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MEASURES FOR CONTROLLING TRAFFIC CONGESTION

Traffic congestion has become a severe scourge in large cities, in both the industrialized and developing countries. Increasing demand for urban transport and transit has led to longer travel times, and a greater incidence of accidents, environmental problems and deterioration in the quality of life than is considered acceptable for citizens.

A multidisciplinary approach is required in order to keep the negative effects of congestion under control and to ensure standards of living remain sustainable. In view of the seriousness of the problem, ECLAC with the support of the German Agency for Technical Cooperation (GTZ) is carrying out a project to study measures that contribute to traffic control. As part of this project, initiatives regarding the supply of, and the demand for, transport have been examined, and a programme to disseminate information is being conducted.

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A. SUPPLY INITIATIVES

The supply of transport services consists of a range of means of providing transit, which can be categorized as follows:

- urban road infrastructure or network;
- the means of transport or vehicles; and
- the way in which both are managed.

Improving any component of supply normally increases passenger-bearing capacity and reduces congestion. However, action on only one of the three components is subject to the law of diminishing returns. All three components are closely connected on account of technical

factors and complement one another. A number of solutions are outlined below.

The urban road network. Infrastructure is comprised of avenues, streets and intersections. In the region, the road system is often poorly designed and maintained, and this state of affairs would need to be improved before extensions to reduce congestion could be envisaged.

Substandard design or condition of the road system causes unnecessary congestion. Instances abound of unmarked traffic lanes, unexpected changes in the number of such lanes, bus stops located next to intersections and other shortcomings that hamper the flow of traffic and compromise security.

The poor condition of road surfaces, and in particular potholes, restricts the capacity of the roads.

Obviously, there may be situations where it is appropriate to widen streets or build new ones, though with the proviso that the solution is efficient and environmentally sustainable. In some instances, there have been negative consequences for residents, passers-by and children due to the loss of pedestrian space, parks and gardens, or because districts or neighbourhoods have been split up. Habitability should combine with ease of movement, and one way to do this is to assign special functions to different streets; some may be designed and used for long journeys and high volumes, others for local service and accessibility, with the remainder performing mixed roles.

Besides, large investments in wider roads typically fail to deliver the expected results, as new motorists join the traffic flow, recreating the congestion with greater traffic volumes, a phenomenon evident in cities where motorway networks have been built.

Intersections. Crossroads can lead to substantial improvements in traffic flows. As a general rule, road capacity is determined by intersections; since they are where two or more roads meet, they must allow vehicle flows that cross each other's path to continue their journeys.

It is important to design intersections with care, since they are normally where bottlenecks occur. The paths to be taken should be clear, as should waiting areas for vehicles continuing on or turning. Similarly, the needs of pedestrians must be catered for. When designing intersections, both physical and operational aspects need to be taken into consideration, in conjunction with one another. Suitable models of analysis are available for this purpose.

Intersections may be unsignalized (only where there are lower traffic volumes), feature right-of-way signs (with priority determined by "Give way" and "Stop" signs), or operate with traffic lights. The choice of traffic control system depends on a range of factors, such as traffic volumes, visibility, hold-ups or accidents. Contrary to what one might assume, the installation of traffic lights does not always entail benefits and enhance safety; traffic lights should only be installed where the right conditions are met.

Coordination of traffic lights. Traffic lights are appropriate at many intersections. Where

many lights are located at close intervals, coordination is one of the most effective means of increasing the speed of traffic flows, and achieving significant savings in terms of travel times, fuel, pollution and accidents.

Coordination involves establishing cycles, allocating times and providing phases in a road or network in such a way that vehicles can travel at a specified speed, thereby keeping the disruption caused by red lights to a minimum. Coordination may vary over the course of the day in line with the main streams or in order to give preference to those vehicles that use space more efficiently, such as public transport. Some ways of coordinating traffic lights are:

- Coordination using fixed, that is pre-set, plans, which can be changed manually. Though this approach is not obsolete, the results achievable are limited in scope.
- Centralised flexible coordination, which allows for phasing changes as and when required; the system is administered from a central computer, and is responsive to changes in actual volumes at each intersection. In this way, it is possible to make very fine adjustments in areas of high traffic density.
- Combined systems, such as providing for dynamic control in the city centre, fixed plans in some more remote arterials, and even autonomous operation of traffic lights that are not part of any network in functional terms.

Initiatives to give priority to public transport. One practical method of increasing passenger-bearing capacity is to place greater reliance on vehicles that transport more passengers than cars. This means fewer vehicles on the road, leading to more efficient use of scarce road space. Buses show the best results in this respect.

