5 harbor cities in the world. In Pusan, the number of cars rose at the annual average increases of 15.3% from 124,000 in 1986 to 785,000 in 1999, and subway is 32.5km(the rate of transportation share is 11.9%), and 2,721 buses run on their own 191 lines (the rate of transportation share is 32.6%). However, because of the road rate is 17.0%, the traffic congestion is occur. That means a waste of money with the amount of \$1.7 billion lost by the traffic congestion.

Though there are 785,000 cars, the traffic infrastructure has yet to reach a level of convenience. Severe traffic jam occurs in all places around the city. Especially, the extent of congestion of bus and subway stands at 147% and 171%, respectively. Further, it is not convenient for people to pay tokens and fares for the bus, magnet tickets for the subway, and fares for taxis and tollgates.

According to professional and citizens' consensus, the investment in the

field of traffic seems to be the most urgent in policy matter.

## **Introduction to The Hanaro Traffic Card System**

### **Outline of HANARO Traffic Card**

The HANARO Traffic Card is an “Electronic Monetary System” that can be used for the payment for taxi, bus, parking, toll and even other kinds of services with a single piece of I. C. card.

HANARO Traffic Card is composed of the Electronic Wallet Card and the HANARO Public Traffic Card (HANARO Traffic Card). The latter consists of three different kinds for adults, university students, and middle and high school students. To stimulate the use of this system Pusan Metropolitan City Government (PMCG) gives financial support (single HANARO Traffic Card costs \$3.35, Consumers pay \$1.72, PMCG pays \$0.86 and the bank pays \$0.77).

HANARO Traffic Card can be used for I.C. advance payment card, electronic wallet, cash card, credit card, and electronic bank account. I.C. advance payment card has contact and contactless types. Users charge their HANARO Traffic Card in its contactless I. C. chip with certain amount of money (\$1~ \$60.2) at first and pay for bus (both bus and maul bus), subway, and toll fare with it.

In case of contact type HANARO Electronic Wallet, users charge contact I. C. chip (prepayment part) with certain amount of money (maximum \$60.2) that can in restaurants and taxi, etc. For Electronic Wallet, people first charge contact I. C. chip (electronic wallet part) with certain amount of money (maximum \$4,000) and be used in places like department store with its secret code. Also it can be used as a credit card and a cash card in stores where they accept credit cards all across the country and as an ATM card, too.

Other than those services you can also use it as an electronic bank account and you can transfer account, deposit, withdraw, wire without passbook and seal.

## Objectives and Organization HANARO Traffic Card System Development

Too many people drive their own cars and that's the basic cause of traffic problems in metropolitan cities. So the enforcement of policy that could stimulate people to use public transportation is more important than anything. So the acceptance of HANARO Traffic Card seems suitable for the solution. The following are the objectives of HANARO Traffic Card.

To begin with, The HANARO Traffic Card will help public transit users for transferring easily, removing the inconveniences of using, several fair tickets and give high quality services. Then, reduce cost of travel by discount fares.

**Table 1. Participants and their Roles**

Participants	Roles
PMCG	<ul style="list-style-type: none"> <li>- Develop Policies</li> <li>- Set the system development schedule</li> <li>- Support system development</li> <li>- Compromise disputes among the participants</li> </ul>
Service Providers	<ul style="list-style-type: none"> <li>- Install card readers</li> <li>- Send transaction Information to HANARO Traffic Information Center</li> <li>- Support Sepc. Design</li> </ul>
Management Organization (Ex-DongNam Bank)	<ul style="list-style-type: none"> <li>- Support system development</li> <li>- Pay the partial costs of HANARO Traffic Card</li> <li>- Provide financing services</li> <li>- Provide recharge services</li> </ul>
Secondary management Organization	<ul style="list-style-type: none"> <li>- Design system and specification</li> <li>- Technique support</li> <li>- Operate the account settlement and recharge systems</li> <li>- Operate the entire system</li> </ul>
Private Enterprises	<ul style="list-style-type: none"> <li>- Develop card readers</li> <li>- Establish a network of system</li> </ul>

In addition, it is expected to save manpower, prevent profits from leaking, and facilitate management for transportation company by advanced public transit information system. At third, it will provide prompt and accurate information or data about the numbers of user, transferring passengers and so on. Lastly, the HANARO Traffic Card can be make information society in early stage using one card system per person.

