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ALTERNATIVES FOR CONTROLLING URBAN TRAFFIC CONGESTION

Traffic congestion is nothing new in Latin American cities but has worsened in recent years. Eliminating it is a pipedream, but it should be brought under control. Many economists and transport planners think electronic road pricing would be the best way of tackling it, now that the appropriate technology for implementing it is available. On the other hand, experience shows that, for political reasons, it would be better to begin by adopting simpler methods.

To start with, simple road pricing would seem to be the best option. But, over 20 years of experience in London and more than six in Santiago, Chile, made it clear that socio-political barriers have to be surmounted before even this option can be applied in practice. There is more political support for measures to control parking, due in part to the fact that the legal
powers do not normally extend to restricting the number of parking spaces available to high-income and influential motorists who have the right to park near their offices and who cause a great deal of the congestion whilst getting there. In Latin America, the relative importance of taxis also diminishes the effectiveness of measures geared to parking, since taxis contribute to congestion although but they do not park.

The problem of congestion cannot be solved by using tame measures. The time has come for something bolder, i.e., measures that, at the very least, exercise control over those parking spaces, which so far have been beyond the reach of governments and local authorities, ideally, simple road pricing systems would be even more effective. For additional information, contact Ian Thomson: e-mail ithomson@eclac.cl

Should we try to do away with congestion?

What is congestion? According to one definition, congestion is the result of the obstruction of the flow, circulation or movement of something(1). In the case at hand, that "something" is urban traffic. In theory, this obstruction starts when an extra vehicle enters the traffic flow and causes the others to slow down. The point at which this occurs depends on the capacity of the most critical points of the road system which are, in most cases, intersections(2).

Congestion Control Measures that Influence Supply and Demand

The capacity of urban road networks has tended to expand over the years for various reasons: (i) technological improvements to vehicles; (ii) banning of the use of the network by vehicles powered by persons or animals, or their natural disappearance; (iii) due to the reduced importance of invasion of road space by street vendors, (iv) better driving practices, (v) improved road design, and (vi) use of traffic lights and generally more efficient means of traffic control. For example, traffic speeds in the centre of Boston, United States, were 27% higher in 1960 than in 1927, even though traffic flow had increased by 80%[(3)]. In other cities, there was also an increase in traffic speeds. However travel times did not always decline proportionately, since some traffic management measures imply increases in mileage[(4)].

In some cities, it would appear that most feasible measures that to keep traffic flowing without influencing the number of car trips accomodated have already been taken. The only way forward would seem to be to act on the demand side. In London, where statistics on bus speeds are regularly collected, these increased up to 1971 and then fell back considerably[(5)]. In cities such as London or Paris, well developed metro and suburban rail networks provide an escape route from congestion; however, in Latin America, with the exception of Buenos Aires and Mexico City, urban passenger-carrying rail networks are not in the same category.

There is no doubt that traffic congestion in major Latin American cities leads to both huge economic costs and social injustice. However, this article will confine itself to congestion per se and how to reduce it rather than the problems that it generates.

Congestion can arise even at quite small traffic volumes. Normally, it is worthwhile tolerating a certain level of congestion as long as it does not increase travel times too much, since the costs of so doing are much lower than those of eliminating it altogether. These latter costs include: (i) those associated with diverting users to other routes, modes or times of travel, (ii) those related to trip suppression, and (iii) the investment needed for expand road capacity.

The dream of optimizing congestion

The right amount of congestion is not none at all. Whenever, alleviating congestion is warranted speaking, charging a toll or fee is generally the most efficient way of doing this. The average cost of car travel is the amount paid by each road user in terms of the value of his own time, the fuel consumption and maintenance of his vehicle, etc.. The marginal social cost is the increase in total transport cost caused by each new vehicle which enters the system. The optimum toll or fee is the difference between the average cost and the marginal social cost. In cases where congestion is severe, the marginal cost far exceeds the average cost as each new user of the roadway slows the others down, resulting in higher costs in terms of travel time and vehicle operation. (If users already pay a tax, such as a fuel tax, for each journey that they make, then the toll or fee should be reduced by the amount already paid.) In this article, we shall not enter into theoretical details on this issue; readers interested in such matters might refer to another study recently published by ECLAC[(6)].

