ANALYSIS AND EVALUATION OF THE PUBLIC RESPONSES TO TRAFFIC CONGESTION PRICING SCHEMES IN URBAN STREETS

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Abstract - Traffic congestion pricing in urban streets is one of the most suitable options for solving the traffic problems and environment pollutions in the cities of the country. Unlike its acceptable outcomes, there are problems concerning the necessity to pay by the mass. Regarding the fact that public response in order to succeed in this strategy is so influential, studying their response and behavior to get the feedback and improve the strategies is of great importance. In this study, a questionnaire was used to examine the public reactions to the traffic congestion pricing schemes at the center of Tehran metropolis and the factors involved in people's decision making in accepting or rejecting the congestion pricing schemes were assessed based on the data obtained from the questionnaire as well as the international experiences. Then, by analyzing and comparing the schemes, guidelines to reduce public objections to them are discussed. The results of reviewing and evaluating the public reactions show that all the pros and cons must be considered to guarantee the success of these projects. Consequently, with targeted public education and consciousness-raising advertisements, prior to initiating a scheme and ensuring the mechanism of the implementation after the start of the project, the initial opposition is reduced and, with the gradual emergence of the real and tangible benefits of its implementation, users' satisfaction will increase.

Keywords - Demand Management, Traffic Congestion Pricing, Public Acceptance, Public Objection.

I. INTRODUCTION

Today, most urban environments are affected by high traffic, air pollution and environmental pollution, and as a result of these, huge amounts of money are spent annually. With the loss of people's time in traffic and the excessive consumption of fuel in the long queues of cars and the environmental impacts caused by traffic factors, the societies' economy suffers huge damage every year. In this regard, "Traffic Congestion Pricing" through demand management is able to solve the traffic congestion and environmental problems. Therefore, the congestion pricing is an accurate and efficient way to get the costs of roads from the users to the extent of their actual use of roads and it can vary according to the type of vehicle and the hours of a day; in return, these expenditure which will be spent to reduce congestion and to improve the environmental issues; it also helps to the construction and infrastructure and the improvement of the quality of urban life.

The roads pricing can be implemented for all road networks or for specific roads and bridges. Since the implementation of the pricing for all urban roads is very ambitious, it is normally applied only to certain passages. The road pricing is either used to retrieve the exorbitant cost of constructing expensive infrastructure such as freeways or to prevent more congestion in crowded or high-congested roads; it also serves as a deterrent for drivers not using personal cars on these routes, and as an encouragement for using the public transportation system. Congestion pricing restricts the use of high-congested roads and reduces the need to expand the road network. In most busy and densely populated urban areas, it's not practically possible to have enough roads for peak hours, so pricing will limit demand by increasing travel costs. Pricing may include a single road (road toll) or cordon boundary or all city areas (commercial centers). People show different responses to travel demand management measures such as congestion pricing. Considering how people pay attention to these projects is of particular importance because more effective schemes are those that, in addition to solving environmental and congestion problems, consider probable public disagreements. A scheme with the least opposition will be more effective. This research, while reviewing global experiences on public reactions to congestion pricing schemes, examines the reactions of the people of Tehran to the city's traffic schemes and also analyzes the effective parameters in pricing acceptance. Further, with the assessment of emerging opportunities and threats, solutions are recommended to reduce public opposition to these schemes.

II. RESEARCH LITERATURE

In the past few years, various studies have been conducted on the public perception about congestion pricing projects. Most of these surveys are done by telephone (e.g., Ubbels and Verhoef in 2006, and Burris et al. 2007) [1]-[2]. Some studies are also based on interviews with participants in previous pricing programs (e.g., Evans et al. 2007) [3] or with specific local stakeholders (such as Benjamin et al. 2007) [4]. And a number of studies used "Focus groups" (such as Research and Analysis of Texas Transport Institute in 2005 and Cook's research in 2004) to further elucidate details of users' reactions