We made first foundation of this plan in July 1995. We held a meeting to precede this plan in Apr. 1996 and in Aug. 1996 we made the Steering Committee. It is composed of 11 people including the mayor of PMCG, the chief executives of Pusan Urban Transport Agency and the Bus Corporation Association, the representatives of Taxi Association and Private-owned-Taxi Association, Chairpersons of ex-Dongnam Bank and KICC.

PMCG makes policy and manages the whole plan. Transportation Companies operates the system. Managing organization issues HANARO Traffic Cards and manages the funds. Management assistance organizations (Korea Telecommunication and Information) develop and manage the system. Private corporations developed system machinery.

PMGC has tested this system from Dec. 1996 to Jul. 1997 and installed system machinery in buses and subways on Feb. 3, 1998. On Jun. 16, 1998, installation was expanded to some maul minibuses and some tollgates and finally completed on Aug. 20 1998. It took about three years from planning of this plan to operation on each transportation system.

### **Outline of HANARO Traffic Card System**

The HANARO Traffic Card System consists of the HANARO Traffic Card, issuing cards, supplements, payments and Van System (calculation, BBS, report production).

The issuing system produces RF (Radio Frequency) traffic card, with database, it takes out or put information. When user spends up all the money in a card, it can be recharge it at places where they accept credit card, vendors and also through vending machine. Those means are called issuing system and they transmit the data of recharging to calculation center.

Payment system refers to the one that you can pay for bus, taxi, subway, parking fees through the machinery. VAN system is a network that calculates the charges between consumers and transportation companies.

Accurate account system works by collecting machine and sending information to transportation companies and banks. BBS system is a reading system from all kinds of information of getting in-off condition or company's profits to cars and months. To report information gathered from many sources, Report Product system is to be used

## **The Status of Utilization and Field Survey of Hanaro Traffic Card**

### **Card Distribution**

The 2,689,000 HANARO Traffic Cards have currently been distributed. 1,819,000 cards are for adults, 275,000 for college students and 634,000 for high school and middle school students. The number of users is reached 71.1% of traffic population. The number of cards is increasing by 3,000-4,000 pieces per day.

### **System Installation**

On January 2000, Reader machines were installed on 3,003 buses (100%), in 976 gates of subway stations (100%), in 7,966 taxis (32%), on 416 maul minibuses belonging to 68 companies (94.5%), and at 28 tollgates (100%) on Pusan urban highways. There are 43 transmit systems in companies and fare recharged boxes are 1,446.

Figure 1. HANARO Traffic Card System Components

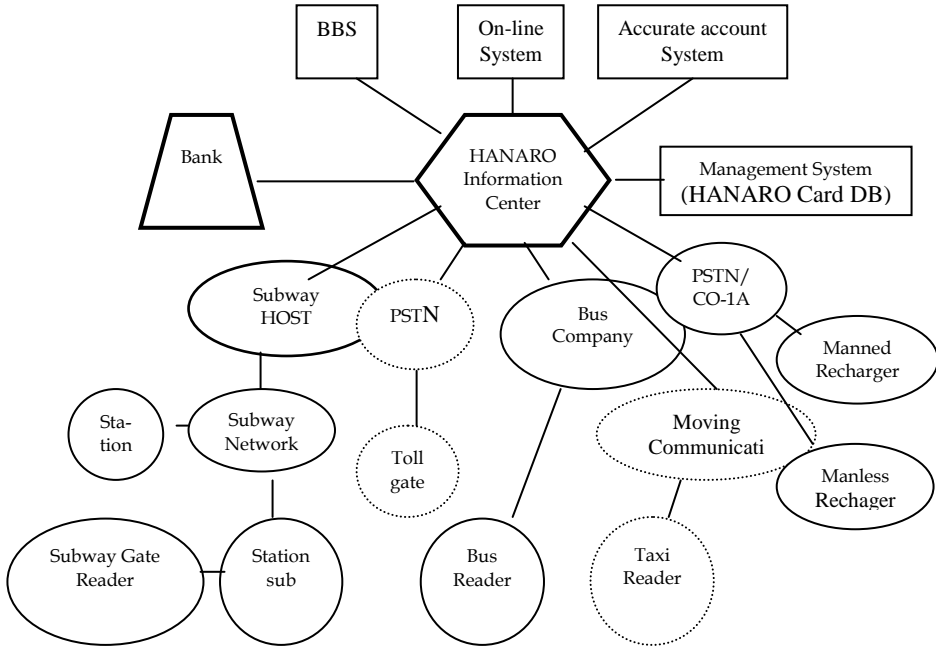
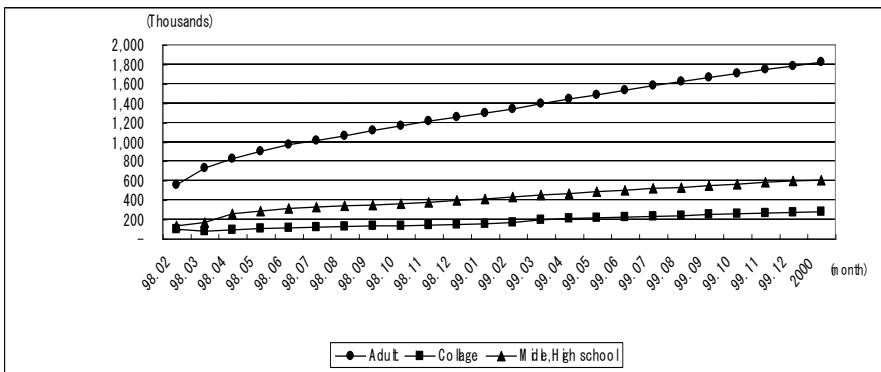