Assuming that the cost of the pricing mechanism applied is insignificant and that each road user knows in advance what the cost to her or him of each travel options would be, then a charge equivalent to the difference between the average cost and the marginal cost would maximize the

difference between the value that the user attaches to the journey she or he wants to make and the real cost of making it. This is what we mean by ideal road pricing.

Applying road pricing does not mean that investments in the road system should dry up. In existing circumstances, where road users do not pay for the costs that their presence on the streets generates for other people, as increase in road capacity expand, congestion tends to build up as the new infrastructure. Traffic speeds after the capacity increase would be very close - at least at peak hours - to those prevailing before the system was expanded, the only difference being that traffic flows would be greater. In other words, the potential benefits that the new infrastructure could provide, in terms of higher travel speeds, would be cancelled out by the increase in the volume of traffic. In this respect, road pricing, especially ideal road pricing, has the potential to enable the potential benefits of investing in the expansion of road capacity to be realized, by restricting infrastructure use to those who are prepared to cover the costs imposed by their using it.

It should be pointed out that the sum of road charges paid for use of different sections of the road network is not necessarily a good indication of the potential benefits from investment to expand them. In other words, ideal road pricing does not exempt transport planners from their obligation of carrying out economic evaluations of road expansion projects.

The problems of implementing ideal road pricing. However, a mechanism for charging optimum fees throughout the system, at different times of day, is not yet economically feasible. Hardware costs are on the decline but remain significant. Hence, transport economists have suggested simpler, although less efficient, alternatives to ideal road pricing, such as the sale of supplementary licences or permits which would entitle the holder to occupy road space within a congested area. The intrinsically lower efficiency of a supplementary licensing system is due to the fact that it would make no distinction between different streets and between different times of day, and would not take into account the fact that congestion levels vary significantly. Because of this, such simple alternatives are inherently unable to properly penalize traffic when or wherever the greatest congestion occurs nor redirect it to less congested routes and/or times of day. Another disadvantage of simplified road pricing systems is that, the amount charged bears no relationship to how long the road space in the payment area is used.

Figure 1: This photograph of the interior of a VW Beetle, then owned by the British Road Research Laboratory, one can see the on-board pricing equipment located in front of

the driver's seat. The photo was taken almost 30 years ago. To explain the little progress that has been made since then to implement electronic road pricing one should look beyond mere technical reasons.

Quantitative studies comparing the efficiency of different methods of road pricing are few and far between. However, one such study, published in 1994[7], makes a comparison between four alternative systems of road pricing, namely: (i) tolls paid on crossing a cordon line; (ii) tolls based on the distance covered within the priced area, (iii) tolls based on the time spent in the area and (iv)tolls based on the time spent queuing in the same area. The impact of different road pricing options was simulated using a network and travel data for the city of Cambridge, England, but the study stopped short of evaluating the results in a comprehensive manner. Its authors noted that one method of road-user charging - option (iv) of those tested - was better able than others to reduce congestion at relatively low toll rates. Hence, it is very likely that an economic evaluation between of the four alternatives considered would show this to be the preferred option in terms of efficiency.

On the other hand, option (iv), which is close to the ideal road pricing system, would be very difficult to apply in practice. How does one go about charging for each minute that a vehicle is stuck in a traffic jam? The payment mechanism would have to be activated whenever the vehicle stopped with its engine locking over and deactivated whenever the vehicle started to move again.