[5]. The most prominent process seen when comparing different surveys is that those who implemented the project after a specific pricing scheme had more favorable opinions compared to those who addressed these projects only theoretically. The lack of prior knowledge of users with congestion pricing or managed lanes will increase this likelihood that users oppose congestion pricing (Kockelman, 2005; Burris et al. 2007) [2], [6]. Another point to consider is the way pricing is presented. A study in Oahu showed that pricing as "day's time-based tolls" for managing congestion by taking turn for travel and travel times, can only win 15% of public positive opinion; but offering pricing at "user expenditure" such that who made more use of the facility, pay more costs and spending these expenditures to develop and maintain roads achieve 42% of public acceptance (Ungemah and Collier in 2007) [7]. In addition, those groups of people living in non-toll areas are more likely to consider congestion pricing as unfair (Kockelman, 2005) [6]. Pricing policies are designed to reduce the problems caused by the use of cars by changing the individual behavior of users. Therefore, considering all the pros and cons of these changes and determining the necessary measures in policy-making, one can reduce the opposition of the people and increase the success rate of the project. These policies may cause a variety of behavioral changes in users. **Table 1** provides an overview of possible changes [8].

Table 1: Potential Behavioral Changes Due to Density Pricing

Behavioral changes	details
Driving behavior	Driving style (such as speed, stop, etc.)
Travel behavior	Travel Changes - Route Selection - Travel Time - Destination Selection (such as Shopping, Recreation,...) - Number of Trips - Travel Methods (for example, by car, motorcycle service, public transport, bicycle, walking)
Car ownership	Type of drive (type of fuel, size ...) - having a car (number of cars, replacing the car)
Location choose	Choose a location - choose a place of work

To have a comprehensive overview of the implications of pricing policies, it is crucial to distinguish among a variety of behavioral changes and to consider short-term effects of congestion pricing as much long-term impacts. People need time to adapt to new conditions, and behavioral adaptations are more likely to occur only in the long run. According to Gehlert et al. (2011), many researchers have emphasized the importance of reactive effects. Therefore, policymakers should carefully consider the goals they want to achieve and the behavioral changes that are targeted when designing and implementing pricing policies [9].

III. RESEARCH METHODOLOGY

The questionnaire was used in this study as part of the study of the potential effects of congestion pricing on the travel behavior of travelers in a metropolitan area. So, to evaluate public responses to congestion pricing schemes in our country's urban roads, a research survey of Revealed preferences (RP) was prepared. The survey consisted of five sections for collecting data, and finally, a total of 200 samples were collected. In general, the questionnaire contains revealed preferences (RP) questions about the current travel behavior and their socioeconomic and occupational status. Thus, a sample of employees working in the area of the city center of Tehran and other people of the community were provided to travel to this area with the aim of non-working trips. Thirty hundred questionnaires were distributed at various business centers and offices within the Tehran traffic planning area in June 2013. Out of the 300 questionnaires distributed, 255 replied questionnaires were returned; of these, the number of questionnaires was reduced to 200, due to incomplete and non-filled questionnaires. Among 200 respondents, 112 were men and 88 were women. All respondents should have a car and drive with it (for work or other non-working purposes) (or own a car or have access to a car and can use it to depart). In these questionnaires, respondents report information about their reactions to the congestion pricing schemes, as well as information about non-working trips (such as travel).

IV. GENERAL ANALYSIS OF DATA

Data collection from the questionnaires shows that about 51% of the respondents oppose the implementation of the Tehran traffic scheme, and 49% agree with it, indicating that there is no a favorable perception of congestion pricing schemes among Tehran citizens. But the more important point is that about 61% of respondents do not believe that the scheme is fair, while only 39% of them consider it fair. Another interesting issue is that 56% of respondents said that affluent groups benefit from the implementation of these projects. While only 42% of users reported that all people of society benefit from congestion pricing schemes. Another question asked was that, depending on their income, whether users are able to pay the fees or not, of which 55% answered the negative and 45% answered positively. Another important question that users responded to was about the effectiveness of Tehran's traffic schemes in reducing traffic congestion and air pollution, of which about 61% of respondents said that it was ineffective, and only about 39% of users considered it to be efficient. In the other section, the

users were asked about their responses to the implementation of the schemes that only 43% of the respondents chose to reduce travel time and paying more; while 57% chose to increase their travel time and paying lower cost. Another important issue in this regard is the issue of user departure time which plays an important role in reducing or increasing traffic congestion and it showed that 47% of users prefer a departure time earlier than usual and paying lower toll fees and 29% of them prefer a departure time later than the usual time and paying lower toll fees, and 24% prefer usual departure time and paying more toll fees. In the final section, users were asked about how to use revenues from taking tolls, of which 37% wanted the revenue to be used in construction of new roads and 30% in strengthening the public transportation system, and 21% in improving the quality of existing routes and only% 12 demanded it be used in construction projects.

