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## MANAGEMENT OF TRAFFIC CONGESTION IN URBAN AREAS

### ABSTRACT

*The use of road vehicles is increasing, the benefits they afford have been progressively diminished by external costs. Whereas traffic increases as we approach the centre, the road and open space decreases. The greater specialisation allows the city growth in size and in traffic attraction. In this way urban growth feeds itself. Inter-urban transport facilities also become more extensive. Growth in size of the city generates greater amounts of traffic and can eventually give rise to agglomeration diseconomies. Higher transport costs, offices and shops, attracted by the accessibility of central locations, gradually replace residential uses, people being forced to seek housing in the suburbs. As the urban area expands and offices in the city centre are built denser and higher, traffic congestion increases. This may result in the fall in central land values, since accessibility diminishes with the saturation of transport network. Increased pollution takes various forms as noise, smoke and overcrowded housing in the centre, urban decay in the transitional zone as commercial development is anticipated.*

### KEY WORDS

*city growth, urban growth, traffic, traffic congestion*

### 1. INTRODUCTION

In the twentieth century motor transport has increased the accessibility of goods and people through mobility, flexibility and convenience it affords. The result is generally the improvement of living standards and better opportunity for commercial development. The use of road vehicles has increased, and the benefits they afford have been progressively diminished by external costs. The greater mobility afforded by the car has enabled workers to live some distance from their place of employment and has thus been a major cause of urban sprawl. Moreover, people still have to travel from the suburbs to the city centre for work, shopping and leisure activities. As traffic increases as we approach the centre, the road and open space decrease. The same impact can be also seen in all our towns.

Transport developments were vital to the process of urbanisation. First by bringing food from distant areas they allowed agricultural labour to be released for urban jobs. second, by improving the mobility of goods and factors of production they extend the market. This allowed greater specialisation both between economic units within the urban area, and between urban areas and towns themselves. The greater specialisation allows the city growth in size and in demand for traffic attraction. In this way urban growth feeds itself. As an urban area grows, external economies arise in both production and consumption through the concentration of many types of activities.[1] Even companies in different trades benefit from the larger market, access to large and well organised labour markets, specialist commercial facilities and improved transport. As cities grow, economies of scale occur in the provision of basic public utilities and services, such as transport. Inter-urban transport facilities also become more extensive, thereby facilitating further growth of the urban area.

### 2. TRAFFIC IMPACTS ON THE CITY GROWTH AND URBAN EXTERNAL COSTS

Growth in size of the city generates greater amount of traffic and can eventually give rise to agglomeration diseconomies. The following examples are possible [2]:

- Higher transport costs; offices and shops, attracted by the accessibility of central locations gradually replace residential uses, people being forced to seek housing in the suburbs. Thus, while employment increases in the centre, there is an increasing separation of work-place and homes, adding the cost and inconvenience of commuting. Eventually, the town centre may lose its long-established functions, it ceases to be the commercial and social point of the city.

- Traffic congestion; as the urban area expands and offices in the city centre are built denser and higher, traffic congestion increases. This may result in the fall of central land values, since accessibility diminishes with the saturation of the transport network.
- Increased pollution; pollution as urban areas expand takes various forms such as noise, smoke and overcrowded housing in the centre, urban decay in the transitional zone as commercial development is anticipated, suburban sprawl along the main road and rail routes, the loss of open space for recreation and the despoliation of the surrounding countryside.[3]

Transport is a source of considerable costs and benefits to transport users and community. Good proportion of these effects are taken into account by users when they opt for a particular means of transport on the basis of its price and quality. On the one hand, there are external effects which are not taken into account by users because they lie outside the market. The external benefits and costs of infrastructure use, on the other hand, must be passed on directly to the users and internalised through prices of the costs involved. These effects were studied by the IWW and INFRAS Institutes in Karlsruhe and Zürich respectively. They include accidents, air pollution, noise and climate change, in other words the main environmental damage caused by the transport sector. Account is taken not only of the short-term damage to human health, but also of very long-term consequences for the earth's future, the most important example being the greenhouse effect.