Giving priority to public transport is justified on two counts: firstly, public transport causes less congestion per passenger transported; and secondly, it is a regulatory step that corrects the distortion resulting from private motor vehicles not paying for the costs of the congestion they cause. Apart from granting buses certain advantages in phasing traffic lights, the main preference is to reserve lanes solely for their use. That enables buses to speed up, while eliminating friction with other vehicles, which in certain circumstances step up their speed, as has been borne out on quite a few occasions. Some options are listed below:

- Bus only lanes: lanes set aside solely for buses, normally signposted by markings. They are cheap to implement, but their effectiveness, except in the case of reverse flow, depends on motorists' acceptance, which is not always forthcoming.
- Segregated bus lanes: these are similar to bus only lanes, but are physically separated from the other lanes, so as to prevent encroachment.
- Exclusive bus roadways: here the entire width of a street is given over to public transport. Except in the case of new roadways, this solution should be

implemented only at peak times.

- Public transport reorganised on dedicated routes: these bear some resemblance to the subway, since they are exclusive routes, operated by buses, with predetermined itineraries and stop at stations.

Variable direction roads. These are roads where the direction in which traffic moves changes during the day, in accordance with traffic volumes, with a view to improving flows. Hence, at peak times, the direction of traffic in a one-way street can be reversed or a street can be converted from a two-way to a one-way street, temporarily providing greater capacity to the benefit of the more dense streams.

This traffic management system yields significant time savings in many cases. However, it needs to be remembered that the changes entail the reassignment of flows in the opposite direction, which are required to take other routes, possibly longer and slower; this needs to be considered when designing the system and assessing its impact. In addition, changing direction according to the time of day requires good information and signposting in order to prevent confusion and accidents.

B. DEMAND INITIATIVES

Well-thought-out measures concerning supply help create greater capacity. However, the fact should not be overlooked that improved use of supply is only part of the complex picture of congestion. It may also be necessary to incorporate measures that affect demand; such measures enable mismatches in the use of infrastructure to be corrected and are aimed at achieving a balance acceptable to the community.

Action in respect of demand signifies modifying transportation habits. These sorts of measures promote behaviour that is more in keeping with high volumes of traffic and safe travel. Consequently, the aim is to improve the behaviour of vehicles and pedestrians, change the types of vehicle circulating at peak times, with preference given to large-capacity vehicles, and also to shift some trips to times when there is less traffic. In other words, the goal is to rearrange trips rather than to eliminate them, since that would mean forgoing the benefit such trips represent to those wishing to undertake them.

Congestion is to a large extent due to the intensive use of motor vehicles, particularly in commuting. Traffic hold-ups could be considerably alleviated if significant numbers of motorists who travel in high-volume areas or periods could be persuaded to use public transport or change the time of their journey. Several options are set out below.

Road safety education. It is vital that drivers and pedestrians alike improve their behaviour. Traffic regulations set out rights and constraints as to the use of streets, thereby improving flows and preventing accidents. Undisciplined driving coupled with a lack of respect for others reduces the road network's capacity to a fraction of its potential. Attempts to gain a few

seconds at the risk of disobeying the traffic rules governing intersections or streets cause serious disruption to other road users, leading to greater congestion and an increased likelihood of accidents. Pedestrians must also respect the rules of the road, crossing streets only at authorised times and places. Therefore, it is enormously important to educate the entire community about traffic regulations, a process which should start from childhood.

Staggering of trips. This entails establishing different starting and finishing times for various activities, such as work, commerce, schools, universities, etc.

Traffic volumes are characterised by distinct peak periods, during which a large number of journeys are concentrated. Many activities start up in the early part of the day, so numerous journeys to places of work and study take place virtually at the same time. A similar pattern occurs in the afternoon when work and business activities come to an end. As a result, it would be beneficial to be able to stagger trips over a longer period of time.

Schools might be able to start earlier than most jobs. Home banking makes it less necessary to open early. Tertiary education, businesses, a good proportion of private activities and even government offices all seem to have some degree of flexibility as regards starting times.

Another possibility is for business to adopt flexitime. Where feasible, the employee chooses his starting time, taking care to be in the office during times when his presence is required, for meetings or other group activities. Teleworking, which takes advantage of modern communication techniques (internet, e-mail, etc.), can help in this respect.

During reorganisation, care should be taken not to interfere with normal business operations. Every city has its own patterns of commercial activity, an educational system with distinctive spatial distribution, and a culture which may or may not facilitate such measures.

Parking restrictions. Parking is a vital element of any road transport system. Taxis aside, motor vehicles are not designed to be in perpetual motion, but rather to make specific journeys. Once the journey is completed, the vehicle remains stationary.