V. ANALYZING THE PARAMETERS EFFECTING ON THE PUBLIC ADOPTION OF TRAFFIC CONGESTION PRICING

Acceptance or opposition to congestion pricing schemes depends on a number of factors that can be pointed out to some of them:

5.1. Obvious Benefits

When a genuine and tangible benefit is accompanied by a pricing scheme for using the roads, it has more public support than a project that is unprofitable. The expression of the benefits of the scheme is very important when it is related to individuals, groups of people and society. According to a study by Burris (2007), the Atlanta people accepted the proposed scheme of toll lane for high occupancy toll (HOT) lanes because it offered more options to choose and provided the benefit of reaching the destination fastly [2]. According to a study by Litman (2006) in London, where the pricing scheme has realized the improvement in the air quality and reduction of suspended particle size in the air that are effective on the health, the supports for the London Center congestion Pricing project increased. In a survey in New York, reducing congestion and air pollution, increasing the use of urban transportation and urban incomes were the reasons for supporting the congestion pricing scheme [10].

5.2. Logical Reasons

Pricing schemes in the framework of a specific project for a reasonable and accurate reason have a higher level of support than those that are a general rule or policy. In the past, road pricing is seen as a "choice" rather than a type of punishment and this is the most probable reason for why low-income people support a congestion pricing scheme. They appreciate having the right to choose lanes and roads without tolls. Traffic problems should be evident and it should be shown that pricing is the best solution to these problems. In many European countries, the road pricing scheme was further supported as part of a comprehensive policy package for investment on road and public transport system.

5.3. How to Use Income from Tolls

Using pricing revenues is a determinant in accepting or rejecting the pricing scheme. When it was observed that only certain groups (such as private companies and investors) benefit from revenues from pricing, the supports for the pricing scheme reduced. A study by Holguin (2005) showed that in New Jersey, people opposed the sale of New Jersey toll and Garden State Park to pay for public debt, but the supports increased when the revenue was used to finance the transport infrastructure in the state [11] So, when revenues are spent on highway infrastructure or improvement of public transportation and faster completion of essential construction, the supports will also increase.

5.4. Experiences

From the beginning of the scheme, it is not expected that the majority of citizens support that. Public support for pricing when the opportunity to use the priced infrastructure already exists is more than when the scheme is just as a feasible possibility for the future. In Oslo, Stockholm and London, public support for the priced cordon increased after the implementation of the pricing scheme. **Table 2** shows the increase in support in Norway's pricing schemes [12]. Creating support is a continuous and long-term trend that should not be stopped after the implementation of the scheme. According to Cain (2005), the evaluation of the SR-91, 15-I schemes, and the high occupancy toll lane of 394-I in the United States showed that public support for the scheme remained high, and even when users experienced more advantages, the supports have also increased [5].

5.5. Available Information

Supporting the Congestion Pricing scheme when public opinion is aware of the objective and actual description of pricing conditions and mechanisms as well as the positive and negative aspects of it is more than when there is no background to how pricing works. According to Podgorski's (2006) study in Denver surveys, public support for HOT (Hot) projects increased after users were informed about how the HOT lanes work. In San Diego, when users received clear and accurate information about the features of the project, their concerns about respect for justice were resolved and support for the pricing project increased [6]. This factor can justify why people in the community may have negative attitudes toward road pricing and road tolls, but when these schemes begin to implement, they will use it.