Simplified road pricing systems versus parking control

A more practical method of pricing for application on the short term. By supplementary licensing or charging a fee for entry into a priced area, a flat rate levied for the use of any route or set of routes within such an area. This rate would be announced beforehand, thus solving a further difficulty inherent in ideal road pricing, i.e., the fact that, at the time of planning her or his journey, the traveller would not know what rates she or he would be charged at different points of the system, since the amounts would depend on the prevailing degree of congestion. In surveys of road pricing, respondents have stressed that the scheme should be simple and it should be possible to work out the cost of the trip in advance[8]. Owing to the lack of prior information as to the cost of each alternative route, mode of transport or time of travel, with an ideal road pricing scheme, drivers would only choose the best route by chance.

Another advantage of simple road pricing is that no sophisticated technology is needed to implement it. It should be noted that as traffic flow capacity on a road approaches its theoretical level, small fluctuations in the volume of traffic produce magnified changes in the appropriate charge to be applied; thus, in an urban environment, at certain points where congestion tends to be acute, the road fee can vary significantly from one day to the next at the same hour, so that a motorist might have to face charges subject to a wide degree of variation around their expected values[*].

In any event, the use of supplementary licences as a form of pricing still has undeniable theoretical advantages over other methods for controlling congestion, including the most effective, i.e., control of parking. This is clearly demonstrated in one of the classic works of the vast literature on road pricing, which makes a comparison between a policy of applying supplementary licences policy and one for controlling parking in Central London[9].

Policies for control of parking and through traffic. The conclusion reached in the above-mentioned study on London was that the potential benefits of a simple supplementary licensing system would be double those attainable through a policy for controlling parking. The author of this study, which was carried out some thirty years ago (when the technology for automatic payments was still in the embryonic phase), considered that one third of the traffic reduction in the centre of the city following the introduction of road pricing would be due to the diversion of through traffic - which prior to pricing would have crossed the payment area - towards alternatives which bypass the centre. Clearly, a policy geared to parking would not be capable of rerouting such journeys away from the centre; on the contrary, motorists who would have used ring roads prior to the introduction of parking restraints would now be tempted to drive through the central streets using the road space freed by vehicles that priced off.

The jurisdiction of authorities is limited to parking used by lower-income motorists, who cause relatively little congestion. Policies that target parking are impeded by legal and other means from controlling, either by physical or by financial means, parking spaces located on private property. The fact that private property is out of bounds to transit planners detracts considerably from the effectiveness of congestion control policies. In the United States, for example, it is estimated that 90% of commuters who travel to work by car have free parking facilities(10). Latin America is going the same way due, in part, to municipal regulations which specify that new buildings must have a minimum (rather than a maximum) number of parking spaces per office, square metre, or employee, even if those buildings are easily accessible via public transport.

Staff with reserved parking spots at their workplaces almost invariably travel during peak hours. So, if measures solution adopted for congestion control are geared to parking, authorities normally have no influence over those parking spaces that generate most of the congestion. Restricting only those parking spaces under municipal control, which are mainly located on streets, could interfere with non-peak hour activities such as shopping, visits to the doctor or trips to the bank, without doing very much to reduce congestion. If the measures taken affect only parking controlled by government authorities, high-income commuters with the right to reserved parking would still be free to continue to cause congestion, while the freedom of movement of less affluent motorists, who usually park in public spaces, would be restricted.

Taxis cause congestion but do not park. Policies which operate on parking, clearly, have no impact on taxis. If all journeys made by private cars before the introduction of a control policy on parking were replaced by taxi trips, then the impact on congestion could be zero. In many Latin America cities, such as Buenos Aires, Lima or Santiago (Chile), taxis are much more widely used than in European or North American cities like London or New York. In Lima, recent traffic counts have shown that taxis account for over half of the traffic flow on some routes(11). Any traffic control policy in Latin America should therefore take into account the role of taxis and recognize that policies which control parking are less beneficial than in those cities where taxis do not feature so prominently in the urban landscape.

If the congestion problem iscaused by traffic in the streets, then it should also be solved by acting at the street level. The London study referred to above concludes that solving a problem generated by too many vehicles in the streets should be directed at street borne vehicles rather than parking spaces, which are only used once the trip is over.