Above, the correlation between the growth of the city, impacts on traffic and on transport were described. The major external costs are polluted soil and water, damaged vegetation and especially the congestion, which undermines the chief advantage - accessibility - provided by motor transport.

The expansion of motor transport has to lead to the demand for road users in the extra costs of congestion - higher fuel consumption, reduced speed and time spent in traffic jams. Indeed, the problem is likely to become more acute as income and population increase and the use of cars and commercial vehicles expands.[1]

### 3. CONGESTION PROBLEMS OF TRAFFIC IN URBAN AREAS

Two points should be noted. First, it is basically the peak-hour problem, confined to approximately five hours a day on fewer than 250 working days of the year. Second, it is largely the result of increased use of private cars for travelling to work. The former tends to restrict the amount of investment which can be profit-

able undertaken in the transport system. The latter indicates that some effort should be directed toward making the road user pay the full costs (including external costs) of taking his vehicle on the road.

With these principles in the background, six main lines of traffic policy can follow:

- do nothing;
- invest in construction of more roads;
- impose physical controls to improve traffic flows;
- restrict parking;
- use the price system to allocate existing road space;
- more efficiency on the existing road system through better distribution of the travelling means as between the car and public transport.[3]

### 4. SOME SOLUTIONS TO PROBLEMS OF TRAFFIC CONGESTION

As it was described above, there are some ideas for dealing with traffic congestion. Let's see which policy can be introduced.

#### *Do nothing:*

The argument that congestion increase leads to the point where the costs in terms of wasted time and frustration are such that motorists switch to public transport has snags. The high level of congestion envisaged would become a permanent feature, penalising equally the essential car-users and the optional users. The congestion would affect non-car users such as pedestrians.

#### *More road investment:*

This could take the form of comprehensive redevelopment of city centres and improved town planning, such as sitting industry and other not appropriate functions away from city centres. It is doubtful whether this would be a complete solution.

It is difficult to impose tolls on short-run roads, they have to be financed from taxation and made freely available to all wishing to use them. But such a possibility is limited. Without direct pricing of road use, there is no precise indication of what people are prepared to pay for more roads. Thus, there is the basic question of whether vast investment in new urban road systems is economically viable, only for peak-hour travel.

Investment in roads, as opposed to extending public transport, involves an income redistribution, since public transport is used mainly by poorer persons. Such a decision on whether to invest in more roads is a political one, it is connected with very high cost of urban road construction.

It would take many years for a complete road network to be built. In the meantime, movements in in-

dustry and population and transport could change needs considerably.

#### *Manage traffic flows:*

Immediate improvement in traffic flows can be achieved by clear ways, reversible lanes, linked traffic signals, bus lanes, etc. Such adaptation can often be combined with schemes which improve the environment e.g. designating pedestrian-only areas, constructing cul-de-sacs in residential districts or simply restricting the movement of heavy vehicles in residential zones. In longer term, attempts can be made to spread the flow of rush-hour traffic over a longer period, or vice versa. Nevertheless, care must be taken to ensure that the commercial heart of the city is not destroyed as a result.

#### *Restrict parking:*

Perhaps the greatest advantage of motor vehicle is the convenience of door-to-door travel. This requires parking facilities. Too many facilities lead to congestion. Parkers are of two sorts: the long-term parker and the short-term parker. The problem is largely one of removing the first from the streets. Two approaches are possible: physical control and road pricing. Both involve costs of adequate administration.

Physical control takes various forms, from the restriction of parking to certain days, times, side of the street or type of vehicle to the complete ban on all kinds of waiting. Permits may also be issued to give priority to essential users and residents. Furthermore, planning consents for new buildings usually stipulate the minimum number of parking spaces to be provided. Kerbside parking has to be supplemented by off-street parking, especially for the long-term commuter. This induces commuters to travel by public transport, there is a net benefit to the community through reduced congestion and less cost of road construction.

#### *Use the price system to allocate scarce road space:*

The allocating limited parking space by charges can also be applied to moving vehicles by imposing a tax to reduce the use of vehicles and so relieve congestion. In addition to his running costs, the private motorist allows for the time the travelling will take. The greater the traffic flow, the longer the time. There is thus a rising cost curve, MPC (Figure 1). The demand curve D, also takes account of this time factor: the greater the congestion, the longer the time journey, so that demand falls as the intensity of traffic flow increases. Thus, left to the private motorist's decisions, the flow of traffic will be OP, where private marginal cost equals marginal benefit (price).