By restricting parking in congested areas, it is possible to increase the space available to traffic and to discourage certain car trips, thereby easing the congestion. Some of the measures available include:

- Parking bans in specific places and at specific times, especially along roads with high traffic volumes;
- Setting of limits on parking space or time;
- Imposition of a charge for parking or provision of the space that reflects the costs of parking borne by the community;
- Provision of park and ride facilities, which enable journeys to be made using a

combination of automobiles and public transport.

One option for reducing congestion is to discourage car trips at peak times to central areas of cities. The existence and cost of parking facilities determines access by car, if the vehicle is required to be parked. It must be remembered that over half of the trips made at peak times are work-related and that a large number of jobs are located in the central city. For these reasons, one interesting way of tackling congestion that offers potential is through actions that discourage long-stay parking in commercial areas.

Since the aim is not to stifle urban activity nor ban cars, the right approach is to provide a suitable number of parking spaces in uncongested areas and to place certain restrictions in areas that are congested. The challenge arising from this dichotomy is to elaborate a balanced strategy for improved development of a city.

Road pricing. Traffic congestion is due in part to the strong propensity for using the car, which is reinforced by the fact that the individual user is unaware of the cost he or she imposes on others (see FAL Bulletin No. 170, October 2000).

Road pricing consists in charging users a fee, either for travelling in or entering congested roadways or areas. Only users who are prepared to pay will be able to take to the road, with all others forced to either use alternative modes of transport or undertake the car journey in periods when there is no charge. One interesting feature is that, in principle, the use of public roads is regulated by a market instrument and not by government-imposed regulations.

The optimum charge is equal to the additional costs that each vehicle in the flow imposes on the other vehicles. Charges can be set according to the distance travelled, the time spent in the charging area, or may be levied simply for entering the area. There are manual charging and monitoring mechanisms available, with stickers that are affixed to the windscreen, as well as electronic systems, which use transponders, sophisticated equipment installed in streets and vehicles.

The congestion fee should be applicable only in congested areas and periods (generally those where demand is greatest), and it makes no economic sense to enforce the charge in other parts. Given that the morning peak tends to be the more marked, it may be sufficient to implement the measure only at that time, since many people would stop taking the car to and from work. On the face of things, all vehicles should be subject to a charge, as they all contribute to the congestion. However, as the biggest culprits per passenger transported are cars, it is acceptable to only make them pay the charge.

Road pricing has been discussed for over 30 years, but has not been widely implemented. The measure has met stiff resistance from the public and lawmakers. That is why, before road pricing is implemented, answers need to be found to aspects such as the impact on areas not subject to charges, the intended purpose of revenues raised and possible adverse effects on residents and activities in the charging area.

Restrictions on vehicle use (“carless days”). This involves banning a portion of vehicles from being on the roads from Monday to Friday, in places and at times prone to congestion. Restricting a large number of vehicles from circulating at the same time, though not impinging on the right to purchase them, is one way to lessen congestion.

Where the goal is to ease congestion, it makes sense only to implement the measure in the city centre during peak periods. Significant results can be obtained if the measure is applied to a sizeable portion -say 20%- of the stock of motor vehicles. The measures may be applied to all cars in turn over the course of the week, in accordance with the final digit of the number plate. In addition, trucks and other cargo-laden vehicles would normally be banned from circulating in the central city at peak periods. Buses should be exempted, since they create the least congestion per passenger transported and represent an important alternative for people forced to keep their own car at home.

Another possibility, more in keeping with market mechanisms, is to implement the restriction via a surcharge on the annual motor vehicle licence. This could be set at a high figure for those who wish to be exempted from the restriction, low in the case of a restriction on one or two days per week, and nil for a restriction running from Monday to Friday. In order to differentiate between the various categories, stamps of different colours and characteristics would be stuck to the windscreen.

Restrictions could lose their effectiveness over the medium term as the rate of car ownership increases. Accordingly, vehicle restriction should be viewed as a stop-gap measure until other congestion management initiatives are adopted.

C. DISSEMINATION PROGRAMME

The ECLAC/GTZ Programme on Traffic Congestion Control Measures provides for information activities in the form of workshops and seminars. To date workshops have been conducted in Guatemala City (18-19 July 2001) and Lima (28-29 August 2001).

The workshops saw lively, thought-provoking discussions, proof that traffic congestion is a real problem. In Guatemala, the measures that received the widest support were a continuation of the intersection alteration programme already put in place by the Town Council, a segregated pilot road for buses and two-digit vehicle restriction at peak times. In Lima, the participants felt that priority should be given to altering intersections and improving the traffic light cycle, implementing a segregated pilot lane for buses and setting up a single authority for traffic control.

Events scheduled for the rest of 2001 include a workshop in Campinas, São Paulo, Brazil (24-25 October) and an international seminar at ECLAC Headquarters in Santiago, Chile (28-29 November).