Figure 2. Cumulative number of HANARO Traffic Card sold (2. '98~1. 2000)



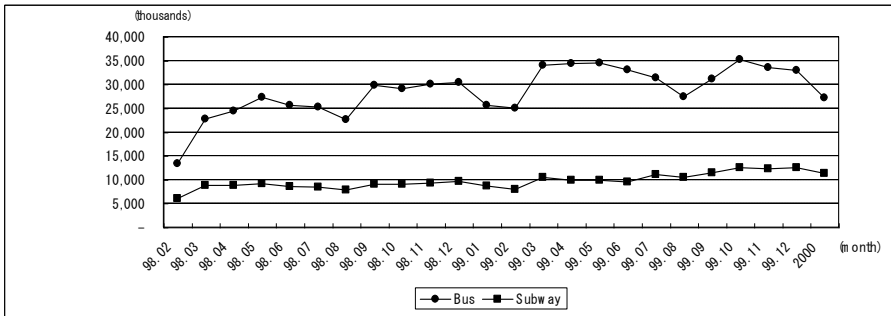
**Table 2. Present Situation about HANARO Traffic Card Systems**

Classification		2. 3. '98	1. 2000	Remark
Card Readers	Buses	3,003	3,003	41 companies
	Subway fare gate	604	976	53 stations
	Taxies	6,802 (29% of total taxies)	7,966 (32%)	+1,164
	Maul minibus	0	416	47 companies
	Tollgate	0	28	3 urban expressway
Transmit Systems	Bus operators	40	39	-1
	Maul minibus	0	4	+4
Recharge Center	Subway	50	74	+24
	Banks	45	320	Korea Housing Bank Pusan Bank +275
	Saemaul Finance Firms	261	338	+77
	General recharge centers	306	714	+408

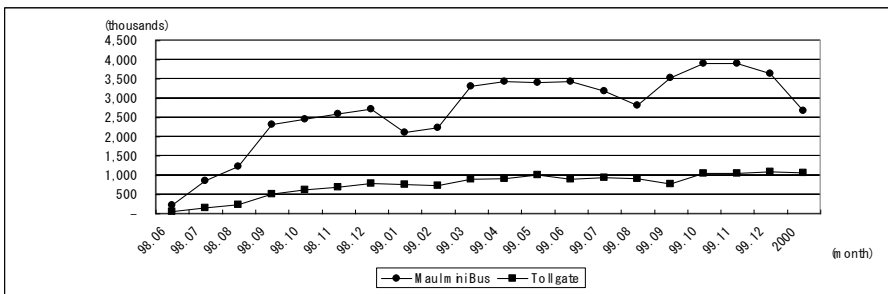
### Utilization of HANARO Traffic Card

62.3%(total 1,820 thousands) of bus passengers use HANARO Traffic Card and 60.4%(total 664,000) of subway passengers use this system. Recently 125,000 passengers of maul minibus and 33,000 cars that go through the tollgate are using this card system but these numbers are gradually increasing. Figure 3, 4 shows this graphically. In case of taxi, there are not many people with HANARO Electronic Wallet Card that pay for taxi, so we only found 30 people use this card per day.