But while the private motorists allow for the time-cost of heavy traffic flow, the very fact of his taking the car on the road will add to the time-cost of oth-

ers. Congestion can be defined as occurring when the private use of a car by a motorist "impedes" the movement of other road users, that is, at OC. There is a marginal social cost which, if added to the marginal private cost, gives the curve MSC. Applying the principle that output should take place where marginal social cost equals marginal benefit gives the economically efficient flow of traffic would be OS.

This could be achieved by imposing a charge equal to LM. Ideally, such a charge should reflect the time, miles covered on the road, the degree of congestion, the size of car and the location and direction of the journey in relation to the city centre. The difficulty lies in devising a single tax which covers all these requirements and is practical. The most appropriate method of charging is to fit each car with a meter which would electronically register units as certain control points were passed. Some economists consider that an additional advantage of such road-pricing is that it would establish "road values" and thus rates of return to guide future road investment.

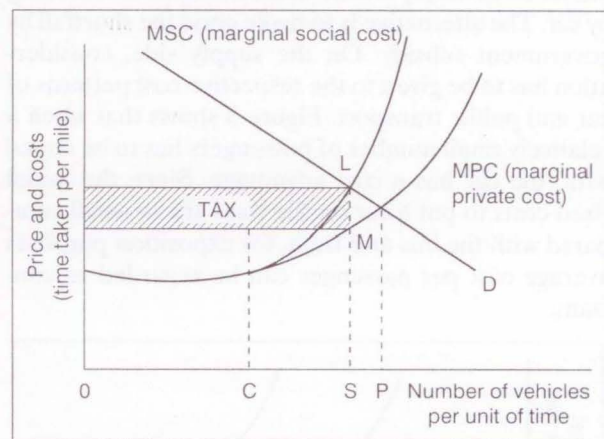


Figure 1 - Allowing for the external cost of congestion [3]

#### *Pricing policies to improve the split between the private car and public transport:*

Much of the car's costs are fixed costs. The cost of actually using the car - the variable cost is the cost of fuel and wear and tear. Thus the private motorist adopts a marginal-cost basis of pricing. In contrast, apart from any subsidies given, fares on public transport have to cover both fixed and variable costs. That is, the fare per mile tends to equal average total cost. The price system cannot yield an efficient allocation of resources between private and public transport when different principles are adopted as the basis for pricing. Since fixed costs, particularly for the railways are high, public transport tends to operate under conditions of decreasing cost. This means that the principle of marginal cost pricing cannot be used if total costs are to be covered (Figure 2).

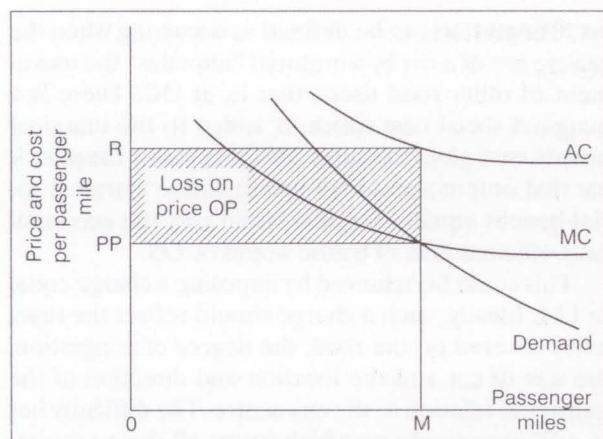


Figure 2 - The effect of high fixed costs on public transport [3]

Instead, public transport seeks to cover total costs by price discrimination, charging higher fares to passengers whose demand is least elastic. Such passengers tend to be commuters and business people - and higher fares simply induce them to switch to travelling by car. The alternative is to make good the shortfall by government subsidy. On the supply side, consideration has to be given to the respective cost patterns of car and public transport. Figure 3 shows that when a relatively small number of passengers has to be coped with, the car has a cost advantage. Since the initial fixed costs to put a car on the road are so small compared with the bus and train, for exposition purposes average cost per passenger can be regarded as constant.