Table 2: Percentage of public dissatisfaction with the implementation of the toll collection scheme

Name of city (year of project start)	One year before the project implementation	One year after the project implementation
Bergen (1986)	54%	37%
Oslo (1990)	70%	64%
Trondheim (1991)	72%	48%

5.6. Justice and Equality

When users feel that there is injustice in the scheme, public opposition to the pricing scheme is higher. According to Evans (2007), in the Atlanta study, people supported the three- occupant (4-HOT) scheme more than two-occupant (3-HOT) scheme because the 3-HOT scheme was intended to penalize a particular category, while in (4-HOT) almost all would need to pay a toll [3]. Holguin's study showed that in Perth Aurora, New York / New Jersey, pricing the peak period is called "Unfair for Travelers" and in fact, people do not want to pay tolls for the roads they used for free in the past and they call it “unfair” [11]. That is why the existence of an alternative non-toll route to attract people’s support is very important and public support for pricing schemes for new roads and bridges is often more than the supports for pricing schemes on existing infrastructure and roads. Concerns may also be caused by the feeling that managed lanes act such as luxury lanes and only be accessible to the rich. In terms of justice, there is a general consensus that decisions about whether or not to use the priced infrastructure only be depended on the needs and demands of the people. Everyone, no matter who they are or where they live, have the right to choose.

5.7. Simplicity of the Layout

People want simple, non-complex designs. When the pricing mechanism or other toll collecting programs from the users are simple and transparent and therefore easy to understand, public support for pricing, in this case, is more than a very complicated program. In two unsuccessful cordon toll schemes in Hong Kong, designs had complex pricing structures and locations have had many complications. According to Ubbels (2006), in a survey at the Oregon state, general opposition to simple ideas (for example, tolls on roads 68%) compared to complex ideas (for example, the cost per household was 91% and the cost of the traveled distance was % 81) was less. In a Washington study, some people preferred to fuel tax as a means of earning money instead of using the traveled distance system (GPS) and mobile technology tested in the survey [1]. Sophisticated systems also raise concerns about creating opportunities for abuse or fraud by its administrators.

5.8. Toll Instead of Tax

People agree with tolls that replace taxes. However, there are also some cases in which People prefer tax increases on congestion pricing, but these are few. According to a study by Burris (2007) in Maine, the respondents to a survey about the list of other alternatives for financing a new highway or bridge commented as follows: 56% voted to replace of taxes with tolls, 16% supported increasing Fuel taxes and 10% also supported the cancellation of the project. In the review, a person expressed his opinion as follows: “I agree with the toll, because I will not use it and will not pay for it, we will pay enough tax." In New Jersey, nearly two-thirds of the people were opposed to raising tolls on state highways for debt payments. However, when asked them to choose between increasing tolls, interrupting services or raising taxes, most people voted for increased toll fees (44%, 28%, and 9% respectively). In a California-wide survey, users of HOT lanes, preferred road tolls, and high-speed lanes over higher fuel taxes and sales. Similarly, in a survey by the National Automobile Association of America, people preferred increased tolls on existing roads, new roads and highways over increased fuel taxes and non-fuel taxes or impose a tax on traveled distance of vehicles [2].

VI. OPPORTUNITIES, THREATS AND STRATEGIES TO ENHANCE THE ACCEPTANCE OF THE CONGESTION PRICING STRATEGY

6.1. Political Difficulties in Implementation of Traffic Congestion Pricing Schemes

Successful pricing projects need high-level political support. Congestion pricing schemes in the past have always lacked strong supporters because they lacked an element that showed that their centralized interests are more than their cost. There are a number of unsuccessful attempts to implement pricing schemes. According to Brinckerhoff's (2004) study, Portland, Oregon was unable to turn the available HOV lanes into HOT lanes in several busy and crowded locations because people thought that this conversion would lead to capacity depletion. The variable toll scheme for the Chesapeake Bay Bridge, Maryland was canceled partly by the governor due to local concerns. In the UK, although the flat congestion toll was successfully implemented in London, the road-user-based pricing scheme in Edinburgh, Scotland, was rejected by a majority vote. This project consists of two cordons around the city with once toll payment of four Euros for passing one or two cordons per working day, and exemptions included taxis, buses, motorcycles, emergency vehicles and disabled people. It did not include residents of the city, and the proceeds from it were used in transport sector investments. After five steps and three years of public participation process, voting in the February 2005 led to the fact that 74.4% of voters disagreed with the

proposed scheme [13]. Thus, the Edinburgh scheme, like the schemes of Maryland and California, lacked political and public support. Therefore, the revenue collected from the congestion pricing can be granted to cities, so urban officials will politically support the congestion pricing schemes.