**Figure 3. Uses of HANARO Traffic Cards:  
Subway and Buses (2. '98-1. 2000)**



**Figure 4. Uses of HANARO Traffic Cards:  
Maul minibus and tollgate (7. '98-1. 2000)**





**Table 3. The Status of Utilization of HANARO Traffic Card  
in each Traffic modes**

Transportation System	Person trips Using HANARO Card (A)	Total Person trip (B)	% Person trips to the total person trip (A/B×100)	Operation
Bus	1,134,000	1,820,000	56.6	Full
Subway	401,000	664,000	62.8	Full
Maul minibus	125,000	237,000	52.7	Full
Toll gate	33,000	220,000	15.0	Partial
Taxi	30	1,010,000	-	Partial

**Table 4. Traffic modes using HANARO Traffic Card**

	Bus	Subway	Maul minibus	Taxi	Bus+ Subway	Maul minibus +Subway	Maul minibus+Bus	The others
First	34.6%	20.2%			44.9%			0.3%
Second	35.6%	6.5%	2.3%	0.8%	46.2%	2.1%	4.8%	1.6%

**Table 5. Degree of satisfaction using HANARO Traffic Card**

	Strongly Satisfaction	Satisfaction	Undecided	Dissatisfaction	Strongly dissatisfaction
First	16.9%	59.6%	19.1%	3.4%	1.0%
Second	18.1%	64.9%	15.8%	2.3%	0.6%

## Analysis of Field Survey

In the first place, transfer passengers for bus and subway, 44.9% (first), 46.2% (second) people use HANARO Traffic Card. 76.5% (first), 83.0% (second) of users show their satisfactory responses on HANARO Traffic Card.

As it was expected, HANARO Traffic Card is used mainly for transfer passengers. Especially, it seems to develop sequent transportation system on both bus and taxi. And it is very important for bus to play a role as feeder traffic and for subway to play a role as a main transportation. It will be very helpful to establish a good system for HANARO Traffic Card.

The convenient point in using HANARO Traffic Card is not only “no more charges or tickets” (75.5% of responses), but also “transfer convenience” (45.5%)-as the second result shows-, which can provide high quality service.

**Table 6. The convenient point using HANARO Traffic Card**

	Transfer Convenience	No more charges or tickets	Advantage of Fare discount	Convenience for keeping and Portability	The others
First	10.3%	75.7%	4.4%	8.4%	1.1%
Second	45.9%	41.5%	4.3%	5.2%	3.2%

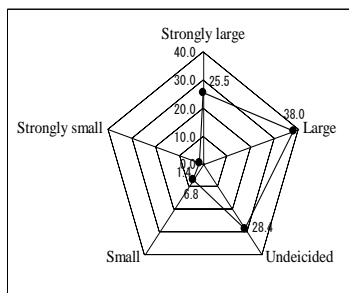
Additionally, convenient point in using tollgate is a convenient payment (67% of responses) and a short time to pass (20.9%). The shorter (2.5 seconds per car), the better traffic condition will be.

Now, an Electric Wallet Card is available for taxi, but people, including HANARO Traffic Card non-user, want to use taxi with HANARO Traffic Card if it is available for taxi. Thus, taxis need to install HANARO Traffic Card Reader, being cooperated with other transportation system. That is why PMCG need Combi Card (contact and contactless type). If there is a Combi Card, people are likely to exchange for the card and use it.

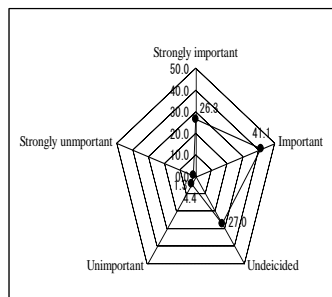
According to the survey, 30.7% of people have pagers, 31.7% have cellular phone, and 60.3% have both of them. If HANARO Traffic Card's function is added to such a machinery, 40.5% of people (including HANARO Traffic Card non-users) would use them. That is a considering result.