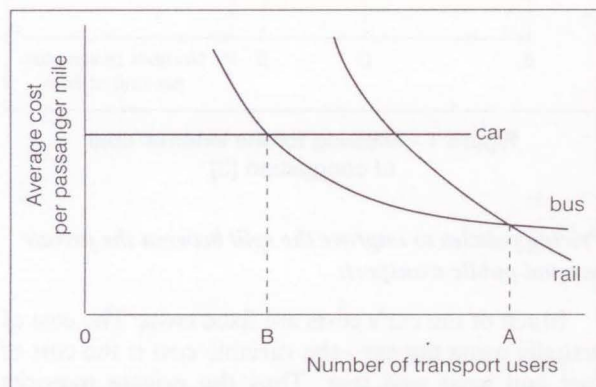


Figure 3 - Difference in average costs per passenger mile of car, bus and transport [3]

As the number of passengers increases, the higher fixed costs of the bus are spread more thinly, so that eventually at OB average cost per passenger mile falls below that of the car. Rail transport has to incur even higher fixed costs in maintaining tracks, stations, expensive rolling stocks, and so on, and so costs per passenger mile are only below those of the bus at a high level of passengers use, OR. In addition, development density should be high so that the number travelling

from a single station is large. Hence urban rail travel is limited to very large cities.

It must be emphasised that while the bus and train have a cost advantage over the car in dealing with passenger-users above OB and OR respectively, relative prices for each mode of travel will also depend upon demand. It may be that people's preference for car travel is so high, its price would indicate that the mode should prevail even with the number of transport users.

## 5. CONCLUSION

The analysis suggests that regarding cost considerations rush-hour travel is most economically provided by public transport, since this follows the predominantly radial flow to the centre and causes less congestion per passenger carried than the private car.

To tax the private car-user is, therefore, the logical step as described earlier. This tax, supplemented by funds from general taxation, could be used to subsidise public transport. This subsidy would:

- enable public transport to cover its fixed costs; recognise the "fall-back" or "option" benefit which everybody enjoys simply from there being available public transport facilities;
- reward public transport users for the external benefits conferred by not increasing road congestion and other environmental costs, and
- redistribute income in favour of the poorer sections of the community who are most dependent on public transport.

There are many approaches to the traffic problem and considerable controversy as to the most appropriate 'mix' of policies. A system which relies on any one mode of transport, or on one single approach, is unlikely to be satisfactory. There is a need for facilities in cities which permit all types of transport: walking, cycling, car, minibus, bus and rail transport.

## POVZETEK

*Uporaba cestnih vozil narašča, korist, ki so jih vozila prinesla pa se pospešeno zmanjšuje zaradi eksternih stroškov, povzročenih s stroški. Kjer promet narašča, predvsem v mestnih središčih, se zmanjšuje prostor na cestah in na javnih površinah. Večja specializacija mestnih središč omogoča njihovo rast po obsegu in prometni privlačnosti. Na ta način hrani urbana rast sama sebe. Notranje urbano transportne naprave postajajo manj uporabne. Rast mesta po velikosti generira obseg in število vozil, s tem prometne zgoštevke, kar vodi k ekonomskim težavam. Visoki transportni stroški, obseg poslovnih prostorov in trgovin, ki se večja s privlačnostjo zaradi dostopnosti centralnih območij, postopoma zamenjujejo stanovanjsko gradnjo v središčih mest, in ljudje so prisiljeni iskati bivališča v primestnih predelih. Zaradi tega se mestna središča še bolj gosto in visoko pozidujejo, narašča pa prometna*

z gostitev. Vse to prispeva postopoma k manjši vrednosti stavbnih zemljišč v središčnih območjih, saj je dostopnost središč vse manjša zaradi vse večje obremenitve prometnic. Veča se onesnaževanje vseh vrst - hrupa, emisij vseh vrst, veča se prenaseljenost središč, s tem je urbani razkroj območij poslovnih dejavnosti zagotovljen.

## LITERATURE

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