6.2. General Education and Its Development

When supporting the congestion pricing projects increase that people have learned more about the subject. Targeted and coordinated general education, as well as efforts in the context of information, can provide people with the necessary information and form their views on the value of pricing projects or managed projects. Successful implementation of pricing scheme of MnPASS at 394-I in Minnesota, United States can, to a large extent, relate to this after a decade and several unsuccessful attempts. According to a study by Zmud (2007), after proposing converting HOV lanes in 394-I into HOT lanes was rejected because of public opposition, Minnesota, in 2001, it redefined the scheme with a general revision strategy about the pricing scheme and succeeded in approving the project in 2003. General training and deliberative guidance were considered by the MnPASS project team as a very important and critical factor so that they hired a communications consultant to help the coordinated efforts, and an engineering company supported the training sector with an accurate response to all the questions. Given that public confidence in the primary model offered by an academic institution is greater than a government organization, Humphrey Institute at the University of Minnesota constituted a pricing guidance consultancy working group that was providing the interests of various groups in the community. The public training workshop focused on building strong relationships with stakeholders. The development team held meetings in several small groups with legislators, stakeholders groups, government officials, urban and transportation officials, and transport advisers. They also conducted conversations in large groups with citizens and held several roundtable discussions between experts and the general public about the general policy, as well as used economic research, and mass media to disseminate information [14].

According to Munnich's study, MnPASS project team collected a collection of learned lessons as a reference for other teams of congestion pricing projects among successful and unsuccessful works. These lessons are:

1) It is difficult to maximize public development efforts without higher level officials support. For example, the governor of Minnesota participated in talks with pricing fans.

2) A coalition of community leaders is required. The MnPASS Project team discussed the project with the community leaders and they discussed the concepts, and then, supporters of the project were asked to help in communicating with members and their sub-elements.

3) An unanswered question can become a charge. Minnesota formed a public development team to respond quickly to any question from people. People's common concerns include technical capabilities, justice, the impacts on the use of HOV lanes and public acceptance.

4) Members of the community must understand the benefits they will gain. Minnesota used sending special messages (in addition to shared topics) for each audience. For example, messages for business focused on issues of cost reduction due to congestion and increased reliability and stability. While in messages to fans of shared cars, they assured drivers that their priority right will be kept on the HOT lanes and they will have the right to make more choices.

5) The project team should focus on the benefits offered by pricing instead of costs. In other words, use words that emphasize positive points. Minnesota used the terms "express lanes" and "MnPASS" more than the terms that emphasized the cost of users (such as congestion pricing, toll lanes, etc.) [15].

CONCLUSION

Traffic congestion pricing in urban roads is one of the most suitable options for solving the traffic problems in the cities of the country. Since that, a cost should be levied on a part of the network that was free in the past so people consider it as unfair and oppose it. But these objections can be reduced with detailed studies and plans as well as strong political and research support, and even with its successful implementation, support for the project can be enhanced. Therefore, in order to achieve the above objectives, the following are proposed:

1) Train the citizens about the current transportation system and compare it with the congestion pricing.

2) Create simple short messages to transfer congestion pricing and managed lanes concepts to people.

3) The use of marketing and economic aspects from the beginning and in the continuation of the project, which includes the name of the project, which can be identified early on.

4) Raising public awareness about why the pricing scheme is used instead of traditional financing schemes and reducing congestion which is often applied as an efficient means of allocating transport resources and fostering the financial potential of a project.

5) Preparing to answer questions about earnings and expenses.

6) Relying on the positive points of the scheme.

7) Providing managed lanes as an additional choice for travelers

8) Emphasizing that pricing-managed lanes are not short-term solutions, but are a tool in a

comprehensive long-term plan.

9) Explaining that increasing the pricing variable will increase capacity and ensure users, especially unfamiliar users, that electronic toll collecting will not disturb their journey.

10) Ensuring the implementation of the mechanism that doesn't stimulate user's pessimistic in such a way that they may pay the toll while others violate it.

11) Describing and informing users about this fact that how the revenue generated will be used from the beginning of the scheme.

12) Identify pricing as a means of increasing revenue for projects that might be without funding

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