There can be HANARO Traffic Card for parking, cross country bus, public phone, commuter, vending machine (like those of newspaper, coffee etc), paying bills. It means that HANARO Traffic Card can help to improve life-convenience with HANARO Traffic Card, having complex and multiple functions.

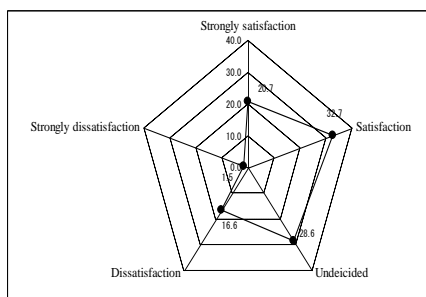
**Figure 5. Valuation of HANARO Traffic Card policy**



(a) Enforcement effect



(b) Degree of important



(c) Degree of satisfaction

The following is the summary of other survey. The HANARO Traffic Card stands fourth among the 30 most favored traffic related policies. In the list, it was the policy related roads, TDM, TSM and service improvements, etc. 63.5% and 67.4% of people marked that the effect would be huge and the importance of this plan were also considerable. 53.4% of people answered that they was satisfied with this card system. About the HANARO Traffic Card System, people showed higher satisfaction than with the construction of road and subway or Rainbow movement (not driving their own cars once a week).

## **Problems of Hanaro Traffic Card System**

### **Problems**

Following are several problems for developing system.

At first, there is resistance against HANARO Traffic Card, which can be caused of completely visible tax revenue, for excessive non-profit equipment investment of transportation companies and computerized earnings.

At, it is difficult to negotiate the division of prepaid price and charge of service fare between transportation companies and organization.

At third, others occur when they are asked to pay more to protect deficit and improve functions of the system.

At fourth, considering system, rate of using at taxi is low. Taxis accepting only HABARO Electric Wallet Card (contact) cause this problem. This is the biggest failure indecision in terms of for transportation policy, selecting system and management.

At fifth, available area is limited in Pusan Metropolitan City. It is stipulate to the primary grade C (first grade, APTS, second grade, CBIS) of the third architecture in collecting Korea's public transportation fare in National ITS Master Plan. So it makes difficult to practice the metropolitan city project. For example, like cross-country bus fare.

At sixth, transferring payment system is not settled down yet, for the effect of discounting of bus and subway, which people can transfer. And Korean

Economic Crisis causes weak investment or supporting for the ITS project and it postpones development of Combi Card and other systems.

## **Solutions**

PMCG held 25 meetings and seminars to solve those aforementioned problems. They informed this policy in more detail to transportation companies and organizations and urged them to participate. The city had tests with banks, in part and the whole transportation companies, and applied this system to some transportation and extended it. Further they made three kinds of negotiations to deal with transportation companies' interest.

Nowadays they are improving the system and preparing for Combicard.

## **The Effect And Improvement of Hanaro Traffic Card System**

### **The Effect**

Following are HANARO Traffic Card's expected efficiency.

HANARO Traffic Card user can have an effect of discount (Bus token, subway ticket), easy transfer and convenient payment. Transportation companies use a computerized system to collect fee would be helpful to increase the transportation flows in accordance with reasoning management, protecting profit-omission, printing tickets, reducing management fare and growing public transportation.

It will be efficient to get data related to public transportation. Information recorded by HANARO Traffic Card has 21 things are date, time, balanced, card's number and sort, discount rate, transfer discount rate and stops codes. These can be used to analyze traffic flow, the number of cars on a road to day, time and several kinds of information for traffic policy or payment. It will be very useful to emphasize the utility of public transportation. That's the reason why it is important to expand the functions of HANARO Traffic Card. For bus, especially, it will give the possibility of section-fare system and