Other options sometimes put forward for controlling congestion are still more indirect, hence, even less effective. Consider, for example, policies aimed at improving public transport; they can, on their own, reduce congestion indirectly solely by offering a quality of service that is good enough to convince motorists to leave their vehicles in their driveways and take the metro or the bus. In Latin America, few motorists are prepared to do this, even when they are offered the option of travelling in a fast, quiet, ultra-modern metro. Moreover, it is worth remembering that relatively small number of motorists who do switch to public transport would liberate a few parking spaces, which would soon be snapped up by other motorists who had previously been happy to use public transport and who now switch to their cars. In other words, the number of parked cars would be the same as before and the level of congestion, even if redistributed spatially, would not be very different(12).

The best measures for coping with traffic congestion are the most difficult to implement

Measures that do not upset people always enjoy popular support, even if they do not solve the problem. Experience has shown that the public readily accepts stricter parking regulations without protest but is not so enthusiastic about the idea of road pricing. In Latin America, comments can be heard to the effect that: (i) it (road pricing) would mean charging for something that has already been paid for (i.e., the use of roadways), (ii) it would penalize the middle class, and (iii) public transport is not a viable alternative. On the other hand, there are fewer complaints from motorists about restrictions on parking spaces already in place in many cities (although owners of stores in the areas affected may react differently). Even though it has yet to be proven, this may be because the more influential motorists already have a reserved parking space which is paid for directly by their employer or out of their own pocket on a weekly or monthly basis. There is no doubt that measures which are hoped to relieve congestion by improving public transport meet with much more popular support than those that restrict the use of cars. This is because the users surveyed assumed that other motorists would switch to public transport leaving the streets clearer for themselves(13).

Parking controls have already been applied in many cities, including Rio de Janeiro, Santiago (Chile) or São Paulo. These cities are not noted for their immunity to the plague of traffic congestion. Measures adopted in Santiago towards the mid-1980s included a ban on the use of privately-owned parking lots normally used by the public (but not parking facilities in buildings); however, parking restrictions usually apply only to spaces on the streets(**).

Conclusion. It is impossible to solve the problem of traffic congestion in a socially just manner in large cities by applying measures designed only to restrict the availability of existing parking under the control of public authorities. Amongst the various policies that might be adopted, two warrant special considerations:

- **The first choice** would be, the application of one of the more elementary forms of road pricing, such as the sale of supplementary licences for the use of roads in congested areas. This would usually imply increasing the legal powers of the authorities. Once the basic pricing scheme has been proven in practice, the way will have been paved for the subsequent adoption of more sophisticated versions.

- **As a second option,** if the first choice was to be ruled out, local governments should be given increased authority over private parking spaces for public use and those of non-residential buildings. Once this authority has been granted, taxes could be imposed on each parking space in proportion to the cost of the congestion produced by the onward and return journeys of cars that park there. The funds generated in this way could be used to subsidize conversion of parking areas for other uses.

Neither option will be easy to put into practice for socio-political reasons. Nevertheless, the potential benefits are tremendous and will tend to increase as cities and the number of cars the house continue to grow, while the depletion of non-renewable resources, such as liquid fuels, and environmental degradation become ever more serious problems.

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[*] If **c** is the average cost and **q** the volume of traffic, then **c=f(q)**. The operating cost of all vehicles in traffic stream **q** will be **cq**. The marginal cost, i.e., the change in the total cost caused by a change in q is expressed as (cq)/q. (cq)/q = qf (q)+c, which is equivalent to **c,** if there is no congestion; it can reach high values if **q** is also high and if the gradient of the function of average costs in relation to q is relatively steep.

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** The elimination of public parking lots in Santiago came at a time when the metro was being expanded and there was a general shift in private offices from the centre (where the restriction applied) to new commercial areas located in the eastern part of the city (not affected by the measure).