distance-fare system

**Table 7. Expectation effects using HANARO Traffic Card**

Participants	Costs	Benefits
PMCG	Subsidy for the cost of card purchase: \$.82/ea.	Enhanced policy formulation processes Enhanced fare level Reduce traffic jam at tollgate Survey cost reduction: \$98,100/yr
Citizens	Card purchase: \$1.63/ea.	Fare discount: \$8.65/prs/yr
Bus Companies and Union	Card reader: \$900/veh Transmit systems: \$6,000/ea.	Reduce Manpower (Token, ticket handling): \$915,600/yr Token vending machine: \$147,100/ea. Token and ticket products cost: \$60,000/yr Reduce frauds
Taxi Companies	Card reader and Cellular phone: \$500/veh	Cash handling manpower: \$107,900~215,800 Profit for phone device: \$6,323,500/yr
Pusan Urban Transport Agency	Subway HANARO Traffic Card System installation - Line 1: \$2,799,600 - Line 2: \$1,807,000 - Line 3: \$797,000	Ticket production cost: \$341,700 Manpower reduction - Line 1: \$1,667,700 - Line 2: \$3,335,400 - Line 3: \$2,208,900 Ticket vending machine: \$2,830,200

### Suggestions for Improvement

In order to maintain these effects, we suggest the future developing strategies to HANARO Traffic Card System.

At first, long-term strategies are needed. Organizing a HANARO Traffic Card committee, sequent systems, schedules of technology and analysis of system should be improved considerably. Also, this plan will be in harmony with ITS project by the government, serving efficient budget allocation and supporting private investment for technology.

It is necessary to develop Combi Card and to add functions to pager, and cellular phone. As see n in Table 8, HANARO Traffic Card can be used for

finance, distribution and life.

At tollgate, the payment is contactless type like those for subway and bus, but HANARO Traffic Card will be useful, for a Non-stop toll system. To build Traffic Information Center is expected to analysis public transportation system.

At second, it should be analyzed for the profits by Transportation Company, and be discussed how to rise the charge-fare, to discount fare, and to support card-fare, which can make people beneficial.

At third, government needs to extend the policy. They need to install the booth for this system machinery at subway and toll gate and extend it so that they could increase the quality of the service. Also they need to consider the acceptance of payment method through which the public pay per distance and need to establish transferring system and give people discount.

At fourth, they need to make HANARO Traffic Card that fits with standard National ITS and work with public relations so that they can be known to other cities (especially the area with metro transportation area). Through that kind of work, they save the manufacturing expense and public, transportation companies, private corporations can also save their budget.

Lastly, today HANARO Traffic Card only pays for bus, subway and toll fee, etc. but they need to make more people in financial business and VAN (Value Added Network) business by using this system more.

**Table 8. Parts where HANARO Traffic Card can be used**

Divisions	Details
Transportation	Taxi (Comb card), toll gate (private management), parking fare, cross country bus, Light rail, commuting train, gas station
Finance	Automatic payment through account, paying bills
Distribution	Vending machine, small store
Public Service	Public phone, sports ticket, concert, admission fee at park, Official document fare

## Conclusion

First of all, HANARO Traffic Card is designed suitable for metropolitan city transportation system (bus, subway, taxi (contact type) and toll gate).

Considering the properties of each transportation system, the extension (to other parts of services) of this system seems rather easy.

Secondly, we found that the local authority, citizens, transportation companies, banks and other related private corporations could get benefit from this system. Consumers don't have to care about different kinds of token or tickets and at the same time they can easily transfer to other transportation system and save certain amount of money.

Transportation companies can increase their income by computerization because in that way, they don't have to print tickets and they can have more consumers due to its convenience.

Moreover, this system can give the local authority the basis of fine transportation policy. The record of one time use of this system includes 21 codes such as the date, time, charge, card number and its kind, discount rate, the time and place the person gets on and off the transportation system

From this record we can see how traffic flows and get some foundation for making policy and charge system.

Thirdly, we found that a lot of people are satisfied with this system due to its convenience when they transfer. That's why we assume HANARO Traffic Card fits to the connections between transportation systems.

At fourth, technological and financial problems in its early stage of development, the separation between contact type and contactless type which made inconvenience to use it in taxi, the imperfect connections between transportation systems, insufficient funds, non preparation of long term plan are main problems of this system.

Some cities in the world today are using or planning to use Smart Card for charge system but they lack the information for this. Therefore we consider this paper can provide that information to policy makers or transportation companies in those cities that are planning to accept the system.



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